PE NUMBER: 0603401F
PE TITLE: Advanced Spacecraft Technology

Exhibit R-2, RDT&E Budget Item Justification

DATE: February 2006

BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

	Cost ($ in Millions)	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
	Total Program Element (PE) Cost	80.832	85.564	68.026	79.897	85.435	93.866	95.610	Continuing	TBD
2181	Spacecraft Payloads	31.229	28.835	19.110	25.945	28.782	30.567	31.139	Continuing	TBD
3834	Integrated Space Technology Demonstrations	15.577	24.996	26.579	29.534	32.770	36.025	36.700	Continuing	TBD
4400	Space Systems Protection	5.726	3.263	3.452	3.507	3.806	4.180	4.259	Continuing	TBD
5021	Space Systems Survivability	3.887	4.518	4.824	4.903	5.321	5.432	5.533	Continuing	TBD
5083	Ballistic Missiles Technology	5.550	5.413	3.916	3.978	4.314	4.395	4.469	Continuing	TBD
682J	Spacecraft Vehicles	18.863	18.539	10.145	12.030	10.442	13.267	13.510	Continuing	TBD

(U) A. Mission Description and Budget Item Justification

This program develops, integrates, and demonstrates space technologies in the areas of spacecraft payloads, spacecraft protection, spacecraft and launch vehicles, ballistic missiles, space systems survivability, and development of advanced laser communications technologies to support next generation satellite communication systems. The integrated space technologies are demonstrated by component or system level tests on the ground or in flight. Note: In FY 2006, Congress added $4.0 million for Large Automated Production of Expendable Launch Structure (LAPELS), $3.0 million for Intelligent Free Space Optical Satellite Communications Node, $1.2 million for Precision Integrated Navigation an Position-Intelligent Networking Technology, $4.2 million for Beta Energy Cells (BEC) for Defense and Intelligence Applications; $1.2 million for Radiation Hardening Microelectronics, $1.5 million for Alternating Current (AC) Coupled Interconnect, $1.0 million for Radially Segmented Launch Vehicle Risk Reduction, $1.0 million for Integrated Spacecraft Engineering Tool, $1.0 million for Magnetic Random-Access Memory Communications Materials, $1.4 million for Microsatellite Serial Manufacturing Process, $4.0 million for Thin Film Amorphous Solar Arrays, and $2.4 million for System Approach to Radiation Hardened Electronics. This program is in Budget Activity 3, Advanced Technology Development, since it develops and demonstrates technologies for existing space system upgrades and/or new space system developments that have military utility and address warfighter needs.

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

		FY 2005	FY 2006	FY 2007
(U)	Previous President's Budget	89.839	60.915	67.221
(U)	Current PBR/President's Budget	80.832	85.564	68.026
(U)	Total Adjustments	-9.007	24.649	
(U)	Congressional Program Reductions	0.000	-0.014	
	Congressional Rescissions	-0.086	-1.237	
	Congressional Increases	0.000	25.900	
	Reprogrammings	-7.207		
	SBIR/STTR Transfer	-1.714		
(U)	Significant Program Changes:			

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology

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 2006

BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)

PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology

PROJECT NUMBER AND TITLE: 2181 Spacecraft Payloads

Cost ($ in Millions)	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
2181 Spacecraft Payloads	31.229	28.835	19.110	25.945	28.782	30.567	31.139	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project funds the development, demonstration, and evaluation of radiation-hardened space electronic hardware, satellite control hardware and software for advanced satellite surveillance operations, and development of advanced laser communications technologies to support next generation satellite communications systems. Improved space-qualifiable electronics and software for data and signal processing will be more interchangeable, interoperable, and standardized. In the near-term, this project's work concentrates on converting (i.e., radiation-hardening) commercial data and signal processor technologies for use in Air Force space systems. For mid-term applications, the Improved Space Computer Program will merge advanced, radiation-hardened space processor, memory, and interconnect technologies with commercially-derived, open system architectures to develop and demonstrate robust, on-board processing capabilities for 21st century Department of Defense satellites. In the long-term, this project area focuses on developing low-cost, easily modifiable software and hardware architectures for fully autonomous constellations of intelligent satellites capable of performing all mission related functions without operator intervention.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Develop spacecraft microelectronic devices, including radiation-hardened data processors and ultra-high density strategically hardened memories, space-qualifiable, high density advanced packaging technology, and micro-electro-mechanical systems (MEMS) components and applications. Note: In FY 2006, emphasis changed from microelectronics to focal plane arrays.	14.367	9.365	10.947

(U) In FY 2005: Developed inital general-purpose processor at 500 million instructions per second and digital signal processors at one million operations per second. Demonstrated electronics circuits in support of adaptable, self-repairing processors and memories enabling spacecraft capable of autonomously adapting to new missions. Built functional elements of chalcogenide-based field programmable logic and analog microelectronics. Developed hardened by design macrocell libraries enabling the use of state-of-the-art commercial manufacturing plants for high performance, low-cost electronics. Demonstrated elements for hieratical smart-wiring manifolds capable of reconfiguring entire space asset subsystems. Implemented the hardened-by-design mixed signal library and the design for analog-to-digital converter (ADC) demonstration; fabricated devices in the Silicon Germanium process. Validated performance and environmental ruggedness of the miniaturized military global positioning system (GPS) receiver through initial logic block engineering model.

