Exhibit R-2, PB 2010 Air Force RDT&E Budget Item Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research					R-1 ITEM NOMENCLATURE PE 0602102F Materials					
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	175.040	188.152	127.957						Continuing	Continuing
6201SP: Space Materials Development	36.012	28.963	0.000						Continuing	Continuing
624347: Materials for Structures, Propulsion, and Subsystems	65.942	83.446	82.625						Continuing	Continuing
624348: Materials for Electronics, Optics, and Survivability	26.068	35.703	27.087						Continuing	Continuing
624349: Materials Technology for Sustainment	28.912	29.223	14.312						Continuing	Continuing
624915: Deployed Air Base Technology	18.106	10.817	3.933						Continuing	Continuing

Note

Note: FY 2008 funding totals include $3.41 million in supplemental funding. In FY 2010 and out, funds from Project 01SP have been moved to Project 4347, Project 4348, and Project 4349 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This program develops advanced materials, processing, and inspection technologies to reduce life cycle costs and improve performance, affordability, supportability, reliability, and survivability of current and future Air Force systems and operations. The program has five projects that develop: (1) the materials and processing technology base for spacecraft and launch systems; (2) structural, propulsion, and sub-systems materials and processes technologies; (3) electronic, optical, and survivability materials and processes technologies; (4) sustainment materials, processes technologies, and advanced non-destructive inspection methodologies; and (5) air base operations technologies including deployable base infrastructure, force protection, and fire fighting capabilities. 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.

Exhibit R-2, PB 2010 Air Force RDT&E Budget Item Justification	DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials

B. Program Change Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011
Previous President's Budget	179.516	117.143	127.504	
Current BES/President's Budget	175.040	188.152	127.957	
Total Adjustments	-4.476	71.009	0.000	
Congressional Program Reductions	0.000	0.000		
Congressional Rescissions	0.000	-0.511		
Total Congressional Increases	3.410	71.360		
Total Reprogrammings	-5.311	0.160		
SBIR/STTR Transfer	-2.575	0.000		

Change Summary Explanation

In FY 2009, Congress added $3.0 million for Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Material Substitution and Repair, $1.6 million for Advanced Aerospace Heat Exchangers, $2.4 million for Advanced Carbon Fiber Research and Test Initiative, $1.6 million for Advanced Thermal Control Coatings for Space Applications, $2.4 million for Carbon Non-Materials for Advanced Aerospace Applications, $4.0 million for Ceramic Matrix Composite Turbine Blade Demonstration, $1.12 million for FEL Capabilities for Aerospace Microfabrication, $1.6 million for Fire and Blast Resistant Materials for Force Protection, $1.6 million for Gallium Nitride RF Power Technology, $2.4 million for High Power Broadly Tunable Middle-Infrared Laser Sources, $2.4 million for Intelligent Manufacturing Initiative, $0.8 million for Large Area, APVT Materials Development for High Power Devices, $1.2 million for Light Weight Organic Photovoltaic Technologies, $1.6 million for Liquid Crystal Laser Eye Protection, $1.2 million for Nanocomposites for Lightning Protection of Composite Airframe Structures, $0.8 million for Optic Band Control Program, $1.6 million for Partnership for Emerging Technologies, $2.0 million for Pennsylvania NanoMaterials Commercialization Center, $2.8 million for Plasma-Sphere Array for Flexible Electronics, $1.6 million for Science for Sustainment, $4.0 million for Advanced Military Installations That Integrate Renewable Energy and Advanced Energy Storage Technologies, $8.0 million for Air Force Minority Leaders Program, $3.0 million for Aircraft Fatigue Modeling and Simulation, $1.44 million for Conducting Polymer Stress and Damage Sensors for Composites, $2.4 million for Consortium for Nanomaterials for Aerospace Commerce and Technology, $2.0 million for Diamond Substrate for Cooling of Micro-Electronics, $1.6 million for LGX High Temperature Acoustic Wave Sensors, $0.8 million for Mobile Wind Turbine Systems to Power Forward Bases, $4.0 million for ONAMI Safer Nanomaterials and Nanomanufacturing, $1.6 million for Tactical Shelters Next Generation Composite Initiative, $3.36 million for Institute for Science and Engineering Simulation (ISES), and $1.6 million for Innovative Polymeric Materials for Three-Dimensional (3-D) Microdevice Construction.

C. Performance Metrics
Under Development.

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602102F Materials					PROJECT NUMBER 6201SP	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
6201SP: Space Materials Development	36.012	28.963	0.000						Continuing	Continuing

Note

Note: Funds from Project 01SP have been moved to Project 4347, Project 4348, and Project 4349 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops the materials and processing technology base for spacecraft and launch systems to improve affordability, maintainability, and performance of current and future Air Force space systems. Families of affordable lightweight materials are being developed, including metals, polymers, ceramics, metallic composites, and nonmetallic composites to provide new capabilities for spacecraft, ballistic missile, and propulsion systems to meet the future space requirements. Rocket propulsion materials development in this project supports the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program. Advanced high-temperature protection materials are being developed that are affordable, lightweight, dimensionally stable, thermally conductive, and/or ablation and erosion resistant to meet space and ballistic missile requirements. Materials technologies are also being developed to enable surveillance and terrestrial situational awareness systems and subsystems for space and ballistic missile applications.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
MAJOR THRUST: Develop materials and processes to dramatically improve performance, durability, and cost of rocket propulsion systems. In FY 2008: Optimized candidate materials and processing techniques to ensure more consistent material characteristics to meet the next level of performance goals for high-speed turbopump housings and turbines, ducts, valves, solid rocket casings, insulation, and nozzle throats. Developed processes to produce full scale test components that can be tested in rocket engine environment. Analyzed material behavior in rocket combustion environment. Constructed pervasive materials requirements to meet advanced performance and cost goals. Validated and demonstrated materials, test sub-elements, and sub-components for thrust chambers, nozzles, and catalysts. In FY 2009: Down select the highest payoff materials and processes for high-speed turbopump housings and turbines, ducts, valves, solid rocket casings, insulation, and nozzle throats and develop mechanical property	4.400	3.241	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification			DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials		PROJECT NUMBER 6201SP	
B. Accomplishments/Planned Program ($ in Millions)	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
databases for design consideration. Optimize processes to produce full scale test components that can be tested in rocket engine environment. Analyze material behavior in rocket combustion environment. Focus development plans on pervasive materials requirements to meet advanced performance and cost goals. Optimize selected materials, test sub-elements, and sub-components for thrust chambers, nozzles, and catalysts. In FY 2010: Not Applicable.				
MAJOR THRUST: Develop affordable, advanced structural and non-structural materials and processing technologies for Air Force space applications. In FY 2008: Developed and validated test methodology and evaluation techniques for processing, durability, and life prediction of thermal protection system applications for selected thin gage metallic materials. Developed scale-up processing and integration techniques that will provide the capability for fabrication of complex geometries and built-up structures. Explored materials options for high-temperature protection systems for expendable and reusable high-speed vehicle applications in collaboration with industry. Transitioned data on oxidation protection schemes for carbon-carbon materials. Demonstrated benefits of nano-tailored composite materials for multifunctional space applications. Validated wear-resistant materials, lubricants, and Micro-Electro-Mechanical System (MEMS) devices for moving mechanical assemblies on spacecraft against environment specific criteria. Evaluated candidate space materials and collected critical data to facilitate materials transition. In FY 2009: Optimize initial test methodology and evaluation techniques for processing, durability, and life prediction of thermal protection system applications for component operation in robust high-temperature, long-duration cruise, or access to space environments. Continue materials processing development and demonstrate structural integration into sub-scale components for testing in relative environments. Develop materials candidates for high-temperature protection systems for expendable and reusable high-speed vehicle applications in collaboration with industry. Evaluate candidate space materials and collect critical data to facilitate materials transition.	18.701	14.739	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 6201SP	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2010: Not Applicable.					
MAJOR THRUST: Develop materials and materials processing technologies to enable improved performance and affordability of surveillance, tracking, targeting, situational awareness systems, and space-based communications/computing. In FY 2008: Demonstrated processes and process control methodology to enable very long wavelength infrared detection. Developed materials processing technology for short wavelength detectors that will provide capability of staring focal plane arrays with more than 4 million pixels (2k x 2k). Developed nano-photonic materials for high performance optoelectronic devices for optical communications and system control architectures. Demonstrated materials and materials process technologies for application in combined optical and radio frequency communication system apertures. In FY 2009: Continue to demonstrate processes and process control methodology to enable very long wavelength infrared focal plane arrays. Demonstrate processing technology for short wavelength infrared detectors by hybridization and characterization of 2k x 2k format focal plane array. Demonstrate nano-photonic materials for high performance optoelectronic devices for optical communications and system control architectures. Transition suitable materials and materials process technologies for application in combined optical and radio frequency communication system apertures. In FY 2010: Not Applicable.		12.911	10.983	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 6201SP

