PE NUMBER: 0602601F
PE TITLE: Space Technology

Exhibit R-2, RDT&E Budget Item Justification

DATE: February 2007

BUDGET ACTIVITY: 02 Applied Research

PE NUMBER AND TITLE: 0602601F Space Technology

	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	103.604	103.472	109.566	106.755	123.509	123.927	125.251	128.550	Continuing	TBD
1010	Space Survivability & Surveillance	47.152	48.567	43.484	46.991	46.119	46.968	48.596	49.893	Continuing	TBD
4846	Spacecraft Payload Technologies	16.314	17.150	22.949	21.877	24.050	24.224	25.181	25.755	Continuing	TBD
5018	Spacecraft Protection Technology	2.129	1.923	2.548	3.503	3.831	3.840	4.657	4.754	Continuing	TBD
8809	Spacecraft Vehicle Technologies	38.009	35.832	40.585	34.384	49.509	48.895	46.817	48.148	Continuing	TBD

Note: Funds for the FY 2007 Congressionally-directed Integrated Control for Autonomous Space Systems in the amount of $1.6 million were moved from PE 0602500F, Multi-Disciplinary Space Technology, Project 625028, and funds for the Center for Solar Electricity and Hydrogen in the amount of $3.6 million were moved from PE 0602203F, Aerospace Propulsion, Project 6233SP, to this PE for execution. Also, funds for the FY 2007 Congressionally-directed Space-Qualified Common Data Link in the amount of $2.2 million were moved from this PE to PE 0602702F, Command, Control and Communications, Project 6266SP, for execution.

(U) A. Mission Description and Budget Item Justification

This PE focuses on four major areas. First, space environmental protection develops technologies to understand, mitigate, and exploit effects of weather and geophysics environments on the design and operation of Air Force systems. Second, spacecraft payload technologies improve satellite payload operations by investigating advanced component and subsystem capabilities. Third, spacecraft protection develops technologies for protecting U.S. space assets in potential hostile settings. The last major area, spacecraft vehicles, focuses on spacecraft platform, payload, and control technologies, and their interactions. Note: In FY 2007, Congress added $1.0 million for Elastic Memory Composites, $1.1 million for Three Dimensional Deployable Structure Systems for Space, $0.3 million for Shielding Rocket Payloads, $1.0 million for Multicontinuum Technology for Space Structures, $1.1 million for Deployable Structures Experiment, $1.0 million for Field Programmable Gate Array, $1.0 million for Flexible CIGS Solar Cells on Silicon Substrates for Spacecraft, $3.2 million for High-frequency Active Auroral Research Program (HAARP), $1.0 million for Joint Micro Power Initiative, $1.1 million for Nanoscale Microelectronic Circuit Technology Development, $1.3 million for USAF National Security Research - Signature, and $2.2 million for Space-Qualified Common Data Link. This program is in Budget Activity 2, Applied Research, since it develops and determines the technical feasibility and military utility of evolutionary and revolutionary space technologies.

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology

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

		FY 2006	FY 2007	FY 2008	FY 2009
(U)	Previous President's Budget	104.392	85.594	114.195	129.471
(U)	Current PBR/President's Budget	103.604	103.472	109.566	106.755
(U)	Total Adjustments	-0.788			
(U)	Congressional Program Reductions		-0.015		
	Congressional Rescissions	-0.017	-0.392		
	Congressional Increases		15.285		
	Reprogrammings	0.680	3.000		
	SBIR/STTR Transfer	-1.451			

(U) Significant Program Changes:

Changes to this PE since the Previous President's Budget are due to higher Air Force priorities.

C. Performance Metrics

(U) Under Development.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2007
BUDGET ACTIVITY: 02 Applied Research	PE NUMBER AND TITLE: 0602601F Space Technology	PROJECT NUMBER AND TITLE: 1010 Space Survivability & Surveillance	

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
1010 Space Survivability & Surveillance	47.152	48.567	43.484	46.991	46.119	46.968	48.596	49.893	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 the technologies to exploit the space environment for warfighter's future capabilities. The project focuses on characterizing and forecasting the battlespace environment for realistic space system design, modeling, and simulation, as well as the battlespace environment's effect on space systems' performance. It includes technologies to specify and forecast the environment from "mud to sun" for planning operations and ensuring uninterrupted system performance, optimize space-based surveillance operations, and allow the opportunity to mitigate or exploit the space environment for both offensive and defensive operations. Finally, this project includes the seismic research program that supports national requirements for monitoring nuclear explosions.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(U) MAJOR THRUST: Develop technologies for specifying, monitoring, predicting, and controlling space environmental conditions hazardous to Department of Defense (DoD) operational space systems in order to improve performance, reduce cost, and increase operational lifetimes.	4.104	5.215	6.854	8.649

(U) In FY 2006: Developed initial multi-sensor global data assimilation models for real-time situational awareness of energetic electron hazards to space systems. Validated dynamic radiation belt specification and forecast model with data from geosynchronous and low-earth orbit DoD satellites. Completed physical design and accomplished Preliminary Program Design Review of next generation, high-resolution solar telescope. Developed autonomous procedures to cross calibrate, quality control, and validate solar magnetic field data from disparate network of ground-based telescopes for use in kinematic and hybrid solar wind models. Completed analysis of promising micro- and nano-technology space plasma and energetic particle sensor concepts and transition into spaceflight hardware development programs.