(U) In FY 2006: Develop and validate the building blocks for a general-purpose processor at 500 million instructions per second. Provide the set of design tools for integrating hardening by design into commercial design tools. Fabricate a 16 megabyte chalcogenide-based nonvolatile memory. Initiate the first design hardened structured application specific integrated circuit (ASIC) to implement increased ASIC performance on low cost devices. Design and

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 2181 Spacecraft Payloads

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	fabricate the initial test vehicle to demonstrate the miniaturized military GPS receiver performance on low-cost devices.			
(U)	In FY 2007: Complete engineering model of the high performance 500 million instruction per second general-purpose processor. Fabricate a high performance design hardened analog-to-digital converter (ADC) for use in space and design a very low-power ADC using advanced design cells and design hardening. Fabricate the miniaturized military GPS receiver for use on terrestrial, aero, and space platforms. Fabricate the building blocks for a very high performance ten million-gate design hardened field programmable gate array.			
(U)				
(U)	MAJOR THRUST: Develop intelligent satellite system technologies for responsive spacecraft operations and for satellite control, precision navigation, formation flying, and proximity operations technologies for spacecraft constellations.	2.740	2.568	2.716
(U)	In FY 2005: Advanced development of command, control, and navigational capability for high fidelity spacecraft proximity operations with application to counterspace operations. Completed development of guidance, navigation, and control algorithms for proximity operations and large deployable systems. Furthered command and telemetry simulation development for mission ops center testing. Integrated hardware-in-the-loop engineering development unit into testbed, interface with spacecraft command and telemetry simulations, and performed mission ops center testing. Refined autonomous software technologies for responsive space systems. Designed integrated distributed aperture sensor analysis tool for engineering level, mission/engagement and campaign level analyses, identifying modules required for implementing unique distributed aperture sensor features to be incorporated into existing modeling and simulation tools.			
(U)	In FY 2006: Validate command and control capabilities and guidance, navigation, and control algorithms for proximity operations with flight experiment data. Refine command, control, guidance, and navigational capabilities for counterspace to apply to space situational awareness and offensive/defensive operations. Complete command and telemetry simulation development for mission ops center testing. Complete integration of hardware-in-the-loop engineering development unit into testbed, interface with spacecraft command and telemetry simulations, and conduct mission ops center testing. Build unique distributed aperture sensor simulation modules for engineering level, mission/engagement and campaign level analysis tool.			
(U)	In FY 2007: Continue to refine command, control, guidance, and navigational capabilities for counterspace to apply to space situational awareness and offensive/defensive operations. Begin to integrate autonomous flight software technologies with command, control, guidance, and navigation technologies to support responsive space systems. Extend hardware-in-the-loop testbed, spacecraft command and telemetry simulations, and mission ops center to development and testing of responsive and tactical space systems. Integrate modules and complete distributed			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 2181 Spacecraft Payloads

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
aperture sensor analysis tool for engineering level, mission/engagement and campaign level analyses.			
(U)			
(U) MAJOR THRUST: Develop modeling, simulation, and analysis tools and data exploitation methodologies for space-based surveillance systems, space capability protection technologies, access/mobility technologies, and flight experiments. Note: In FY 2006, reduction due to higher Air Force priorities.	2.043	0.682	1.213
(U) In FY 2005: Completed development of models for radio frequency (RF) system simulation. Completed development of RF signal processing models. Expanded development of simulations of space-based surveillance systems for military utility analysis. Refined development of modeling, simulation, and analysis tools for technical assessment of space capability protection and access/mobility technologies. Further developed physics-to-engineering-to-engagement level models for systems engineering, tech trades, mission planning and operations, and utility analysis applicable to potential flight experiments.			
(U) In FY 2006: Further expand development of models of surveillance systems for military utility to include tactical surveillance and electro-optical technologies. Initiate model development of responsive and reconfigurable technologies. Refine development of physics-to-engineering-to-engagement level models for systems engineering, tech trades, mission planning and operations, and utility analysis for flight experiments in tactical and responsive satellites.			
(U) In FY 2007: Complete development of models of surveillance systems for military utility to include tactical surveillance and electro-optical technologies. Continue to develop models of responsive and reconfigurable technologies. Apply physics-to-engineering-to-engagement level models for systems engineering, tech trades, mission planning and operations, and utility analysis to flight experiments in tactical and responsive satellites.			
(U)			
(U) MAJOR THRUST: Develop advanced space infrared technology and hardened focal plane detector arrays to enable acquisition, tracking, and discrimination of hot targets, as well as "cold body" targets such as decoys, satellites, and midcourse warheads.	1.472	2.142	2.669
(U) In FY 2005: Completed pathfinder, dual-band (mid-wave, long-wave) focal plane arrays (FPA) performance characterization and transition plan for insertion into a potential hyperspectral demonstration. Investigated detector array and cryogenic detector multiplexer interfacing concepts that lead to improved, larger-format, space hyperspectral imaging capabilities. Extended performance of single and dual color FPAs from moderate background levels to more stressing lower background levels needed for operation in space sensing.			
(U) In FY 2006: Initiate assessment of large format Read Out Integrated Circuits, designed through radiation hardened-by-design (RHBD), and fabricated on existing foundries. Investigate the readout and greater focal plane array performance enhancements needed for emerging detector array technologies.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 2181 Spacecraft Payloads