C. Other Program Funding Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
Activity Not Provided/ Related Activities:	0.000	0.000							Continuing	Continuing
Activity Not Provided/ This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate	0.000	0.000							Continuing	Continuing

D. Acquisition Strategy

Not applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602102F Materials					PROJECT NUMBER 624347	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
624347: Materials for Structures, Propulsion, and Subsystems	65.942	83.446	82.625						Continuing	Continuing

Note

Note: Funds from Project 01SP have been moved to Project 4347 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops the materials and processing technology base for aircraft and missiles to improve affordability, maintainability, and performance of current and future Air Force systems. A family of affordable lightweight materials is being developed, including metals, polymers, ceramics, metallic and nonmetallic composites, and hybrid materials 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. Advanced high temperature 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. Alternative or replacement materials are being developed to maintain the performance of aging operational systems. Materials for thermal management including coolants, adaptive thermally conductive materials, coatings, friction and wear-resistant materials, and other pervasive nonstructural materials technologies are being developed for directed energy, propulsion, and subsystems on aircraft, spacecraft, and missiles. Develops nanostructured and biological materials for aircraft structures, munitions, air vehicle subsystems, and personnel. Develops novel materials for electromagnetic interactions with matter for electromagnetic pulse (EMP), high power microwave (HPM), and lightning strike protection. Concurrently develops advanced processing methods to enable adaptive processing of aerospace materials.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
MAJOR THRUST: Develop ceramics, ceramic matrix composite, and hybrid materials technologies for revolutionary performance and supportability improvements in advanced propulsion systems and high temperature aerospace structures. Note: The increase in funding in FY 2010 and out is a result of funds being moved from Project 01SP to better align efforts. In FY 2008: Demonstrated advanced ceramic composite performance through testing under real and simulated engine service life conditions. Demonstrated environmental degradation analysis in the ceramic	2.700	2.389	11.340	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials		PROJECT NUMBER 624347

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
composite life prediction model. Validated the severe environment durability of advanced ceramic composite systems with advanced interfaces via mechanical testing. In FY 2009: Validate advanced ceramic composite performance through testing under real and simulated engine service life conditions. Validate the life prediction model to address time dependent degradation associated with environmental exposure. Validate the severe environment durability of advanced ceramic composite systems with advanced interfaces via mechanical testing. In FY 2010: Complete validation of advanced ceramic composite performance through testing under real and simulated engine service life conditions. Validate the life prediction model to address time dependent degradation associated with environmental exposure. Validate the severe environment durability of advanced ceramic composite systems with advanced interfaces via mechanical testing. Initiate development of new spacecraft catalyst bed systems. Assess performance of ultra high temperature ceramics (UHTC) leading edges in a relevant hypersonic environment (arc jet test rig) and validate oxidation models. Validate materials and materials process technologies for application in combined optical and radio frequency communication system apertures.				
MAJOR THRUST: Develop enabling nanostructured materials for diverse aerospace applications including enhanced aircraft canopies, electromagnetic hardening, air vehicle energy generation and storage devices, and improved low-observable platforms. Develop nanoscale architectures to address electromagnetic applications. Develop metamaterials with properties enabling compact sensors including conformal array antennas, low-electromagnetic interference (EMI) electronics, and optical elements based upon complex media. Note: In FY 2009 and out, this increase in funding is due to greater emphasis on metamaterials. In FY 2008: Delivered second-generation two photon absorbing (TPA) materials for night vision goggle evaluation. Transitioned photonic crystals for super prism applications. Transitioned aromatic hyperbranched polymers for structural component manufacture via resin transfer molding processes. Developed organic-inorganic metamaterials for Air Force electromagnetic and photonic applications for reduced aperture size, conformal radar, and antenna systems. Transitioned organic-inorganic nanostructured materials for lightning	5.384	13.200	19.193	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624347	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
strike resistant refueling boom. Developed EMI and high power microwave (HPM) shielding for electronics hardening. Developed adaptive (shape memory and actuator) materials based on polymer nanocomposites for adaptive aircraft structures, wings, fins, antennas, and mirrors. Developed lightweight, low-cost photovoltaics for uninhabited air vehicle applications. In FY 2009: Develop organic-inorganic metamaterials for Air Force electromagnetic and photonic applications for reduced aperture size, conformal radar, and antenna systems. Develop EMI and HPM shielding for electronics hardening. Investigate and develop lightweight, conformal metamaterials with properties that will enable compact sensor applications including: conformal array antennas, low EMI electronics, and optical elements based upon complex media. Evaluate the properties of these materials and determine performance enhancement of fixed frequency metamaterial optical elements. Assess the viability of obtaining metamaterial properties consistent with the demonstration of highly integrated subsystems based on radio frequency integrated circuit applications to enable small, highly directional antenna element device drivers. In FY 2010: Explore material concepts for adaptive and multifunctional aircraft structures. Explore low-cost processing methodologies for photovoltaics for unmanned aerial systems (UAS) applications. Explore new materials systems and nano geometries to improve electrochemical energy storage including development of long-life electrodes. Investigate materials for high frequency passive microwave components for reduced size and lightweight application to air vehicles. Explore concepts for multifunctional and conformal radio frequency (RF) passive components for air vehicles. Explore metamaterials options for electro-optic/infrared (EO/IR) applications. Explore metamaterials for high frequency RF passive microwave applications.					
MAJOR THRUST: Develop affordable, lightweight metallic materials, behavior and life prediction technologies, higher temperature intermetallic alloys, and metals processing technologies to enable enhanced performance, lower acquisition costs, increased durability, and improved reliability for Air Force weapon systems. Note: The increase in funding in FY 2010 is related to an overlap of efforts that are completing with the initiation of follow-on efforts.		13.314	11.035	15.786	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials		PROJECT NUMBER 624347