(U) In FY 2007: Continue development of energetic electron data assimilation models for real-time situational awareness by coupling to dynamic radiation belt model to provide data-driven specification and forecast capability. Initiate coupling of radiation belt model to global geospace environment models to increase accuracy and lead time. Complete initial predictive model of solar explosive events, including flares, bursts, and coronal mass ejections. Develop concepts for active beam and wave probes of radiation belt dynamics.

(U) In FY 2008: Complete detailed analysis of Solar Mass Ejection Imager. Compile specifications and guidance for operational heliospheric imager. Initiate measurement of interplanetary magnetic fields

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 1010 Space Survivability & Surveillance

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	using wide-field radio array. Initiate development of magnetic reconnection model to study solar flare initiation and energy storage. Initiate program to test and evaluate empirical flare prediction models based on synoptic data from Air Force and national observatory assets. Complete development of energetic electron data assimilation models for real-time situational awareness by coupling to dynamic radiation belt model to provide data-driven specification and forecast capability. Continue coupling of radiation belt model to global geospace environment models to increase accuracy and lead time. Validate models for ionospheric penetration by very low frequency (VLF) electromagnetic waves and their injection into the magnetosphere.				
(U)	In FY 2009: Continue measurement of interplanetary magnetic fields using wide-field radio array. Complete Spiral 1 magnetic reconnection model to study solar flare initiation and energy storage. Continue program to test and evaluate empirical flare prediction models based on synoptic data from Air Force and national observatory assets. Complete coupling of radiation belt model to global geospace environment models to increase accuracy and lead time. Utilize three-dimensional global radiation belt diffusion models to simulate ultimate global effect of wave-particle interactions from VLF electromagnetic wave power injected in narrow altitude slices of radiation belts. Validate models for virtual VLF electromagnetic wave generation in the ionosphere and global transport and power distribution.				
(U)					
(U)	MAJOR THRUST: Develop spectral signature libraries, target detection techniques, and decision aids for application to space-based surveillance, laser weapons, and countermeasure systems, including detection of low-observable targets, and targets and space-based resident space object characterization. Note: In FY 2007, there is an increased emphasis on low-observable target detection.	13.882	16.942	13.617	14.236
(U)	In FY 2006: Developed technologies for visible to infrared wavelength sensing for space-to-space resident space object characterization. Using available airborne and spaceborne data, validated daytime spectral processing algorithms and related signature databases for remaining terrain classes. Used test data and validated simulations to evaluate candidate sensor technologies for spectral theater surveillance and area search missions. Developed real-time hypertemporal processing algorithms and determine optimal parameters for operational system. Improved turbulence forecasting skill, as required, and assisted in transition of airborne laser decision aid for testing to operational decision aid status. Performed case studies on existing and improved stratospheric clear air turbulence forecast tools. Addressed decision aid requirements for tactical high-energy lasers and laser communication systems.				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY **02 Applied Research**	PE NUMBER AND TITLE **0602601F Space Technology**	PROJECT NUMBER AND TITLE **1010 Space Survivability & Surveillance**

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

	FY 2006	FY 2007	FY 2008	FY 2009

(U) In FY 2007: Demonstrate technologies for space-based detection, identification and characterization of for resident space object characterization, environmental monitoring, and missile warning/defense. Develop super-resolution techniques for space-based resident space objects for space situational awareness. Initiate transition of validated spectral processing and exploitation algorithms and related signature databases to appropriate users. With available thermal spectral sensors, validate nighttime spectral processing algorithms and related signature databases for specific environments. Initiate transfer of sensor technologies and architecture concepts to acquisition and operational commands as appropriate. Refine real-time hypertemporal processing algorithms; and continue determination of optimal parameters for operational system. Develop third generation (model) hypertemporal sensor for space. Initiate transition of improved stratospheric clear air turbulence forecast models to Air Force Weather Agency. Continue to address technology requirements for transition of operational decision aids for airborne lasers, tactical high-energy laser systems, and laser communication systems.

(U) In FY 2008: Finalize real-time hypertemporal (HT) processing algorithms with optimal parameters for space-based missile launch detection. Continue development of third-generation brassboard HT sensor for space-based missile launch detection. Begin feasibility study of HT applications for technical intelligence from ground, air, and space-based platforms. Use satellite tracking test bed and Air Force Maui Optical and Supercomputing tracking telescopes to demonstrate Space Situational Awareness (SSA) capability of HT sensors and validate the utility of this technique to obtain operational and health status of resident space objects. Other advanced sensors of spectral, polarimetric and temporal capabilities are considered in the down selection phase and tested with ground systems as needed. Complete analysis of space data on real world detections of resident space objects with multiple band thermal infrared, visible, and ultraviolet and develop models of sensor performance to evaluate capability of space-based sensors. Utilize planned space demonstrations to validate spectral theater surveillance and area search missions and supporting models. Continue transition of spectral image processing and exploitation algorithms and related signature databases to Government users. Begin investigation of spectral applications for material identification in support of military chemical/biological weapons detection and identification in the thermal infrared and other bands.