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U)	In FY 2007: Initiate studies for detectors and readouts needed for laser-based surveillance. Continue investigation into readouts fabricated on existing foundries and radiation hard design principles.			
(U)				
(U)	MAJOR THRUST: Develop technologies for multi-access laser communications space terminals with reduced weight, power, and cost for transformational communications.	1.608	2.092	1.349
(U)	In FY 2005: Explored component integration issues of multi-access laser communications systems. Completed ground breadboard testbed. Tested breadboard terminal designs in approved compatibility testbed. Developed initial multi-access laser communications terminal brassboard development.			
(U)	In FY 2006: Start development of components toward space-qualification and brassboard integration. Continue development of multi-access laser communications terminal brassboard. Start testing of components/system in relevant environmental.			
(U)	In FY 2007: Finalize brassboard integration.			
(U)				
(U)	MAJOR THRUST: Develop spectral/polarimetric sensing and data exploitation demonstrations for military imaging and remote sensing applications.	0.158	1.833	0.216
(U)	In FY 2005: Developed concepts for electro-optical/infrared spectral polarimetric space demonstrations. Examined hardware issues and begin technology development plan. Developed initial polarimetric FPA technology.			
(U)	In FY 2006: Complete polarimetric FPA test article and validate performance. Integrate FPA into laboratory camera and collect high quality data in the laboratory of relevant materials.			
(U)	In FY 2007: Conduct field collection with polarimetric focal plane camera. Demonstrate feasibility of hardware design for transition to acquisition system.			
(U)				
(U)	CONGRESSIONAL ADD: Alternating Current (AC) Coupled Interconnect.	0.971	1.478	0.000
(U)	In FY 2005: Demonstrated the ability of an AC-coupled interconnect approach to be used in connecting two different parts of a complex system (i.e., third-level packaging.) Under this assumption, optimized the design of the interconnect to maximize signal transport efficiency and minimize the bit error rate due to misalignment and multiple mating cycles.			
(U)	In FY 2006: Conduct Congressionally-directed effort for AC Coupled Interconnect.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Magnetoresistive Random Access Memory (MRAM) Innovative Communications Materials/Magnetic Random-Access Memory Communications Materials.	1.165	0.986	0.000

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 2181 Spacecraft Payloads

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U)	In FY 2005: Integrated MRAM cells, which are intrinsically radiation-hard, with RHBD microelectronics, leading to embedded memories for spacecraft systems that are more immune to single event upset effects from high energy particles. Supported an unlimited number of read-write cycles with ten nanoseconds access time, while consuming less than a nonowatt per bit.			
(U)	In FY 2006: Conduct Congressionally-directed effort for Magnetic Random-Access Memory Communications Materials.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Advanced Life Cycle Cost (LCC)/Risk Model for Space Concept Development.	0.971	0.000	0.000
(U)	In FY 2005: Incorporated Space concept cost modeling processes and methodologies into a software modeling and simulation code, the Advanced LCC/Risk Estimating Tool, which were incorporated into an existing modeling and simulation tool to provide integrated design, analysis, and LCC/risk estimating.			
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Systematic Hierarchical Approach to Radiation Hardened Electronics/System Approach to Radiation Hardened Electronics.	1.458	2.366	0.000
(U)	In FY 2005: Developed RHBD process design kits (PDKs). PDKs are targeted at commercial, on-shore integrated circuit (IC) fabrication processes. Verified proper operation of PDKs against RHBD ICs generated for DoD space applications such as GPS receiver ICs. Fabricated and characterized radiation response of RHBD IC test chips and validate radiation characterization data versus simulated results. Provided standardized PDKs for the design phase of radiation hardened ICs. Provided accelerated potential for qualified, automated generation of hardened ICs during production phase.			
(U)	In FY 2006: Conduct Congressionally-directed effort for System Approach to Radiation Hardened Electronics.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Radiation Hardened Microelectronics.	1.360	1.183	0.000
(U)	In FY 2005: Developed and demonstrated next-generation electronics technology for reconfigurable DoD space systems applications using both design and process hardening techniques. Showed that an emerging a commercial electronics memory design can be rapidly transitioned to DoD space applications by taking advantage of the improved hardened fabrication industrial infrastructure and by modifying the design to harden against both natural and man-made radiation. Demonstrated sizes as low as 0.15 microns.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 2181 Spacecraft Payloads