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
In FY 2008: Developed materials-damage predictive approaches for engine health determination and life extension capability. Developed advanced metallic materials for enhanced performance propulsion for air platforms with an emphasis on higher temperature capability. Validated computational methods supporting development and processing to reduce costs to accelerate insertion of advanced metals into Air Force systems. In FY 2009: Validate materials-damage predictive approaches for engine health determination and life extension capability. Develop and validate advanced metallic materials for enhanced performance propulsion for air platforms with an emphasis on higher temperature capability. Transition computational methods supporting development and processing to reduce costs to accelerate insertion of advanced metals into Air Force systems. In FY 2010: Continue development and validation of advanced metallic materials and processes for enhanced performance propulsion for air platforms with an emphasis on higher temperature capability. Initiate development of an advanced disk system concept for insertion into advanced propulsion concepts for air platforms. Initiate development of advanced materials and processes for liquid rocket engine applications. Initiate development of advanced computation methods to support modeling of materials for advanced propulsion systems. Demonstrate processing for thin gage metallics and fabrication of honeycomb and sandwich panels. Validate panel analysis methodology. Develop quantitative models linking microstructure with thermal and physical properties of metallic thermal management materials.				
MAJOR THRUST: Develop affordable, advanced organic matrix composite structural materials, hybrid and/or multifunctional materials, and carbon-carbon composites 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. Note: The increase in funding in FY 2010 and out is a result of funds being moved from Project 01SP to better align efforts. In FY 2008: Demonstrated life prediction tools for engine and airframe applications. Transitioned high temperature organic matrix composites. Downselected and optimized most promising new material systems	7.419	7.943	16.252	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624347	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
for space and high speed vehicle applications. Demonstrated the multifunctional payoffs of nanotailored composite materials for aerospace platform applications. Developed and demonstrated nanomaterials modeling and technology with an emphasis on accelerating the insertion and transition of this class of materials. Validated advanced composite material concepts and processes for specific weapon system needs. In FY 2009: Validate benefits of life prediction tools for engine and airframe applications. Demonstrate improved performance of new material systems for space and high-speed vehicle applications. Integrate the developed models into commercial and industry tools. Develop advanced material concepts and processes to address thermal management applications for weapon and air vehicle platforms. In FY 2010: Continue to demonstrate improved performance of new material systems for space and high-speed vehicle applications. Complete development of advanced material concepts and processes to address weapon and air vehicle platforms. Initiate investigation of new advanced composites systems for solid rocket motor cases. Explore composite and hybrid life prediction tools for engine and airframe applications. Explore lightweight, active, adaptive, high temperature, and durable composite and hybrid materials for engine and airframe applications. Demonstrate durable passive leading edge concepts for responsive access to space. Investigate advanced carbon fibers modified by carbon nanotubes. Explore novel high-performance coolants for directed energy and aircraft systems. Explore cost effective, high-conductivity, lightweight, phase change, thermal management and thermoelectric materials with adaptable, tunable heat transfer properties. Explore high-fidelity, multiscale predictive tools for thermal management across heterogeneous material systems and interfaces. Integrate ceramic and metallic thermal protection systems (TPS) subcomponents and evaluate in a relevant space vehicle environment.					
MAJOR THRUST: Develop nonstructural materials for fluids, lubricants, aircraft topcoat and corrosion resistant coatings, and specialty treatments to improve system performance and reduce life cycle costs. In FY 2008: Transitioned candidate gap treatment materials on low observable air vehicles. Demonstrated the analytical models that will be used to predict the optical properties of specialty coatings based on measured data. Transitioned the non-chromate surface treatments for aircraft corrosion protection systems. Validated		5.718	4.355	3.531	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624347	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
chrome-free primer for corrosion protection systems with a 30-year life expectancy. Demonstrated improved low friction wear, multifunctional coatings on engineering components. Developed and optimized surface treatment candidates for friction, stiction, and wear control in micro devices. In FY 2009: Integrate the analytical models into the coatings development applications. Demonstrate chrome-free primer for corrosion protection systems with a 30-year life expectancy. Continue to demonstrate improved low friction wear, multifunctional coatings on engineering components. Demonstrate surface treatment candidates for friction, stiction, and wear control in micro devices. In FY 2010: Initiate effort to develop combined thermal/friction coating materials for extreme environments. Develop alternative/renewable energy materials and technologies for Air Force deployed applications, including biomass and other alternative energy solutions.					
MAJOR THRUST: Develop nanomaterials science and technology in the areas of nanoenergetics to provide nano-reactive materials, additives, coated powders, and laminates for munitions and propulsion with reduced size and higher lethality. Develop science and technology for pervasive nanostructured and biological materials and device processing mechanisms for aircraft and space structures and sub-systems like actuators, sensors, and electronics. Note: The increase in funding in FY 2010 and out is a result of funds being moved from Project 01SP to better align efforts. In FY 2008: Investigated large-scale synthesis and characterization of energetic nanomaterials to provide stable, triggerable, nanoscale energetic materials for enhanced energy release munitions and access to space. Discovered and designed unconventional nanomaterial behavior with regard to energy release via robust modeling and simulation. Investigated the transport and compartmentalization of nanoparticles within the environment. Developed microstructural characterization tools to provide robust processing-performance correlations of nanoenergetic systems. Investigated multi-component, structured nanoparticle catalyses as controlled release agents for enhancing stability and storage as well as providing enhanced ignition for high efficiency air-breathing propulsion.		5.161	5.271	14.523	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624347