(U) In FY 2009: Finalize brassboard HT sensor for space-based missile launch detection. Incorporate latest real-time HT processing algorithms into sensor platform. Transition brassboard sensor and algorithms to customer for space-based missile launch detection. Test feasibility of HT applications for technical intelligence from ground, air, and space-based platforms. Define the requirements and the optimum

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 1010 Space Survivability & Surveillance

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	configuration of a space-based HT sensor. Develop end-to-end simulation capability, based on the sensor performance models, to assist acquisition community and space operator community in trade space analyses of sensors or sensor suites. The emphasis is on the capabilities to derive information and intelligence about space objects with signals in all bands and all temporal regimes. Continue investigation of spectral applications for material identification in support of military chemical/biological weapons detection and identification in the thermal infrared and other bands. Complete transition of spectral image processing and exploitation algorithms and related signature databases to Government users. Complete analysis and documentation of military utility of planned space demonstrations of spectral theater surveillance and area search missions. Complete validation of hyperspectral models.				
(U)					
(U)	MAJOR THRUST: Develop artificial intelligence techniques, forecasting tools, and sensors for improved ionospheric specification and forecasting, including communications/navigation outage forecasting (C/NOFS), space-based geolocation demonstrations, and determination and prediction of radar degradation.	7.650	5.615	7.065	7.305
(U)	In FY 2006: Generated nowcasts and forecasts of communication/navigation outages due to ionospheric scintillation using C/NOFS space and ground system to give the warfighter improved space and battlefield awareness and operational flexibility. Performed metric tests making standardized comparisons between C/NOFS forecast model and product output parameters and selected available measurements to assess effectiveness of scintillation forecasting process. Developed statistical database and tools to track C/NOFS forecast metrics to assess military utility of outage warning due to scintillation. Developed technology to produce artificial ionization patches for use in over-the-horizon radar/comm applications and to mitigate scintillation conditions. Developed specification and forecast models and applications that exploit international network of ionospheric sensors.				
(U)	In FY 2007: Perform metric tests of C/NOFS scintillation forecasting system. Integrate C/NOFS results into ionospheric specification and forecasting algorithms and models for enhanced military utility of scintillation warning system. Investigate coupled solar-magnetospheric-ionospheric-thermospheric models to improve forecast lead times for radar operations, and communications/navigation outages. Develop portable ionospheric sensor suite for measuring total electron content and communications/navigation scintillation.				
(U)	In FY 2008: Expand high-latitude data collection to initiate a high-latitude scintillation warning system.				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY **02 Applied Research**	PE NUMBER AND TITLE **0602601F Space Technology**	PROJECT NUMBER AND TITLE **1010 Space Survivability & Surveillance**

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	Investigate the impact of convection of scintillations to higher latitudes on Ultra High Frequency communication and Global Positioning System (GPS) navigation systems. Investigate HF induced artificial scintillation generation using the High-frequency Active Auroral Research Program (HAARP). Develop portable ionospheric sensor suite for measuring total electron content and communications/navigation scintillation. Initiate space radar data collection for ionosphere compensation study. Develop scintillation mitigation technology by using metal-oxide space cloud. Develop techniques of analyzing GPS radio occultation data acquired by C/NOFS and Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC) satellites. Begin incorporation of Kalman filter ionospheric model into forecast models and ionospheric warfighter impact products. Conduct statistical analysis of neutral density to improve accuracy of empirical neutral density models for specifying and forecasting neutral density during geomagnetic storms. Implement algorithm to assess impacts of penetration electric fields on generation of equatorial irregularities.				
(U)	In FY 2009: Investigate solar activity on enhancement of L-band scintillations to assess the support of the scintillation database and tools to military communication and navigation systems. Measure total electron content and scintillations over the African subcontinent for better defining the equatorial scintillation and GPS error environment in the middle-eastern region. Demonstrate scintillation mitigation technology using metal-oxide space cloud. Deliver ionospheric compensation technique with wide-band radio-frequency waves. Improve modeling techniques for specifying high temporal resolution of neutral density and satellite drag to achieve predictive space situation awareness. Improve empirical and neutral density model based on Atmospheric Density Specification experiment data and develop physics-based model of the neutral composition, wind, and density. Continue transition of physics-based 3-D model of equatorial plasma bubbles into warfighter products and transition of ionospheric Kalman filter operational models into equatorial models.				
(U)					
(U)	MAJOR THRUST: Develop High-frequency Active Auroral Research Program site transmitting and diagnostic instrument infrastructure.	10.000	9.475	9.128	9.942
(U)	In FY 2006: Completed 180-element high frequency transmitter array with 3.6 megawatt radiated power capacity.				
(U)	In FY 2007: Validate performance of 3.6 megawatt transmitting array in Extremely Low Frequency/Very Low Frequency (ELF/VLF) wave generation and optical emissions research programs.				
(U)	In FY 2008: Conduct experimental research with the 3.6 megawatt transmitting array to develop				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 1010 Space Survivability & Surveillance