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U)	In FY 2006: Conduct Congressionally-directed effort for Radiation Hardened Microelectronics.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADDS: Intelligent Free Space Optical Communications and Intelligent Free Space Optical Satellite Communications Node.	2.916	2.957	0.000
(U)	In FY 2005: Developed engineering model intra-satellite fiber optic communications network components, high speed, multi-channel, gimble-less inter-satellite free space optical communications transceivers, and intelligent/adaptive intra-satellite switching and routing components with initial space pre-qualification testing.			
(U)	In FY 2007: Conduct Congressionally-directed effort for Intelligent Free Space Optical Satellite Communications Node.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Precision Integrated Navigation and Position-Intelligent Networking Technology.	0.000	1.183	0.000
(U)	In FY 2005: Not Applicable.			
(U)	In FY 2006: Conduct Congressionally-directed effort for Precision Integrated Navigation and Position-Intelligent Networking Technology.			
(U)	In FY 2007: Not Applicable.			
(U)	Total Cost	31.229	28.835	19.110

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0303601F, MILSTAR Satellite Communications System.									
(U) PE 0305160F, Defense Meteorological Satellite Program (DMSP).									
(U) PE 0602601F, Spacecraft Technology.									
(U) PE 0603311F, Ballistic Missile									

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603401F Advanced Spacecraft Technology**	PROJECT NUMBER AND TITLE **2181 Spacecraft Payloads**

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

Technology.

(U) PE 0603215C, Limited Defense System.

(U) PE 0603218C, Research and Support.

(U) PE 0603226E, Experimental Evaluation of Major Innovative Technologies.

(U) PE 0604609F, Reliability and Maintainability Technology Insertion Program (RAMTIP).

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

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2006
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE: 3834 Integrated Space Technology Demonstrations	

Cost ($ in Millions)		FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
3834	Integrated Space Technology Demonstrations	15.577	24.996	26.579	29.534	32.770	36.025	36.700	Continuing	TBD
	Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project is a series of advanced technology demonstrations designed to address mission needs by applying emerging technologies from the Air Force Research Laboratory, other Government laboratories, and industry. These technologies are integrated into system-level demonstrations that are used to test, evaluate, and validate the technologies in an relevant environment.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Develop microsatellite (10-100Kg) technologies for integrated, robust, flexible, microsatellite demonstrations building on previous work and leveraging investments by other organizations. Applications include space-based space situational awareness and/or tactical satellite concepts. Note: In FY 2005, reduction is due to higher Air Force priorities.	10.720	21.644	26.579
(U) In FY 2005: Completed environmental testing. Completed development of autonomous proximity operations microsatellites ground control interface system. Performed real-time hardware-in-the-loop and software-in-the-loop mission experiments and testing beyond spacecraft envelope. Completed satellite/launch vehicle integration and launch. Performed mission operations around several non-cooperative resident space objects. Evaluated options for potential follow-on space situational awareness technology demonstration, using operational concept trades. Performed preliminary design concept trades and initial satellite design(s). Downselected to best payload option. Designed initial satellite bus. Completed preliminary bus and payload design.			
(U) In FY 2006: Complete autonomous flight demonstration. Perform de-orbit maneuver. Complete satellite design(s). Initiate procurement of bus and payload hardware. Begin fabrication of payload and bus. Develop and test ground control system for real-time planning of flight operations of situational awareness missions. Develop and test flight software. Perform simulated missions against simulated faults and anomalies.			
(U) In FY 2007: Complete payload and bus fabrication. Perform functional and environmental tests of payload and bus. Complete system level integration of payload and microsatellite and complete functional and environmental tests of integrated system. Begin integration with launch vehicle. Integrate ground control system and satellite software simulations. Perform simulated mission operations for missions operations training.			
(U)			
(U) CONGRESSIONAL ADD: Integrated Spacecraft Engineering Tool (ISET).	0.971	0.986	0.000
(U) In FY 2005: Expanded tool to predict performance benefits and impacts for new technologies on a variety of			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 3834 Integrated Space Technology Demonstrations

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U)	spacecraft, spacelift, and responsive force systems. This includes unique subject areas such as satellite field-of-view studies, space radiation effects, directed energy lethality and vulnerability, and implementation of hardware-in-the-loop simulation.			
(U)	In FY 2006: Conduct Congressionally-directed effort for Integrated Spacecraft Engineering Tool (ISET).			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Vehicle Risk Reduction/Radially Segmented Launch Vehicle Risk Reduction.	3.886	0.986	0.000
(U)	In FY 2005: Completed fabrication of all tank body component and assembly tools, fabrication of all tank body sections, fabrication of the structural test fixture, structural testing of the bodies, and fabrication of the tank dome component tools. Fabricated initial tank assembly tools and the remaining tanks.			
(U)	In FY 2006: Conduct Congressionally-directed effort for Radially Segmented Launch Vehicle Risk Reduction.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Microsatellite Serial Manufacturing Process.	0.000	1.380	0.000
(U)	In FY 2005: Not Applicable.			
(U)	In FY 2006: Conduct Congressionally-directed effort for Microsatellite Serial Manufacturing Process.			
(U)	In FY 2007: Not Applicable.			
(U)	Total Cost	15.577	24.996	26.579

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0602601F, Spacecraft Technology.									
(U) PE 0603605F, Advanced Weapons Technology.									
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.									