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
In FY 2009: Develop large-scale synthesis and characterization of energetic nanomaterials to provide stable, triggerable, nanoscale energetic materials for enhanced energy release munitions, high efficiency air-breathing propulsion, and access to space. Establish modeling and simulation tools to support nanoenergetics development. Analyze the transport and compartmentalization of nanoparticles being investigated as nanoenergetics to evaluate potential environmental impact. Develop microstructural characterization tools to provide robust processing-performance correlations of nanoenergetic systems. Investigate multi-component, structured nanoparticle catalyses as controlled release agents for enhancing stability and storage as well as providing enhanced ignition. In FY 2010: Demonstrate large-scale synthesis and characterization techniques for energetic nanomaterials to provide stable, triggerable, nanoscale energetic materials for enhanced energy release munitions, high efficiency air-breathing propulsion, and access to space. Validate the transport and compartmentalization of nanoparticles being investigated as nanoenergetics to evaluate potential environmental impact. Analyze microstructural characterization tools to provide robust processing-performance correlations of nanoenergetic systems. Develop multi-component, structured nanoparticle catalyses as controlled release agents for enhancing stability and storage as well as providing enhanced ignition. Downselect most promising biological/ nanomaterial hybrids for the detection and identification of threat agents.				
MAJOR THRUST: Develop practical, affordable, and novel high temperature materials, structures, and thermal management concepts to enable future defense capabilities for prompt global strike concepts including advanced hypersonic weapons, high mach missiles, global strike missiles, hypervelocity flight vehicles and propulsion systems, and hypervelocity weapons. Note: The increase in funding in FY 2010 and out is a result of increased emphasis in high temperature materials. In FY 2008: Not Applicable. In FY 2009: Not Applicable.	0.000	0.000	2.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624347	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2010: Investigate advanced ceramics, ceramic matrix composites, hybrids, and metallic concepts for hot structure and thermal protection systems.					
CONGRESSIONAL ADD: Air Force Minority Leaders Program. In FY 2008: Conducted Congressionally-directed effort for Air Force Minority Leaders Program. In FY 2009: Conduct Congressionally-directed effort for Air Force Minority Leaders Program. In FY 2010: Not Applicable.		5.876	7.978	0.000	
CONGRESSIONAL ADD: Pennsylvania Nanomaterials Commercialization Center. In FY 2008: Conducted Congressionally-directed effort for Pennsylvania Nanomaterials Commercialization Center. In FY 2009: Conduct Congressionally-directed effort for Pennsylvania Nanomaterials Commercialization Center. In FY 2010: Not Applicable.		1.566	1.995	0.000	
CONGRESSIONAL ADD: Carbon Non-Materials for Advanced Aerospace Applications. In FY 2008: Conducted Congressionally-directed effort for Carbon Nano-Materials for Advanced Aerospace Applications, AQW Rice University.		1.566	2.393	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624347

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
In FY 2009: Conduct Congressionally-directed effort for Carbon Non-Materials for Advanced Aerospace Applications. In FY 2010: Not Applicable.				
CONGRESSIONAL ADD: Nanocomposites for Lightning Protection of Composite Airframe Structures. In FY 2008: Conducted Congressionally-directed effort for Nanocomposites for Lightning Protection of Composite Airframe Structures. In FY 2009: Conduct Congressionally-directed effort for Nanocomposites for Lightning Protection of Composite Airframe Structures. In FY 2010: Not Applicable.	1.566	1.197	0.000	
CONGRESSIONAL ADD: Nanotechnology Research. In FY 2008: Conducted Congressionally-directed effort for Nanotechnology Research. In FY 2009: Not Applicable. In FY 2010: Not Applicable.	4.899	0.000	0.000	
CONGRESSIONAL ADD: ONAMI Safer Nanomaterials and Nanomanufacturing.	3.136	3.989	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624347	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2008: Conducted Congressionally-directed effort for ONAMI Safer Nanomaterials and Nanomanufacturing. In FY 2009: Conduct Congressionally-directed effort for ONAMI Safer Nanomaterials and Nanomanufacturing. In FY 2010: Not Applicable.					
CONGRESSIONAL ADD: Consortium for Nanomaterials for Aerospace Commerce and Technology (CONTACT). In FY 2008: Conducted Congressionally-directed effort for University of Houston CONTACT. In FY 2009: Conduct Congressionally-directed effort for CONTACT. In FY 2010: Not Applicable.		2.351	2.393	0.000	
CONGRESSIONAL ADD: Innovative Polymeric Materials for Three-Dimensional (3-D) Microdevice Construction. In FY 2008: Conducted Congressionally-directed effort for Innovative Polymeric Materials for 3-D Microdevice Construction. In FY 2009: Conduct Congressionally-directed effort for Innovative Polymeric Materials for 3-D Microdevice Construction. In FY 2010: Not Applicable.		0.979	1.596	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624347

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
CONGRESSIONAL ADD: High Temperature Aerogel Materials for Global Strike Vehicles. In FY 2008: Conducted Congressionally-directed effort for High Temperature Aerogel Materials for Global Strike Vehicles. In FY 2009: Not Applicable. In FY 2010: Not Applicable.	1.566	0.000	0.000	
CONGRESSIONAL ADD: Durable Hybrid Coatings for Aircraft Systems. In FY 2008: Conducted Congressionally-directed effort for Durable Hybrid Coatings for Aircraft Systems. In FY 2009: Not Applicable. In FY 2010: Not Applicable.	1.175	0.000	0.000	
CONGRESSIONAL ADD: Chrome Free Environmentally Friendly Corrosion Protection for Aircraft. In FY 2008: Conducted Congressionally-directed effort for Chrome Free Environmentally Friendly Corrosion Protection for Aircraft. In FY 2009: Not Applicable. In FY 2010: Not Applicable.	1.566	0.000	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624347

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
CONGRESSIONAL ADD: Advanced Aerospace Heat Exchangers. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Advanced Aerospace Heat Exchangers. In FY 2010: Not Applicable.	0.000	1.596	0.000	
CONGRESSIONAL ADD: Advanced Carbon Fiber Research and Test Initiative. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Advanced Carbon Fiber Research and Test Initiative. In FY 2010: Not Applicable.	0.000	2.393	0.000	
CONGRESSIONAL ADD: Advanced Thermal Control Coatings for Space Applications. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Advanced Thermal Control Coatings for Space Applications. In FY 2010: Not Applicable.	0.000	1.596	0.000	
CONGRESSIONAL ADD: Ceramic Matrix Composite Turbine Blade Demonstration.	0.000	3.989	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624347	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Ceramic Matrix Composite Turbine Blade Demonstration. In FY 2010: Not Applicable.					
CONGRESSIONAL ADD: Institute for Science and Engineering Simulation (ISES). In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for ISES. In FY 2010: Not Applicable.		0.000	3.351	0.000	
CONGRESSIONAL ADD: Intelligent Manufacturing Initiative. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Intelligent Manufacturing Initiative. In FY 2010: Not Applicable.		0.000	2.393	0.000	
CONGRESSIONAL ADD: Mobile Wind Turbine Systems to Power Forward Bases.		0.000	0.798	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624347

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Mobile Wind Turbine Systems to Power Forward Bases. In FY 2010: Not Applicable.				
CONGRESSIONAL ADD: Partnership for Emerging Technologies. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Partnership for Emerging Technologies. In FY 2010: Not Applicable.	0.000	1.596	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624347