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	techniques to increase the efficiency of ELF/VLF wave generated in space and initiate research to characterize their interactions with charged particles in the earth's radiation belts.				
(U)	In FY 2009: Continue research to characterize wave-particle interactions and wave amplification effects in space and their potential application to mitigate charged particle effects on space systems and operations.				
(U)					
(U)	MAJOR THRUST: Develop basic seismic technologies to support national requirements for monitoring nuclear explosions with special focus on regional distances less than 2,000 kilometers from the sensors.	6.849	6.837	6.820	6.859
(U)	In FY 2006: Provided further updated seismic codes for operational use. Focused on seismic energy partition, magnitudes, and source physics moves from hypothesis development towards major hypothesis flyoff. Continued efforts on seismic calibration; seismic detection, location, and discrimination; and observational studies of seismic wave propagation, including propagation in Eurasia. Focused on transition between local and regional seismic wave propagation and implications for all topics above. Assessed future directions based on results obtained so far.				
(U)	In FY 2007: Continue to update seismic codes for operational use. Develop hypothesis test results into potential discrimination and yield estimation techniques, while addressing unresolved hypothesis issues for seismic energy partition, magnitudes, and source physics. Incorporate seismic energy partition effects into implications for local and regional seismic wave propagation. Continue efforts on seismic calibration; seismic detection, location, and discrimination; and observational studies of seismic wave propagation, including propagation in Eurasia. Continue assessment future directions based on results obtained so far.				
(U)	In FY 2008: Test and incorporate new research methods for automated processing of increasing numbers of seismic events. Develop long-period regional seismic discrimination, while examining challenges in high-frequency regional discrimination. Continue efforts on seismic calibration; seismic detection, location, and discrimination; and observational studies of seismic wave propagation, including propagation in Eurasia. Conduct comprehensive studies to transition the program to meet emerging local seismic monitoring requirements. Design and conduct theoretical, laboratory, and field studies to support local monitoring.				
(U)	In FY 2009: Flyoff different techniques for automated processing of increasing numbers of seismic events. Conduct detailed research on causes of challenges in high-frequency regional discrimination. Further continue efforts on seismic calibration; seismic detection, location, and discrimination; and				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 1010 Space Survivability & Surveillance

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	observational studies of seismic wave propagation, including propagation in Eurasia. Continue to conduct detailed studies of particular challenge areas in local seismic monitoring. Refine design and conduct theoretical, laboratory, and field studies to support local monitoring.				
(U)					
(U)	CONGRESSIONAL ADD: High-frequency Active Auroral Research Program.	3.306	3.188	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for HAARP.				
(U)	In FY 2007: Conduct Congressionally-directed effort for HAARP.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: USAF Center for National Security Research - Signature.	1.361	1.295	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for National Security Research - Signature Exploitation.				
(U)	In FY 2007: Conduct Congressionally-directed effort for USAF National Security Research - Signature.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)	Total Cost	47.152	48.567	43.484	46.991

(U) C. Other Program Funding Summary ($ 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 Cost
(U) Related Activities:										
(U) PE 0305111F, Weather Systems.										
(U) PE 0305160F, Defense Meteorological Satellite Program.										
(U) PE 0601102F, Defense Research Sciences.										
(U) PE 0602204F, Aerospace Sensors.										
(U) PE 0603401F, Advanced										

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY **02 Applied Research**	PE NUMBER AND TITLE **0602601F Space Technology**	PROJECT NUMBER AND TITLE **1010 Space Survivability & Surveillance**

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

Spacecraft Technology.

(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			DATE: February 2007
BUDGET ACTIVITY: 02 Applied Research	PE NUMBER AND TITLE: 0602601F Space Technology	PROJECT NUMBER AND TITLE: 4846 Spacecraft Payload Technologies	

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
4846 Spacecraft Payload Technologies	16.314	17.150	22.949	21.877	24.050	24.224	25.181	25.755	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

Note: Funds for the FY 2007, Congressionally-directed Space-Qualified Common Data Link in the amount of $2.2 million were moved from this Project to PE 0602702F, Command, Control and Communications, Project 6266SP, for execution.

(U) A. Mission Description and Budget Item Justification

This project develops advanced technologies that enhance spacecraft payload operations by improving component and subsystem capabilities. The project focuses on four primary areas: (1) development of advanced, space-qualified, survivable electronics, and electronics packaging technologies; (2) development of advanced space data generation and exploitation technologies, including infrared, Fourier Transform hyperspectral imaging, polarimetric sensing, and satellite antenna subsystem technologies; (3) development of high-fidelity space simulation models that support space-based surveillance and space asset protection research and development for the warfighter; and (4) development of advanced networking, radio frequency, and laser communications technologies to support next generation satellite communication systems.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(U) MAJOR THRUST: Develop advanced infrared device technologies for space applications that enable hardened space detector arrays with improved detection, to perform acquisition, tracking, and discrimination of space objects such as decoys, satellites, and warheads throughout their trajectory.	3.636	3.200	4.166	4.976

(U) In FY 2006: Performed studies in metal films. Demonstrated two-layer single-pixel polarimeter. Improved quantum dot detector responsivity. Characterized superlattice detectors. Investigated magnetic and electric field tuning of detector wavelength responsivity ("wavelength agility"). Performed comparisons of emerging detector technologies for transfer to applied research. Characterized and assessed performance of long wavelength infrared focal plane arrays developed with radiation hardened-by-design process.

(U) In FY 2007: Pursue detector response tunability. Complete assessment of quantum interference towards amplification of incoming weak signals. Study radiation damage of very long wavelength and visible focal plane arrays (FPAs). Pursue long-wave infrared (LWIR) superlattice defect reduction and passivation optimization.

(U) In FY 2008: Continue investigating spectral agility. Begin investigating field-enhancement technologies. Demonstrate a three-layer single pixel polarimeter. Continue LWIR superlattice defect reduction and passivation optimization.