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603401F Advanced Spacecraft Technology**	PROJECT NUMBER AND TITLE **3834 Integrated Space Technology Demonstrations**

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2006
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE: 4400 Space Systems Protection	

Cost ($ in Millions)	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
4400 Space Systems Protection	5.726	3.263	3.452	3.507	3.806	4.180	4.259	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates tools, instruments, and mitigation techniques required to assure operation of U.S. space assets in potentially hostile warfighting environments. The project performs assessments of critical components and subsystems, and evaluates susceptibility and vulnerability to RF and laser threats. This project also develops technologies that mitigate identified vulnerabilities. Technologies are developed and demonstrated to support balanced satellite protection strategies for detecting, avoiding, and operating in a hostile space environment.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Use multi-threat assessment tools to assess space-based electro-optical, communication, and other responses to various candidate RF and laser countermeasures and directed energy threats.	0.641	0.876	0.947
(U) In FY 2005: Investigated models for RF and laser response in communications and power subsystems and integration into single satellite communications and power subsystem models into satellite constellation analysis tool. Applied constellation analysis tool to wargaming exercises and assess efficacy.			
(U) In FY 2006: Perform predicative analysis of laboratory data to validate models being developed for the satellite constellation analysis tool. Begin modeling of mitigation techniques and incorporate into constellation analysis tool.			
(U) In FY 2007: Verify mitigation models against test data and commence predictive analysis of technique effectiveness.			
(U)			
(U) MAJOR THRUST: Develop passive satellite countermeasures and mitigation techniques for current and future threats to satellites.	1.249	2.014	2.101
(U) In FY 2005: Investigated and identified candidate threat mitigation technologies for principle satellite subsystems, such as shielding and terminal protection techniques for multi-chip modules, reconfigurable processors/architectures, and anti-jam modems for uplink subsystems.			
(U) In FY 2006: Develop prospective threat technologies and initiate comprehensive testing for space application.			
(U) In FY 2007: Integrate protection into space experiment for demonstration and validation.			
(U)			
(U) MAJOR THRUST: Develop visible and near-infrared laser protection technologies.	0.435	0.373	0.404
(U) In FY 2005: Designed and fabricated an optical sensor subsystem incorporating adaptive signal processing techniques. Developed optical sensor subsystem threat mitigation techniques using solutions such as acousto-optical switches or other developed limiters to deflect incoming laser energy from the focal plane array.			
(U) In FY 2006: Demonstrate visible and near-infrared laser protection technologies. Conduct ground test of optical			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 4400 Space Systems Protection

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	sensor subsystem incorporating selective mitigation approaches. Develop selected protection techniques and evaluate effectiveness as a laser mitigation technique of optical sensor subsystems. Coordinate space simulation testing of prospective protection technology.			
(U)	In FY 2007: Coordinate space demonstration of protective technology. Identify technology transfer opportunities and report findings to major commands.			
(U)				
(U)	CONGRESSIONAL ADD: Hardening Technologies for Satellite Protection.	3.401	0.000	0.000
(U)	In FY 2005: Evaluated possible protection techniques that are acceptable to systems designers with a goal of minimum impact of additional weight and power, integration issues, and performance loss. Maintained relationship with commercial systems designers to explore acceptable approaches for application to commercial systems. Expanded laboratory testing of prospective protection techniques, filters, rugates, and/or limiters applicable for enhanced survivability. Developed promising protection techniques emerging from FY 2004 effort. Developed inital field tests of the most promising protection techniques. Incorporated test results and feed back from commercial systems designers into the Satellite Survivability Module code.			
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Not Applicable.			
(U)	Total Cost	5.726	3.263	3.452

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost
(U) Related Activities:									
(U) PE 0602102F, Materials.									
(U) PE 0602601F, Spacecraft Technology.									
(U) PE 0603605F, Advanced Weapons Technology.									
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.									

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY **03 Advanced Technology Development (ATD)**	PE NUMBER AND TITLE **0603401F Advanced Spacecraft Technology**	PROJECT NUMBER AND TITLE **4400 Space Systems Protection**

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2006
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE: 5021 Space Systems Survivability	