C. Other Program Funding Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
Activity Not Provided/ Related Activities:	0.000	0.000							Continuing	Continuing
PE 0603112F/ Advanced Materials for Weapon Systems.	0.000	0.000							Continuing	Continuing
PE 0603211F/ Aerospace Technology Dev/Demo.	0.000	0.000							Continuing	Continuing
PE 0603216F/ Aerospace Propulsion and Power Technology.	0.000	0.000							Continuing	Continuing
Activity Not Provided/ This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate	0.000	0.000							Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602102F Materials					PROJECT NUMBER 624348	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
624348: Materials for Electronics, Optics, and Survivability	26.068	35.703	27.087						Continuing	Continuing

Note

Note: Funds from Project 01SP have been moved to Project 4348 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops materials technologies for surveillance and situational awareness systems and subsystems for aircraft and missile applications, including sensor, microwave, and infrared detection and countermeasures devices used for targeting, electronic warfare, and active aircraft protection. Materials for protection of aircrews, sensors, and aircraft from laser and high-power microwave directed energy threats are also developed. Electronic and optical materials are being developed to enable surveillance and 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 threats and to respond to emerging and agile threat wavelengths without impairing mission effectiveness.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
MAJOR THRUST: Develop, evaluate, and mature infrared (IR) detector materials, hybrid materials, and materials processing technologies to enable improved performance, affordability, and operational capability of Air Force surveillance, tracking, targeting, and situational awareness systems. Note: The increase in funding in FY 2010 and out is a result of funds being moved from Project 01SP to better align efforts. In FY 2008: Explored and validated suitable materials and structures for innovative IR materials in order to assess appropriateness for Air Force IR detection applications. Designed and demonstrated IR materials systems capable of responses to more than two discrete wavelengths. Assessed feasibility of further research and utility of three-dimensional material growth to exploit unique detection properties of complex IR materials. Developed promising materials growth technologies for nano-scale IR detection materials. Developed epitaxial materials and devices fabricated for high power applications. Investigated materials to enable development of design capabilities. Improved materials matching between device and substrates to enable higher power efficiency, better reliability, and increased power density to enable power dense devices.	1.437	1.917	8.348	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624348	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2009: Develop materials and transition strategies for innovative IR materials while continuing to exploit newly emerging material concepts. Validate and optimize IR materials systems capable of responses to more than two discrete wavelengths. Develop candidate materials for three-dimensional growth to exploit unique detection properties of complex IR materials. Develop promising materials growth technologies for nano-scale IR detection materials. Demonstrate epitaxial materials device and substrate improvements. Develop design capability, leveraging new materials and substrates. Develop tools and methodologies that address the physics of failure for power dense devices. In FY 2010: Increase yield of full wafer focal plane arrays of 2k x 2k and develop multifunction readout integrated circuit. Investigate alternative IR materials for long wavelength detection. Pursue emerging IR materials in the short wave regime for day-night operation. Model and evaluate optical behavior of materials for low observable (LO), intelligence, surveillance, and reconnaissance (ISR), and other applications. Investigate materials constructs for multi-wavelength detection. Explore single material, multi-wavelength materials schemes. Extend capability of three-dimensional detection to multiple bands and explore tailoring options for diverse mission requirements. Advance and refine growth technology for nano-scale IR detection. Explore options for novel nano-scale detection.					
MAJOR THRUST: Develop and demonstrate enabling materials technologies to enhance the safety, survivability, and mission effectiveness of aircrews, sensors, viewing systems, and related assets. Note: In FY 2010, funds from this effort break out into the fifth major thrust to separate distinct technology areas. In FY 2008: Demonstrated optimized nonlinear optical limiter materials for damage protection of eyes and sensor systems. Validated photorefractive materials properties for Air Force passive protection applications. Developed devices using switchable filter technology into eye and sensor system protection concepts. In FY 2009: Develop nonlinear optical limiter materials into device concepts for damage protection of eyes and sensor systems. Develop photorefractive materials into device concepts for Air Force passive protection		8.118	9.522	5.969	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624348	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
applications. Demonstrate devices using switchable filter technology into eye and sensor system protection concepts. In FY 2010: Develop nonlinear optical limiter solid-state materials into device concepts for damage protection of space-based sensor systems. Investigate photorefractive materials growth repeatability for increased probability of technology transition to Air Force passive protection applications. Demonstrate electrically tunable liquid crystal filters for sensor system protection concepts. Develop thin film concepts for enhanced fixed filter performance. Develop and analyze electromagnetic interference (EMI) and high power microwave (HPM) shielding for electronics hardening.					
MAJOR THRUST: Develop and demonstrate materials and process technologies for power generation, power control, and microwave components to provide improved performance, affordability, and operational capability with reduced size, weight, and power for Air Force surveillance, tracking, targeting, situational awareness, and lethal and non-lethal weapon systems. Note: In FY 2010, funds were reduced to fund higher Air Force priorities. In FY 2008: Explored materials impact on device reliability for power control systems, advanced radar, and electronic countermeasures application. Demonstrated the capabilities of advanced materials process technologies and investigated the reliability of materials as applied to ultra-lightweight, ultra-high-power aircraft electrical generators enabling airborne lethal and non-lethal directed energy weapons in fighter-sized aircraft. Demonstrated performance of candidate materials for use in terahertz components, supporting high speed communications and advanced sensors. In FY 2009: Optimize materials properties for enhanced device reliability. Assess the reliability of materials for ultra-lightweight, ultra-high-power aircraft electrical generator applications, enabling airborne lethal and non-lethal directed energy weapons in fighter-sized aircraft. Demonstrate performance of candidate materials for use in terahertz components, supporting high speed communications and advanced sensors.		6.875	8.281	5.355	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification			DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials		PROJECT NUMBER 624348	
B. Accomplishments/Planned Program ($ in Millions)	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2010: Explore and identify materials-to-materials interactions responsible for reduced reliability. Refine thin film growth process for improved wide bandgap semiconductor material. Investigate performance issues in materials components of high power microwave directed energy weapons. Develop nanostructured materials using multiple approaches for high energy density capacitors for pulsed power applications.				
MAJOR THRUST: Develop enabling and foundational biotechnologies for the areas of guidance and control, rapid tagging, tracking, and identification of targets, and bio-integrated electronics and sensing for continued Air Force dominance. Note: Increase in funding in FY 2010 is due to increased emphasis on bio-taggants. In FY 2008: Investigated use of biological/nanomaterial-based taggants for the detection and identification of threat agents at a distance using hybrid constructs. Assessed effectiveness of threat agent destruction using taggants in counterproliferation operations. Neutralized biological and chemical agents with the inherent and supplementary properties of the taggant nanoparticles. Developed active and passive polymer encapsulation technologies for taggant materials. In FY 2009: Develop new biological/nanomaterial hybrids for the detection and identification of threat agents. Analyze efficacy data of using taggants for preemptive destruction of threat agents. Incorporate taggants into a variety of media (polymers, paints) for optimal and mission-specific dispersal. Model dispersion properties of polymer-encapsulated taggants for optimal release and coverage. In FY 2010: Validate efficacy data of using taggants for preemptive destruction of threat agents. Incorporate taggants into a variety of media (polymers, paints) for optimal and mission-specific dispersal. Model dispersion properties of polymer-encapsulated taggants for optimal release and coverage.	1.647	1.701	4.960	
MAJOR THRUST: Develop materials with properties enabling higher performance lasing media, new laser architectures, optical isolators, beam steering, and other high energy laser components for directed energy. Note: In FY 2010, this effort breaks out from the second major thrust to separate distinct technology areas.	0.000	0.000	2.455	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624348	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2008: Not Applicable. In FY 2009: Not Applicable. In FY 2010: Investigate host/dopant materials for fiber lasers in the eye-safe regime. Demonstrate preliminary fiber development. Demonstrate solid state, very high speed beam steering materials options. Investigate very high speed beam steering configurations. Explore options and develop alternate materials and processes for high energy lasers.					
CONGRESSIONAL ADD: Advanced Engineered Non-Linear Optical Materials for Critical Wavelengths. In FY 2008: Conducted Congressionally-directed effort for Advanced Engineered Non-Linear Optical Materials for Critical Wavelengths. In FY 2009: Not Applicable. In FY 2010: Not Applicable.		0.942	0.000	0.000	
CONGRESSIONAL ADD: Free Electron Laser Capabilities for Aerospace Microfabrication. In FY 2008: Conducted Congressionally-directed effort for Free Electron Laser Capabilities for Aerospace Microfabrication. In FY 2009: Conduct Congressionally-directed effort for Free Electron Laser Capabilities for Aerospace Microfabrication. In FY 2010: Not Applicable.		1.566	1.117	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624348	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
CONGRESSIONAL ADD: Gallium Nitride (GaN) RF Power Technology. In FY 2008: Conducted Congressionally-directed effort for GaN RF Power Technology. In FY 2009: Conduct Congressionally-directed effort for GaN RF Power Technology. In FY 2010: Not Applicable.		1.566	1.596	0.000	
CONGRESSIONAL ADD: Large Area, APVT Materials Development for High Power Devices. In FY 2008: Conducted Congressionally-directed effort for Large Area, APVT Materials Development for High Power Devices. In FY 2009: Conduct Congressionally-directed effort for Large Area, APVT Materials Development for High Power Devices. In FY 2010: Not Applicable.		1.566	0.798	0.000	
CONGRESSIONAL ADD: Plasma-Sphere Array for Flexible Electronics. In FY 2008: Conducted Congressionally-directed effort for Plasma-Sphere Array for Flexible Electronics. In FY 2009: Conduct Congressionally-directed effort for Plasma-Sphere Array for Flexible Electronics. In FY 2010: Not Applicable.		1.566	2.792	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624348	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
CONGRESSIONAL ADD: Polymer Nanocomposites for Energy Storage and Pulsed Power. In FY 2008: Conducted Congressionally-directed effort for Polymer Nanocomposites for Energy Storage and Pulsed Power. In FY 2009: Not Applicable. In FY 2010: Not Applicable.		0.785	0.000	0.000	
CONGRESSIONAL ADD: Diamond Substrate for Cooling of Micro-Electronics. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Diamond Substrate for Cooling of Micro-Electronics. In FY 2010: Not Applicable.		0.000	1.995	0.000	
CONGRESSIONAL ADD: High Power Broadly Tunable Middle-Infrared Laser Sources. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for High Power Broadly Tunable Middle-Infrared Laser Sources. In FY 2010: Not Applicable.		0.000	2.393	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624348