(U) In FY 2009: Continue investigating spectral agility. Demonstrate tuning from 15 to 20 microns in 1 micron increments. Continue investigating field enhancement technologies. Demonstrate amplification

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 4846 Spacecraft Payload Technologies

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
using quantum interference and demonstrate enhancement using plasmons. Continue investigating the single pixel polarimeter. Demonstrate improved LWIR superlattice detector and assess very long-wave infrared feasibility.				
(U)				
(U) MAJOR THRUST: Develop spectral sensing and data exploitation methodologies for military imaging and remote sensing applications.	0.987	0.868	1.137	1.225
(U) In FY 2006: Completed development and continued validation of polarimetric scene modeling capability for space-based surveillance applications. Integrated additional models for accurate prediction of satellite materials signatures and compared with available laboratory and field data. Completed development of instrument models for staring polarimetric surveillance systems. Developed polarimetric and spectral measurement and database of relevant materials for inclusion in the model.				
(U) In FY 2007: Complete validation of polarimetric scene and signature modeling capability, comparing simulated data to measured field data. Complete initial polarimetric database of materials for use in signature and scene modeling. Define concepts for polarimetric or multi-band imaging sensors for space-based space surveillance applications.				
(U) In FY 2008: Begin development of a predictive model for advanced imaging concepts. Using the physics-based models, develop an end-to-end capability to predict the performance, benefit, and cost of various sensors for Intelligence, Surveillance, and Reconnaissance (ISR) and SSA applications.				
(U) In FY 2009: Complete the development and begin the validation of a predictive model for advanced imaging. Validate against laboratory and available field data of ISR and SSA missions. Make improvements to the simulation capability to improve accuracy and usability of the model. Utilize the prediction capability to develop concepts for purpose built sensors for SSA.				
(U)				
(U) MAJOR THRUST: Develop technologies for space-based payload components such as low power, high performance, radiation-hardened electronic devices, micro-electro-mechanical system devices, and advanced electronics packaging for next generation high performance space electronics.	4.129	2.985	3.706	3.834
(U) In FY 2006: Designed new chalcogenide materials for reconfigurable radio frequency (RF) circuits and for reconfigurable wiring. Developed fundamental understanding of exotic high-dielectric constant materials and predicted candidate materials for insertion into aggressively scaled electronic devices for space electronics. Researched radiation effects in highly integrated microelectronics employing the most recent techniques in power management, clock domain partitioning, and monolithic integration of				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 4846 Spacecraft Payload Technologies

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	multiple radio frequency, analog, and digital functions. Identified and evaluated radiation hardening techniques for enhancing immunity to single event and other radiation effects arising from the natural space environment, as well as nuclear events. Developed a "liquid manifold" approach based on combining micro-electromechanical switches and reconfigurable wiring and demonstrate operation.				
(U)	In FY 2007: Complete study of dynamics of phase change materials, and of their interactions with pertinent technological materials. Explore use of polymers in reconfigurable electronics. Continue study of alternative dielectrics for advanced electronics, especially the nitrided oxides. Initiate a nanotechnology collaboration with the Air Force Research Laboratory Materials Directorate. Research radiation effects mitigation schemes using best commercial practices in design and manufacturing to identify new methods for creating radiation hardened, long-lifetime, commodity and custom mixed signal microcircuits for next generation space and missile systems. Evaluate devices using advanced hardening techniques to determine robustness and compatibility with state of the art design and fabrication technology. Develop morphable electronic panels suitable for demonstration in a relevant environment.				
(U)	In FY 2008: Initiate capabilities to the current Satellite Design Automation software to evolve a logical sequence to form a "push-button toolflow" satellite builder. Initiate Radiation-harden space sensor interface modules allocating standardized data messages protocols from sensors for ease device control of sensors and actuators.				
(U)	In FY 2009: Complete capabilities to the current Satellite Design Automation software to evolve a logical sequence to form a "push-button toolflow" satellite builder. Demonstrate radiation-harden space sensor interface modules allocating standardized data messages protocols from sensors for ease device control of sensors and actuators.				
(U)					
(U)	MAJOR THRUST: Develop modeling, simulation, and analysis tools for space-based surveillance systems, rendezvous and proximity operations, optical/infrared imaging space systems, distributed satellite architecture, and space control payloads. Note: In FY 2008, increase in funding is due to acceleration of the development of engineering and military utility models for space superiority analysis of space situational awareness and defensive counterspace technologies.	2.441	2.501	6.428	3.508
(U)	In FY 2006: Supported autonomous and responsive space flight experiments with simulations and data validation. Extended the simulation architecture to feed engineering-level data to mission/campaign models. Extended the architecture to address missions associated with space situational awareness and				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 4846 Spacecraft Payload Technologies

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	tactical surveillance. Developed enhancements to imaging system simulations to include polarimetric and hyperspectral effects. Tailored toolset and methodology developed for the multi-aperture strategic system feasibility study for tactical applications.				
(U)	In FY 2007: Continue to support autonomous and responsive space flight experiments with simulations and data validation. Continue to extend the simulation architecture to feed engineering-level data to mission/campaign models. Ready the simulation architecture to support flight experiment simulation and data validation for experiments on space situational awareness and tactical surveillance.				
(U)	In FY 2008: Complete support of autonomous and responsive space flight experiments with simulations and data validation. Complete extension of the simulation architecture to feed engineering-level data to mission/campaign models. Begin to develop engineering and military utility models for space superiority analysis of space situational awareness and defensive counterspace technologies.				
(U)	In FY 2009: Continue to develop engineering and military utility models for space superiority analysis of space situational awareness and defensive counterspace technologies.				
(U)					
(U)	MAJOR THRUST: Develop technologies for multi-access laser communications terminals. Assess the maturity of single access terminal components and their applicability to a multi-access terminal design.	5.121	5.504	7.512	8.334
(U)	In FY 2006: Verified initial standards of combining multiple airborne intelligence, surveillance and reconnaissance and space asset feeds into a single optical data path. Performed component testing using laboratory testbed.				
(U)	In FY 2007: Finish verification of standards of multiple airborne intelligence, surveillance and reconnaissance and space asset feeds into a single optical data path. Perform system testing using laboratory testbed.				
(U)	In FY 2008: Begin integration of single-access laser communications terminal components into multi-access laser communications terminal.				
(U)	In FY 2009: Complete integration of single-access laser communications terminal components into multi-access laser communications terminal.				
(U)					
(U)	CONGRESSIONAL ADD: Field Programmable Gate Arrays.	0.000	0.996	0.000	0.000
(U)	In FY 2006: Not Applicable.				
(U)	In FY 2007: Conduct Congressionally-directed effort for Field Programmable Gate Arrays.				
(U)	In FY 2008: Not Applicable.				