Cost ($ in Millions)	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
5021 Space Systems Survivability	3.887	4.518	4.824	4.903	5.321	5.432	5.533	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates technologies to improve space system survivability and reliability of current and future Department of Defense space systems that must continue operation despite natural space hazards. It develops and demonstrates cost-effective solutions to mitigate hazardous space environmental interactions including electrical charge buildup and electronics failures due to both single radiation events and long-term radiation doses.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Develop sensors to specify and forecast conditions in the space environment that degrade the operation of satellite, communication, navigation, and surveillance systems. Support integration, launch, validation, and operation of instrumentation to provide improved space radiation and ionospheric hazard specification and forecasting.	2.633	3.215	3.685
(U) In FY 2005: Completed initial all-sky image based solar disturbance forecast algorithms and transition to military/civilian operational forecasters. Further developed relativistic particle sensor for Air Force radiation belt mapping satellite. Investigated joint-agency development of miniaturized plasma, magnetic field, and all-sky white light cameras for inclusion on interplanetary microsatellites. Determined optimal micro- and nano-technology path to achieve maximum deployable, highest capability energetic particle, neutral density, and low-energy plasma sensors for space weather characterization.			
(U) In FY 2006: Calibrate and integrate relativistic particle sensor onto Air Force radiation belt mapping satellite. Complete concept design for joint-agency space-based coronagraph and heliospheric imager for next-generation solar hazard detection system. Initiate concept design of micro- and nano-technology sensors for energetic particle, neutral density, low-energy plasma space weather characterization.			
(U) In FY 2007: Complete integration of relativistic particle sensor onto Air Force radiation belt mapping satellite. Identify space test opportunity and begin construction of joint agency coronagraph and heliospheric imager for solar hazard detection. Complete concept design of next-generation miniaturized space weather sensors and begin development of engineering models.			
(U)			
(U) MAJOR THRUST: Conduct collaborative space and laboratory experiments and develop hardware and software tools to improve the survivability of spacecraft power, communications, navigation, and surveillance systems.	0.315	0.353	0.371
(U) In FY 2005: Completed design and laboratory testing of miniaturized geosynchronous charge control system and explore options for on-orbit demonstration of hazard mitigation. Refined space tether experiment concept and			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 5021 Space Systems Survivability

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	finalize space hardware requirements. Completed integration of ionospheric and satellite drag effects into spacecraft environment effect tool suite. Completed hardware suite selection and begin fabrication of payload for space experiment to actively explore space particle dynamics and demonstrate radiation belt remediation technologies.			
(U)	In FY 2006: Develop space plasma control experiment plan combining satellite charge control and tether propulsion and particle remediation concepts. Begin integration of dynamic space particle climatology and radiation belt forecast models into spacecraft environment effect tool suite. Continue fabrication of payload to demonstrate radiation belt remediation technologies using electromagnetic wave technologies.			
(U)	In FY 2007: Construct space plasma control experiment payload and establish joint-agency collaboration for spaceflight. Continue expansion of spacecraft environment effect tool suite to include dynamic space particle climatologies and forecast models. Complete radiation belt remediation payload and begin calibration and integration onto Air Force test satellite.			
(U)				
(U)	MAJOR THRUST: Develop technology to warn of spacecraft radiation, charging, and kinetic impact hazards and to provide space environment situational awareness and anomaly resolution capability for Department of Defense space systems.	0.939	0.950	0.768
(U)	In FY 2005: Advanced global radiation hazard situational awareness model development by expanding number of sensor inputs to improve accuracy and timeliness. Completed laboratory demonstrations of distributed space hazard sensors needed for space situational awareness. Completed design of active wave experiment to remediate severe radiation environments. Planned for space test flight of active wave and distributed sensor technologies.			
(U)	In FY 2006: Develop filter-based optimization algorithms to determine full particle energy spectra utilizing complete inputs available from compact environment anomaly sensor. Determine impact sensor design and finalize requirements and conceptual design of radiation, plasma, chemical, and impact effect distributed anomaly resolution and spacecraft effects sensor suite. Complete construction of compact environment anomaly sensor to diagnose severe radiation environments expected during active wave radiation belt remediation experiment.			
(U)	In FY 2007: Employ full energy spectra algorithms to convert entire compact environment anomaly sensor data bases into dynamic climatological model for anomaly resolution and space system design. Commence construction of hardware for space demonstration of the distributed anomaly resolution sensor. Calibrate and integrate compact environment anomaly sensor for diagnosing severe radiation environment on Air Force test satellite.			
(U)	Total Cost	3.887	4.518	4.824

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 5021 Space Systems Survivability

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost

(U) PE 0602601F, Spacecraft Technology.

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

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification

DATE: **February 2006**

BUDGET ACTIVITY: **03 Advanced Technology Development (ATD)**

PE NUMBER AND TITLE: **0603401F Advanced Spacecraft Technology**

PROJECT NUMBER AND TITLE: **5083 Ballistic Missiles Technology**

Cost ($ in Millions)	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
5083 Ballistic Missiles Technology	5.550	5.413	3.916	3.978	4.314	4.395	4.469	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project develops, integrates, and demonstrates advanced technologies for sustainment and modernization of strategic ballistic missiles. The project focuses on developing robust, low maintenance inertial navigation instruments to sustain current ballistic missile systems, as well as provide new, small, low-powered, high precision instrumentation for next generation missile systems.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Develop, integrate, and demonstrate advanced navigation instrumentation applied to emerging vehicle designs and other technologies that sustain current strategic missile systems. Provide critical missile technology concepts to support future space force application and strategic systems.	2.775	2.707	1.958
(U) In FY 2005: Downselected to the most advanced navigational instrumentation designs for the next generation of ballistic missiles. Evaluated the designs and provide improvements to meet the established performance goals. Demonstrated and validated improved navigational technology designs that can meet performance goals.			
(U) In FY 2006: Explore further laboratory proof-of-concept of the most promising next generation missile navigation instrumentation designs. Initiate fabrication of navigation instruments and engineering demonstration units. Initiate engineering development tests. Evaluate instrument performance and provide improvements to meet established performance goals.			
(U) In FY 2007: Develop and integrate engineering design next generation missile navigation systems and ground test in environments relevant to subsequent flight test conditions. Evaluate system performance and provide improvements to meet established performance goals. Initiate flight test demonstration planning.			
(U)			
(U) MAJOR THRUST: Develop, integrate, and demonstrate advanced navigation technologies with new vehicle designs to provide robust, flexible, lower cost solutions for sustaining current strategic missile systems.	2.775	2.706	1.958
(U) In FY 2005: Completed advanced thermal materials design integrated with long-glide vehicles to provide greater controllability and selective targeting. Evaluated demonstration results of advanced leading edge and control surface materials and initiated down selection to candidates projected to provide lower cost, robust advanced future vehicle designs. Used results of laboratory testing to improve the capability of on-board navigation instruments and range safety devices to withstand loads greater than 100 times the gravitational force in all axes in flight test demonstrations.			
(U) In FY 2006: Initiate long-term plan for sled testing of high-gravitational force tolerant navigation instrumentation			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 5083 Ballistic Missiles Technology