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
CONGRESSIONAL ADD: Light Weight Organic Photovoltaic Technologies. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Light Weight Organic Photovoltaic Technologies. In FY 2010: Not Applicable.	0.000	1.197	0.000	
CONGRESSIONAL ADD: Liquid Crystal Laser Eye Protection. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Liquid Crystal Laser Eye Protection. In FY 2010: Not Applicable.	0.000	1.596	0.000	
CONGRESSIONAL ADD: Optic Band Control Program. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Optic Band Control Program. In FY 2010: Not Applicable.	0.000	0.798	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624348

C. Other Program Funding Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
Activity Not Provided/ Related Activities:	0.000	0.000							Continuing	Continuing
PE 0603112F/ Advanced Materials for Weapon Systems.	0.000	0.000							Continuing	Continuing
PE 0602202F/ Human Effectiveness Applied Research.	0.000	0.000							Continuing	Continuing
PE 0602204F/ Aerospace Sensors.	0.000	0.000							Continuing	Continuing
PE 0603211F/ Aerospace Technology Dev/Demo.	0.000	0.000							Continuing	Continuing
PE 0603231F/ Crew Systems and Personnel Protection Technology.	0.000	0.000							Continuing	Continuing
Activity Not Provided/ This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate	0.000	0.000							Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602102F Materials					PROJECT NUMBER 624349	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
624349: Materials Technology for Sustainment	28.912	29.223	14.312						Continuing	Continuing

Note

Note: Funds from Project 01SP have been moved to Project 4349 within this Program Element to more accurately align efforts.

A. Mission Description and Budget Item Justification

This project develops 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. Repair techniques and nondestructive inspection/evaluation (NDI/E) methods are developed 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.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
MAJOR THRUST: Develop advanced sensing and life prediction technologies to identify damage and characterize the health of aging aerospace structures, propulsion systems, and complex, low-observable (LO) materials and structures. Note: In FY 2010, funds were reduced to fund higher Air Force priorities. In FY 2008: Matured modeling and simulation methodologies for rapid assessment of multiple NDI/E technologies for depot level inspections. Validated NDI/E technologies for inspection of thick (multi-layer) aging aircraft structures with complex geometries. Initiated studies of harsh environment sensors to enable health management for turbine engines and thermal protection systems. In FY 2009: Demonstrate novel NDI/E methods and techniques to detect and track damage in a wide variety of materials and components for aerospace systems. Demonstrate NDI/E technologies for inspection of thick (multi-layer) aging aircraft structures with complex geometries. Develop sensing technology to detect changes	6.834	6.839	3.012	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials		PROJECT NUMBER 624349