Exhibit R-2a, RDT&E Project Justification		DATE: February 2007
BUDGET ACTIVITY: 02 Applied Research	PE NUMBER AND TITLE: 0602601F Space Technology	PROJECT NUMBER AND TITLE: 4846 Spacecraft Payload Technologies

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

	FY 2006	FY 2007	FY 2008	FY 2009
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Nanoscale Microelectronic Circuit Technology Development.	0.000	1.096	0.000	0.000
(U) In FY 2006: Not Applicable.				
(U) In FY 2007: Conduct Congressionally-directed effort for Nanoscale Microelectronic Circuit Technology Development.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U) Total Cost	16.314	17.150	22.949	21.877

(U) C. Other Program Funding Summary ($ 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 Cost
(U) Related Activities:										
(U) PE 0603401F, Advanced Spacecraft Technology.										
(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

DATE: **February 2007**

BUDGET ACTIVITY: **02 Applied Research**

PE NUMBER AND TITLE: **0602601F Space Technology**

PROJECT NUMBER AND TITLE: **5018 Spacecraft Protection Technology**

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
5018 Spacecraft Protection Technology	2.129	1.923	2.548	3.503	3.831	3.840	4.657	4.754	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 the technologies for protecting U.S. space assets in potential hostile environments to assure continued space system operation without performance loss in support of warfighter requirements. The project focuses on identifying and assessing spacecraft system vulnerabilities, developing threat warning technologies, and developing technologies to mitigate the effects of both intentional and unintentional threats.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(U) MAJOR THRUST: Develop key satellite threat warning technologies and tools for high value satellite asset defense.	0.808	0.846	1.026	1.115
(U) In FY 2006: Processed integrating most promising proximity or threat warning sensor into a space experiment. Identified potential of multiple usage of sensor to detect threats and measure environmental phenomenon associated with space flight (weather experiments, debris analysis, assist in navigation, etc.).				
(U) In FY 2007: Conduct sensor testing and analysis. Identify technology transition opportunities.				
(U) In FY 2008: Continue to conduct sensor space flight experiment and analysis. Identify technology transition opportunities and provide associated engineering designs and concepts.				
(U) In FY 2009: Transfer an active and/or passive threat warning sensor for detection of a direct assent or co-orbital vehicle and transition these engineering designs.				
(U)				
(U) MAJOR THRUST: Develop high value space asset defensive capabilities.	0.529	0.548	0.870	1.678
(U) In FY 2006: Downselected to the most promising defensive technology for space experiment planning and integration. Identified potential of multiple use technology to detect threats and measure environmental phenomenon associated with space flight (weather experiments, analysis debris, assist in navigation, etc.).				
(U) In FY 2007: Conduct defensive technology space demonstration and analysis. Identify technology transfer opportunities.				
(U) In FY 2008: Develop space experiment using onboard systems or develop proof of concept space experiment to validate concept and multiple use technology.				
(U) In FY 2009: Identify two technology options that provide defensive capability for incorporation into geosynchronous orbit/low earth orbit satellites and complete engineering designs.				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 5018 Spacecraft Protection Technology

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(U)					
(U)	MAJOR THRUST: Develop techniques to exploit existing on-board inherent satellite resources, satellite-as-a-sensor, and self-aware satellite technologies as a first-line threat detection system.	0.522	0.529	0.652	0.710
(U)	In FY 2006: Developed space experiment of existing cooperative onboard system or developed proof of concept space experiment to validate concept.				
(U)	In FY 2007: Conduct defensive technology space demonstration and analysis. Identify technology transfer opportunities.				
(U)	In FY 2008: Transition technology to other compatible space systems for multiple uses.				
(U)	In FY 2009: Identify technology transition opportunities and provide engineering designs to potential users.				
(U)					
(U)	MAJOR THRUST: Develop techniques for monitoring and assessing electromagnetic interference and compatibility between ultra-sensitive payload sensors for space systems that support space weather forecasting. Note: Effort completed in FY 2006.	0.270	0.000	0.000	0.000
(U)	In FY 2006: Conducted space experiment demonstration of C/NOFS. Assessed payload performance in measuring ionospheric and scintillation parameters needed for space weather support in theater and for mission planners and other users.				
(U)	In FY 2007: Not Applicable.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)	Total Cost	2.129	1.923	2.548	3.503

(U) C. Other Program Funding Summary ($ 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 Cost
(U) PE 0603401F, Advanced Spacecraft Technology.										
(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.										