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

		FY 2005	FY 2006	FY 2007
(U)	and range safety devices. Characterize instrumentation performance in quiescent environments. Initiate system level design interfaces with experimental test bed.			
(U)	In FY 2007: Continue long-term planning and initiate long-lead hardware acquisition and coordination with test facilities in preparation for sled testing of high-gravitational force tolerant navigation instrumentation and range safety devices. Measure performance of navigation instrumentation and range safety devices with associated platform hardware, power sources, support software, and communication interfaces in 100 times the gravitational force flight-like vibration environments. Continue system level design interfaces experimental test bed.			
(U)	Total Cost	5.550	5.413	3.916

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost
(U) PE 0601102F, Defense Research Sciences.									
(U) PE 0602601F, Space Technology.									
(U) PE 0603311F, Ballistic Missile Technology.									
(U) PE 0603601F, Conventional Weapons Technology.									
(U) PE 0603851F, Intercontinental Ballistic Missile-Dem/Val.									
(U) PE 0604851F, Intercontinental Ballistic Missile-EMD.									
(U) PE 0605860F, Rocket System Launch Program-Space.									
(U) This project has been coordinated through the Reliance process to harmonize efforts and eliminate duplication.									

(U) D. Acquisition Strategy

Not Applicable.

Exhibit R-2a, RDT&E Project Justification			DATE: February 2006
BUDGET ACTIVITY: 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE: 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE: 682J Spacecraft Vehicles	

Cost ($ in Millions)	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total
682J Spacecraft Vehicles	18.863	18.539	10.145	12.030	10.442	13.267	13.510	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

This project develops and demonstrates compact, low-cost, spacecraft and launch vehicle power generation, storage, distribution, and thermal management technologies, including cryogenic cooling technologies. Power generation activities focus on lightweight, low-cost, low-volume, and survivable solar cell arrays. Energy storage work focuses on lightweight nickel hydrogen and sodium sulfur spacecraft batteries and flywheel energy storage systems for extended (five to ten year) satellite missions. The project's power distribution efforts focus on producing lightweight, high-efficiency, standardized power busses for use on future space systems.

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
(U) MAJOR THRUST: Developed and evaluated performance of space conventional power generation technologies such as multi-junction solar cells, advanced thin film solar cells, lightweight flexible solar cell arrays, and radiation resistant solar cell modules.	1.541	1.583	2.266
(U) In FY 2005: Demonstrated methods for interconnecting thin-film solar modules into array-sized thin-film blankets. Demonstrated first six junction solar cell producing voltage twice that of state of the art triple junction solar cells.			
(U) In FY 2006: Complete space environmental testing of thin-film solar cells and modules. Perform radiation testing of lattice mismatch multi-junction solar cells.			
(U) In FY 2007: Perform radiation testing of five to six junction solar cells. Construct flight hardware for thin-film solar array. Demonstrate roll-to-roll production of thin-film solar cells on polymer substrates.			
(U)			
(U) MAJOR THRUST: Develop technologies for long life, efficient, low-vibration, lightweight mechanical cryocoolers and integration components for space applications.	0.862	1.031	1.488
(U) In FY 2005: Refined development of high capacity, multi-stage, low-temperature cryocooler technologies to meet the needs of high resolution, space-based infrared surveillance and tracking sensors with larger focal planes and optics. Expanded development of component cryocooler technologies for regenerative and recuperative cycle devices to transition enabling technology to cryocooler designs. Demonstrated cryogenic integration technologies, including thermal switches, in a relevant environment.			
(U) In FY 2006: Complete development of low temperature flight qualified high capacity cryocooler and demonstrate performance of cryocooler and control electronics integrated with focal plane in a relevant environment. Improve performance of key critical components including compressor, electronics, and heat exchangers.			
(U) In FY 2007: Assess various advanced technologies such as micro-electro-mechanical, optical cooling, and other concepts to further reduce cryocooler mass and improve performance for space based situational awareness			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 682J Spacecraft Vehicles