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
in temperature, strain, pressure, and vibration to enable on-demand health status of turbine engines, aircraft structures, wiring systems, and thermal protection systems. In FY 2010: Advance novel sensing methods and techniques to detect and track damage to other materials and components for aerospace systems. Augment multi-layer sensing capabilities to more extensive applications and potential alternative damage modes on aerospace structures. Augment development of sensing technology to detect changes in material properties, damage evolution, and other factors that detrimentally affect aerospace systems. Develop materials-damage predictive approaches to engine and structure prognosis for life cycle management and life extension capability. Develop and demonstrate novel LO point inspection probes to enable rapid assessment of LO material performance.				
MAJOR THRUST: Develop support capabilities, information, and processes to resolve problems with materials in the production and repair of systems components and structures. In FY 2008: Developed advanced techniques to evaluate corrosion and erosion resistance of new and emerging materials used in operationally fielded Air Force systems. Developed advanced materials and processes technologies to repair Air Force legacy systems and test failure limits for emerging Air Force systems. Initiated analysis to understand the effects of materials processes, such as the application of residual stress on the surface of steel and other structural metals, to support customer-focused studies and point design solutions that will extend the life of specific components on Air Force systems. Demonstrated technologies for improved maintainability of advanced LO materials and designs, such as conductive outer-mold-line, applique, door edges and seals, and multifunctional systems. In FY 2009: Validate advanced techniques to evaluate corrosion and erosion resistance of new and emerging materials used in operationally fielded Air Force systems. Evaluate advanced materials and processes technologies to repair Air Force legacy systems and test failure limits for emerging Air Force systems. Develop test methods and techniques to understand the effects of materials processes, such as the application of residual stress on the surface of steel and other structural metals, to support studies and point design solutions that will extend the life of specific structural components on Air Force systems. Demonstrate and transition	5.268	5.163	4.944	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624349	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
technologies for improved maintainability of advanced LO materials and designs, such as conductive outer-mold-line, applique, door edges and seals, and multifunctional systems. In FY 2010: Evaluate advanced materials and processes technologies to repair Air Force legacy systems and test failure limits for emerging Air Force systems. Develop and demonstrate test methods and techniques to understand the effects of in-service environments and materials processes, such as the application of residual stress on the surface of steel and other structural metals, to support studies and point design solutions that will extend the life of specific structural components on Air Force systems. Demonstrate and transition technologies for improved maintainability and life cycle cost of advanced LO materials and designs, such as conductive outer-mold-line, applique, door edges and seals, and multifunctional systems. Develop and demonstrate laboratory test methods to evaluate and characterize candidate space materials for properties and material behavior suitable for use in space applications.					
MAJOR THRUST: Develop support capabilities, information, and processes to resolve materials problems and provide electronic and structural failure analysis of components. In FY 2008: Performed quick response failure analysis and materials investigations for fielded system, acquisition organization, depot system materials failures, and provided advanced materials solutions to ensure system availability and safety of flight. Developed advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Demonstrated advanced test methodologies for analyzing structural failures of emerging materials for Air Force systems. Developed advanced wiring materials technologies to replace aging wiring systems and new wiring technologies for emerging weapons systems. In FY 2009: Perform quick response failure analysis and materials investigations for fielded system, acquisition organization, depot system materials failures, and provide advanced materials solutions to ensure system availability and safety of flight. Develop advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Demonstrate advanced test methodologies for analyzing structural failures of emerging materials for Air Force systems. Develop advanced wiring materials technologies to replace aging wiring systems and new wiring technologies for emerging weapons systems.		6.233	6.609	6.356	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009			
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials			PROJECT NUMBER 624349	
B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2010: Perform quick response failure analysis and materials investigations for fielded system, acquisition organization, depot system materials failures, and provide advanced materials solutions to ensure system availability and safety of flight. Develop advanced electrostatic discharge protection technologies and procedures for emerging avionics subsystems. Demonstrate advanced test methodologies for analyzing structural failures of emerging materials for Air Force systems. Develop advanced wiring materials technologies to replace aging wiring systems and new wiring technologies for emerging weapons systems.					
CONGRESSIONAL ADD: Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Material Substitution and Repair. In FY 2008: Conducted Congressionally-directed effort for Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Material. In FY 2009: Conduct Congressionally-directed effort for Accelerated Insertion of Advanced Materials and Certification for Military Aircraft Structure Material Substitution and Repair. In FY 2010: Not Applicable.		2.743	2.992	0.000	
CONGRESSIONAL ADD: Aircraft Active Corrosion Protective Compounds. In FY 2008: Conducted Congressionally-directed effort for Aircraft Active Corrosion Protective Compounds. In FY 2009: Not Applicable. In FY 2010: Not Applicable.		0.979	0.000	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009	
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials		PROJECT NUMBER 624349

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
CONGRESSIONAL ADD: Aircraft Fatigue Modeling and Simulation. In FY 2008: Conducted Congressionally-directed effort for Institute for Science and Engineering Simulation (ISES) / Aircraft Fatigue Modeling and Simulation. In FY 2009: Conduct Congressionally-directed effort for Aircraft Fatigue Modeling and Simulation. In FY 2010: Not Applicable.	2.448	2.992	0.000	
CONGRESSIONAL ADD: Conducting Polymer Stress and Damage Sensors for Composites. In FY 2008: Conducted Congressionally-directed effort for Polymer Stress and Sensor Damage Sensors for Composites. In FY 2009: Conduct Congressionally-directed effort for Conducting Polymer Stress and Damage Sensors for Composites. In FY 2010: Not Applicable.	2.841	1.436	0.000	
CONGRESSIONAL ADD: Science for Sustainment. In FY 2008: Conducted Congressionally-directed effort for Science for Sustainment Initiative to Improve Mission. In FY 2009: Conduct Congressionally-directed effort for Science for Sustainment. In FY 2010: Not Applicable.	1.566	1.596	0.000	

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624349

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
CONGRESSIONAL ADD: LGX High Temperature Acoustic Wave Sensors. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for LGX High Temperature Acoustic Wave Sensors. In FY 2010: Not Applicable.	0.000	1.596	0.000	

C. Other Program Funding Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
Activity Not Provided/ Related Activities:	0.000	0.000							Continuing	Continuing
PE 0603112F/ Advanced Materials for Weapons Systems.	0.000	0.000							Continuing	Continuing
PE 0603211F/ Aerospace Technology Dev/Demo.	0.000	0.000							Continuing	Continuing
Activity Not Provided/ This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate	0.000	0.000							Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research	R-1 ITEM NOMENCLATURE PE 0602102F Materials	PROJECT NUMBER 624349

E. Performance Metrics

Please refer to the Performance Base Budget Overview Book for information on how Air Force resources are applied and how those resources are contributing to Air Force performance goals and most importantly, how they contribute to our mission.

Exhibit R-2a, PB 2010 Air Force RDT&E Project Justification								DATE: May 2009		
APPROPRIATION/BUDGET ACTIVITY 3600 - Research, Development, Test & Evaluation, Air Force/BA 2 - Applied Research				R-1 ITEM NOMENCLATURE PE 0602102F Materials					PROJECT NUMBER 624915	
COST ($ in Millions)	**FY 2008 Actual**	**FY 2009 Estimate**	**FY 2010 Estimate**	**FY 2011 Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
624915: Deployed Air Base Technology	18.106	10.817	3.933						Continuing	Continuing

Note

Note: FY 2008 funding totals include $3.7 million in supplemental funding.