Exhibit R-2a, RDT&E Project Justification		DATE: February 2007
BUDGET ACTIVITY: 02 Applied Research	PE NUMBER AND TITLE: 0602601F Space Technology	PROJECT NUMBER AND TITLE: 5018 Spacecraft Protection Technology

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2007
BUDGET ACTIVITY: 02 Applied Research	PE NUMBER AND TITLE: 0602601F Space Technology	PROJECT NUMBER AND TITLE: 8809 Spacecraft Vehicle Technologies	

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
8809 Spacecraft Vehicle Technologies	38.009	35.832	40.585	34.384	49.509	48.895	46.817	48.148	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

Note: Funds for the FY 2007 Congressionally-directed Integrated Control for Autonomous Space Systems in the amount of $1.6 million were moved from PE 0602500F, Multi-Disciplinary Space Technology, Project 625028, and funds for the Center for Solar Electricity and Hydrogen in the amount of $3.6 million were moved from PE 0602203F, Aerospace Propulsion, Project 6233SP, to this Project, for execution.

(U) A. Mission Description and Budget Item Justification

This project focuses on seven major space technology areas: spacecraft platforms (e.g., structures, controls, power, and thermal management); space-based payloads (e.g., survivable electronics); satellite control (e.g., software for autonomous distributed satellite formation flying, signal processing, and control); modeling and simulation of space-based systems; satellite protection technologies (e.g., space environment effects, debris prediction, and threat warning/attack reporting); microsatellite technologies; and space experiments of maturing technologies for space qualification.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(U) MAJOR THRUST: Develop technologies for advanced space platform subsystems such as cryocoolers, compact, high efficiency solar power cells and arrays, and innovative power generation concepts.	3.586	3.175	4.434	4.536

(U) In FY 2006: Built experimental capabilities for flow field measurements in pulse tube cryocoolers. Refined and validated cryocooler component and system models with experimental data. Investigated thermodynamic loss mechanisms in regenerative cycle cryocoolers through computational fluid dynamics models. Demonstrated 12% efficient thin-film solar cell on polymer substrate. Demonstrated five- or six- junction solar cell.

(U) In FY 2007: Develop component-based system model of pulse tube cryocoolers for parametric optimization of cryocooler system design. Design an ultra low-temperature (10 degrees Kelvin), low mass and high efficiency advanced engineering model cryocooler. Transition optimal design methodologies to cryocooler industry. Demonstrate greater than 33% efficient solar cell using either lattice mismatch or five- or six- junction solar cell technology. Develop a greater than 12% efficient thin-film solar cell on a polymer substrate at least 20 square centimeters in area.

(U) In FY 2008: Continue to refine and validate cryocooler component and system models with experimental data. Complete theoretical model of multistage cooler energy flows. Continue to investigate thermodynamic loss mechanisms in regenerative cycle cryocoolers through computational fluid dynamics models. Complete definition and begin procurement technology development design work for improved short-wavelength infrared/medium-wavelength infrared (SWIR/MWIR) cryocooler application needs for missile launch detection and technical intelligence missions. Develop advanced

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 8809 Spacecraft Vehicle Technologies

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
concept solar cells traceable to efficiencies greater than 40%.				
(U) In FY 2009: Further refine and validate cryocooler component and system models with experimental data. Continue to investigate thermodynamic loss mechanisms in regenerative cycle cryocoolers through computational fluid dynamics models. Complete design work for improved SWIR/MWIR cryocooler application for missile launch detection and technical intelligence mission systems. Complete engineering demonstration of advanced array for thin-film solar cells scaleable to greater than 100 kw.				
(U)				
(U) MAJOR THRUST: Develop technologies for advanced space platform structures such as structural controls for vibration suppression, multi-functional structures, deployable large aperture optical arrays, and lightweight composite satellite and launch vehicle structures.	6.364	5.702	10.634	15.570
(U) In FY 2006: Developed advanced mechanisms and guidance strategies for capture and servicing of disabled (non-cooperative) spacecraft. Developed high-temperature, long-soak time thermal re-entry structures.				
(U) In FY 2007: Characterize thermal protection structural performance in reentry environment. Develop autonomy concepts to support defensive/protection actions by spacecraft.				
(U) In FY 2008: Complete characterization of thermal protection structural performance. Provide autonomy concepts to support defensive/protection actions by spacecraft. Begin development of multifunctional structural hardware concepts for space situational awareness, such as structural health monitoring, light occultation by nearby objects, and detection of RF emissions. Begin development of system-level architectures for large precision deployable structures. Begin development of advanced estimation algorithms for better local situational awareness using existing and next-generation hardware, such as star-trackers for object detection, characterization, and tracking.				
(U) In FY 2009: Continue development of multifunctional structural hardware concepts for space situational awareness, such as structural health monitoring, light occultation by nearby objects, and detection of RF emissions. Continue development of system-level architectures for large precision deployable structures. Continue development of advanced estimation algorithms for better local situational awareness using existing and next-generation hardware, such as star-trackers for object detection, characterization, and tracking.				
(U)				
(U) MAJOR THRUST: Develop flight experiments to address key scientific and technological problems in	10.949	15.314	25.517	14.278

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 8809 Spacecraft Vehicle Technologies