(U) B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
applications. Initiate advanced concept development program to support multi-temperature and large focal plane cooling requirements for space-based space surveillance and other mission applications.			
(U)			
(U) MAJOR THRUST: Develop composites for launch vehicle and spacecraft structures and space applications, such as launch vehicle shrouds, thermal protection structures, and space antennas.	1.810	1.945	3.369
(U) In FY 2005: Further refined spacecraft to demonstrate multi-functional structures technologies. Ground demonstrated sub-scale linerless composite cryogenic tanks. Fabricated and characterized components for large deployable optics systems using nanotechnology-enhanced materials.			
(U) In FY 2006: Develop ultra-lightweight, high-structural efficiency mirror support structures for space mirrors. Demonstrate qualification-level performance of all-composite payload adapters and fairing structures for Evolved Expendable Launch Vehicles.			
(U) In FY 2007: Demonstrate space qualification-level performance for large diameter launch vehicle fairing. Transition multi-functional structures technology to unmanned aerial vehicle and launch vehicle community. Demonstrate space qualification-level performance for 25-meters long ultralightweight deployable structures.			
(U)			
(U) MAJOR THRUST: Develop technologies for spacecraft structural controls and mechanisms for on-orbit applications such as advanced high power solar array subsystems, sensitive payload isolation systems, and miniature payload isolation systems.	2.020	1.954	3.022
(U) In FY 2005: Refined launch vibration isolation and primary and secondary payload isolation systems to meet specific launch vehicle requirements. Completed development of operational active acoustic attenuation systems. Completed development of low-shock multiple payload adapter technologies. Performed flight qualification testing of smart docking and deployment hardware. Integrated micro-electro-mechanical attitude control components with conventional attitude control systems.			
(U) In FY 2006: Develop rapid-slew, fast tracking gimbal technology to allow sub-orbital space situational awareness missions. Demonstrate space qualification-level performance for miniaturized vibration isolation systems for optical payloads.			
(U) In FY 2007: Ground demonstrate full multi-axis flywheel attitude control system with integrated energy storage. Demonstrate space qualification-level performance for passive vibro-acoustic damping devices to mitigate launch vehicle acoustic loads. Flight demonstrate on-orbit docking and fluid transfer mechanisms.			
(U)			
(U) CONGRESSIONAL ADD: Thin Film Amorphous Solar Arrays.	7.286	3.943	0.000
(U) In FY 2005: Demonstrated monolithic integration of amorphous silicon solar cells in roll-to-roll processing.			

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 682J Spacecraft Vehicles

	B. Accomplishments/Planned Program ($ in Millions)	FY 2005	FY 2006	FY 2007
	Demonstrated process capable of high volume, roll-to-roll production of amorphous silicon solar cells on polymer substrates.			
(U)	In FY 2006: Conduct Congressionally-directed effort for Thin Film Amorphous Solar Arrays.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Robust Aerospace Composite Materials/Structures.	4.373	0.000	0.000
(U)	In FY 2005: Fabricated full-scale fairings and adapters based on design inputs from FY 2004 and supporting Small Business Innovation Research contracts for new structure fabrication processes and fairing/adapter configurations. Demonstrated large scale out-of-autoclave component fabrications. Investigated influence on practical controlled flaws and performance. Tested structures to failure to demonstrate degree of conservatism in current design practices. Fairing designs up to ten meters in diameter to support large optics experiments will be considered for this demonstration program.			
(U)	In FY 2006: Not Applicable.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Boron Energy Cell Development/Beta Energy Cells (BEC) for Defense and Intelligence Applications.	0.971	4.140	0.000
(U)	In FY 2005: Integrated Boron Energy Cell with battery and capacitor storage device to provide Boron Energy Cell Storage Packs capable of supplying burst power for selected high value Air Force applications. Increased conversion efficiency of devices from 1% to 10%.			
(U)	In FY 2006: Conduct Congressionally-directed effort for Beta Energy Cells (BEC) for Defense and Intelligence Applications.			
(U)	In FY 2007: Not Applicable.			
(U)				
(U)	CONGRESSIONAL ADD: Large Automated Production of Expendable Launch Structure (LAPELS).	0.000	3.943	0.000
(U)	In FY 2005: Not Applicable.			
(U)	In FY 2006: Conduct Congressionally-directed effort for Large Automated Production of Expendable Launch Structure (LAPELS).			
(U)	In FY 2007: Not Applicable.			
(U)	Total Cost	18.863	18.539	10.145

Exhibit R-2a, RDT&E Project Justification		DATE February 2006
BUDGET ACTIVITY 03 Advanced Technology Development (ATD)	PE NUMBER AND TITLE 0603401F Advanced Spacecraft Technology	PROJECT NUMBER AND TITLE 682J Spacecraft Vehicles

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

	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	Cost to Complete	Total Cost

(U) Related Activities:

(U) PE 0602203F, Aerospace Propulsion.

(U) PE 0602601F, Spacecraft Technology.

(U) PE 0603218C, Research and Support.

(U) PE 0603226E, Experimental Evaluation of Major Innovative Technologies.

(U) PE 0603500F, Multi-Disciplinary Advanced Development Space Technology.

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

(U) D. Acquisition Strategy

Not Applicable.