A. Mission Description and Budget Item Justification

This project develops new deployable airbase technologies to reduce airlift and manpower requirements, setup times, and sustainment costs, and to improve protection and survivability of deployed Air Expeditionary Force (AEF) warfighters. Affordable, efficient technologies are developed for base infrastructure, fire fighting, and force protection to improve Expeditionary Combat Support operations.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
MAJOR THRUST: Develop new deployable airbase technologies including energy and aircraft operating surfaces to reduce airlift and manpower requirements, setup times, and sustainment costs in support of AEF operations, while providing for autonomous operations. In FY 2008: Developed and analyzed solar power for bare base applications. Transitioned fuel cell reformer specification for acquisition. Began development of advanced integrated power technologies. Investigated and evaluated high temperature effects on operating surfaces and developed repair technology. Demonstrated nondestructive inspection of airfield surface evaluation technologies. Demonstrated cost effectiveness and performance of synthesized polymer materials. In FY 2009: Analyze and demonstrate renewable power technologies applicable to deployed forces. Demonstrate advanced integrated power technologies. Evaluate and develop mitigation for high temperature effects on operating surfaces. Demonstrate and analyze nondestructive inspection of airfield surface evaluation technologies.	2.906	1.650	2.177	

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2010: Develop deployable applications of higher efficiency collection and conversion of solar power for deployed applications. Analyze performance of candidate high temperature aircraft operating surface materials. Develop remote nondestructive inspection of airfield surface evaluation technologies.					
MAJOR THRUST: Develop affordable technologies to provide force protection and survivability to AEF deployed warfighters and infrastructure. In FY 2008: Developed methodologies to characterize candidate fire suppression agents and began development of supporting fire suppression technologies for crash/rescue. Developed and evaluated combined technologies for fire fighter effectiveness. Demonstrated and analyzed effectiveness of resilient structural materials and methodologies for improved protection of structures and inhabitants. Investigated and analyzed effectiveness of innovative improvised explosive detection and defeat for high energy threat. Investigated mechanisms of gas phase kinetics. Developed and evaluated accuracy for atmospheric models for protection of deployed warfighters from asymmetric threats. In FY 2009: Develop and demonstrate methodologies to characterize candidate fire suppression agents and continue to develop supporting fire suppression technologies for crash/rescue. Develop and analyze combined technologies for fire fighter effectiveness. Validate and demonstrate resilient structural materials and methodologies for improved protection of structures and inhabitants. Develop and demonstrate effectiveness of innovative defeat of improvised explosive device (IED) and high energy threats. In FY 2010: Analyze fire suppression agents using methodologies supporting deployed warfighters and infrastructure. Investigate novel, cost-effective technologies for fire fighter effectiveness and optimize developed technologies. Investigate novel structural materials and technologies to support deployed warfighters and infrastructure, using methodologies developed for protection. Analyze and conduct experiments to verify effectiveness for defeat of IED and high energy threat technologies. Transition mature defeat technologies and investigate emerging threats. Explore functions of microbes and develop effective methodologies to capture biological processes for use in Air Force applications.		3.171	1.986	1.756	

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
CONGRESSIONAL ADD: Blast Resistant Concrete Products. In FY 2008: Conducted Congressionally-directed effort for Blast Resistant Concrete Products. In FY 2009: Not Applicable. In FY 2010: Not Applicable.		1.566	0.000	0.000	
CONGRESSIONAL ADD: Life Shield Blast Resistant Panels. In FY 2008: Conducted Congressionally-directed effort for Life Shield Blast Resistant Panels. In FY 2009: Not Applicable. In FY 2010: Not Applicable.		0.981	0.000	0.000	
CONGRESSIONAL ADD: Fire and Blast Resistant Materials for Force Protection. In FY 2008: Conducted Congressionally-directed effort for Fire and Blast Resistant Materials for Force Protection. In FY 2009: Conduct Congressionally-directed effort for Fire and Blast Resistant Materials for Force Protection. In FY 2010: Not Applicable.		1.566	1.596	0.000	

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
CONGRESSIONAL ADD: Advanced Carbon Fiber Research and Testing Initiative. In FY 2008: Conducted Congressionally-directed effort for Advanced Carbon Fiber Research and Testing Initiative. In FY 2009: Not Applicable. In FY 2010: Not Applicable.		2.940	0.000	0.000	
CONGRESSIONAL ADD: Advanced Aerospace Carbon Foam Heat Exchangers. In FY 2008: Conducted Congressionally-directed effort for Advanced Aerospace Carbon Foam Heat Exchangers. In FY 2009: Not Applicable. In FY 2010: Not Applicable.		1.566	0.000	0.000	
MAJOR THRUST: Counter-Improvised Explosive Device - Explosive Detection Technology. In FY 2008 GWOT: Evaluated sampling technologies to allow screening for explosives in packages, luggage, personnel, and entry control points. Evaluated detectors for emerging threats. Identifed suitable explosives detectors and sample collectors for field deployment. In FY 2009: Not Applicable.		2.858	0.000	0.000	

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2010: Not Applicable.					
MAJOR THRUST: Hardened Expeditionary Structures. In FY 2008 GWOT: Developed expeditionary structure designs/technologies with blast and ballistic protection against 120 mm mortar and 122 mm rocket threats. Designs included complete structures, stand-alone overhead protection systems, and complete troop housing systems that are easy to ship, assemble, disassemble, and repackage for transport. In FY 2009: Not Applicable. In FY 2010: Not Applicable.		0.276	0.000	0.000	
MAJOR THRUST: Composite Rubberized Concrete (CRC) for Blast Applications. In FY 2008 GWOT: Designed, developed, and validated protective systems using recycled rubber as an additive aggregate to conventional concrete to improve blast resistance, with a particular emphasis on reducing secondary concrete fragments produced by the blast. Goal was to reduce or mitigate the spalling effect of conventional concrete, while maintaining structural strength. In FY 2009: Not Applicable. In FY 2010: Not Applicable.		0.276	0.000	0.000	
CONGRESSIONAL ADD: Advanced Military Installations that Integrate Renewable Energy and Advanced Energy Storage Technologies.		0.000	3.989	0.000	

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B. Accomplishments/Planned Program ($ in Millions)		**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Advanced Military Installations that Integrate Renewable Energy and Advanced Energy Storage Technologies. In FY 2010: Not Applicable.					
CONGRESSIONAL ADD: Tactical Shelters Next Generation Composite Initiative. In FY 2008: Not Applicable. In FY 2009: Conduct Congressionally-directed effort for Tactical Shelters Next Generation Composite Initiative. In FY 2010: Not Applicable.		0.000	1.596	0.000	

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C. Other Program Funding Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
Activity Not Provided/ Related Activities:	0.000	0.000							Continuing	Continuing
PE 0603112F/ Advanced Materials for Weapon Systems.	0.000	0.000							Continuing	Continuing
Activity Not Provided/ This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate	0.000	0.000							Continuing	Continuing

D. Acquisition Strategy

Not Applicable.

E. Performance Metrics

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