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
	order to improve the capabilities of existing operational space systems and to enable new transformational space capabilities. Note: Funding changes are due to launch preparation activities and higher Air Force priorities.				
(U)	In FY 2006: Completed fabrication of spacecraft structure. Built and tested core spacecraft and experimental payloads. Completed mission planning and on-orbit operations guide. Completed spacecraft system Preliminary Design Review to freeze all interfaces. Advanced design to level needed for Critical Design Review.				
(U)	In FY 2007: Complete Critical Design Review for all payloads to freeze all designs and authorize fabrication of all flight hardware. Complete fabrication of integrated spacecraft core including structure and electronics. Initiate delivery of individual experiment payloads and begin assembly, integration, and test with the core spacecraft.				
(U)	In FY 2008: Complete delivery of all spacecraft payloads. Complete spacecraft assembly, integration and test. Train mission operations team for on-orbit activities. Prepare science teams for on-orbit operations using simulated data to certify the dissemination and analysis process.				
(U)	In FY 2009: Prepare spacecraft for launch. Complete all spacecraft to launch vehicle interface analysis and approval. Launch spacecraft and commence with Mission Operations.				
(U)					
(U)	CONGRESSIONAL ADD: Converted Silicon Carbide for High Performance Optic Structures.	4.277	0.000	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for Converted Silicon Carbide for High Performance Optic Structures.				
(U)	In FY 2007: Not Applicable.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Consortium for Autonomous Satellite Systems (CASS).	1.459	0.000	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for CASS.				
(U)	In FY 2007: Not Applicable.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Large Aperture Deployable Structure Systems for Space.	1.944	0.000	0.000	0.000

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 8809 Spacecraft Vehicle Technologies

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(U)	In FY 2006: Conducted Congressionally-directed effort for Large Aperture Deployable Structure Systems for Space.				
(U)	In FY 2007: Not Applicable.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Nano-Reinforced Structures and Advanced Multi-Functional Structures for Space Programs.	2.333	0.000	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for Nano-Reinforced Structures and Advanced Multi-Functional Structures for Space Programs.				
(U)	In FY 2007: Not Applicable.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Integrated Control for Autonomous Space Systems (ICASS).	2.430	1.594	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for ICASS.				
(U)	In FY 2007: Conduct Congressionally-directed effort for ICASS.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Elastic Memory Composites (EMC).	1.459	0.996	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for Elastic Memory Composites.				
(U)	In FY 2007: Conduct Congressionally-directed effort for Elastic Memory Composites.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Deployable Structures Experiment.	2.236	1.096	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for Deployable Structures Experiment.				
(U)	In FY 2007: Conduct Congressionally-directed effort for Deployable Structures Experiment.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 8809 Spacecraft Vehicle Technologies

	B. Accomplishments/Planned Program ($ in Millions)	FY 2006	FY 2007	FY 2008	FY 2009
(U)					
(U)	CONGRESSIONAL ADD: Lightweight Photovoltaic Electricity and Hydrogen for Portable, On-Demand Power/Center for Solar Electricity and Hydrogen.	0.972	3.587	0.000	0.000
(U)	In FY 2006: Conducted Congressionally-directed effort for lightweight photovoltaic electricity and hydrogen for portable, on-demand power.				
(U)	In FY 2007: Conduct Congressionally-directed effort for Center for Solar Electricity and Hydrogen.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Flexible CIGS Solar Cells on Silicone Substrates for Spacecraft.	0.000	0.996	0.000	0.000
(U)	In FY 2006: Not Applicable.				
(U)	In FY 2007: Conduct Congressionally-directed effort for Flexible CIGS Solar Cells on Silicone Substrates for Spacecraft.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Joint Micro Power Initiative.	0.000	0.996	0.000	0.000
(U)	In FY 2006: Not Applicable.				
(U)	In FY 2007: Conduct Congressionally-directed effort for Joint Micro Power Initiative.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Multicontinuum Technology for Space Structures.	0.000	0.996	0.000	0.000
(U)	In FY 2006: Not Applicable.				
(U)	In FY 2007: Conduct Congressionally-directed effort for Multicontinuum Technology for Space Structures.				
(U)	In FY 2008: Not Applicable.				
(U)	In FY 2009: Not Applicable.				
(U)					
(U)	CONGRESSIONAL ADD: Shield Rocket Payloads.	0.000	0.284	0.000	0.000
(U)	In FY 2006: Not Applicable.				

Exhibit R-2a, RDT&E Project Justification		DATE February 2007
BUDGET ACTIVITY 02 Applied Research	PE NUMBER AND TITLE 0602601F Space Technology	PROJECT NUMBER AND TITLE 8809 Spacecraft Vehicle Technologies

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

	FY 2006	FY 2007	FY 2008	FY 2009
(U) In FY 2007: Conduct Congressionally-directed effort for Shield Rocket Payloads.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U)				
(U) CONGRESSIONAL ADD: Three Dimensional Deployable Structure Systems for Space.	0.000	1.096	0.000	0.000
(U) In FY 2006: Not Applicable.				
(U) In FY 2007: Conduct Congressionally-directed effort for Three Dimensional Deployable Structure Systems for Space.				
(U) In FY 2008: Not Applicable.				
(U) In FY 2009: Not Applicable.				
(U) Total Cost	38.009	35.832	40.585	34.384

(U) C. Other Program Funding Summary ($ 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 Cost
(U) Related Activities:										
(U) PE 0602203F, Aerospace Propulsion.										
(U) PE 0602102F, Materials.										
(U) PE 0603311F, Ballistic Missile Technology.										
(U) PE 0603401F, Advanced Spacecraft Technology.										
(U) This project has been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication.										

(U) D. Acquisition Strategy

Not Applicable.