Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*				R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	106.852	83.705	74.636	-	74.636	75.715	77.290	76.985	78.251	Continuing	Continuing
632181: *Spacecraft Payloads*	33.317	20.548	18.958	-	18.958	19.455	21.485	20.035	20.368	Continuing	Continuing
633834: *Integrated Space Technology Demonstrations*	38.350	41.188	35.441	-	35.441	32.840	31.725	32.408	32.941	Continuing	Continuing
634400: *Space Systems Protection*	7.891	5.316	4.513	-	4.513	6.763	7.203	7.805	7.929	Continuing	Continuing
635021: *Space Systems Survivability*	4.734	3.845	3.277	-	3.277	3.302	3.467	3.606	3.666	Continuing	Continuing
635083: *Ballistic Missiles Technology*	11.789	5.256	5.260	-	5.260	5.256	5.487	6.356	6.460	Continuing	Continuing
63682J: *Spacecraft Vehicles*	10.771	7.552	7.187	-	7.187	8.099	7.923	6.775	6.887	Continuing	Continuing

Note

NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

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. Efforts in this program have been coordinated through the Reliance 21 process to harmonize efforts and eliminate duplication. 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.

Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Air Force	DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	**R-1 ITEM NOMENCLATURE** PE 0603401F: *Advanced Spacecraft Technology*

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	98.708	83.705	75.985	-	75.985
Current President's Budget	106.852	83.705	74.636	-	74.636
Total Adjustments	8.144	-	-1.349	-	-1.349
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-0.001	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	10.000	-			
• SBIR/STTR Transfer	-1.855	-			
• Other Adjustments	-	-	-1.349	-	-1.349

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Project: 632181: *Spacecraft Payloads*		
Congressional Add: *Micromachined Switches for Next-Generation Modular Satellites.*	2.390	-
Congressional Add: *Domestic Manufacturing of 45nm Electronics.*	3.187	-
Congressional Add: *Integrated Passive Electronic Components.*	1.354	-
Congressional Add Subtotals for Project: 632181	6.931	-
Project: 635083: *Ballistic Missiles Technology*		
Congressional Add: *Ballistic Missile Technology.*	1.593	-
Congressional Add: *Florida National Guard Total Force Integration.*	2.390	-
Congressional Add: *P-Net Ballistic Missile Technology.*	1.992	-
Congressional Add Subtotals for Project: 635083	5.975	-
Project: 63682J: *Spacecraft Vehicles*		
Congressional Add: *Small Responsive Spacecraft at Low-Cost.*	2.390	-
Congressional Add Subtotals for Project: 63682J	2.390	-
Congressional Add Totals for all Projects	15.296	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 632181: *Spacecraft Payloads*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
632181: *Spacecraft Payloads*	33.317	20.548	18.958	-	18.958	19.455	21.485	20.035	20.368	Continuing	Continuing

Note

NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

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, 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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	8.360	6.431	7.336	-	7.336
Description: Develop microelectronic devices, including radiation-hardened data processors and high-density hardened memories, advanced packaging technology, and micro-electro-mechanical system components and applications.					
FY 2010 Accomplishments: Demonstrated improved radiation-hardened space sensor interface modules allocating standardized data messages protocols from sensors for easy device control of sensors and actuators. Further developed high-density volatile memory. Initiated multiprocessor architecture development.					
FY 2011 Plans: Demonstrate engineering model of high-density volatile memory. Continue multiprocessor architecture development. Initiate multiprocessor component development.					
FY 2012 Base Plans:					

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 632181: *Spacecraft Payloads*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Complete development of Single Event Immune Reconfigurable Field Programmable Gate Array for flexible, cost-effective on-board processing in space. Develop multiprocessor components to increase on-orbit processing capability. Develop high-density volatile and non-volatile memory for increased on-orbit storage capability. ***FY 2012 OCO Plans:***					
Title: Major Thrust 2. ***Description:*** Develop intelligent satellite system technologies for spacecraft operations and for satellite control, precision navigation, formation flying, and proximity operations technologies. ***FY 2010 Accomplishments:*** Modeled command, control, and communications systems; conducted engineering trades; and performed military utility analysis for space superiority. Initiated rapid spacecraft development processes to include automated spacecraft design, rapid assembly, automated flight and ground software configuration, and expedited integration and test. ***FY 2011 Plans:*** Complete model of command, control, and communications systems, conduct engineering trades, and perform military utility analysis for space superiority. Continue rapid spacecraft development processes to include automated spacecraft design, rapid assembly, automated flight and ground software configuration, and expedited integration and test. ***FY 2012 Base Plans:*** Complete rapid spacecraft development processes for automated spacecraft design, rapid assembly, automated flight and ground software configuration, and expedited integration and test. Initiate second-generation plug-and-play ground testbed to fully test and demonstrate end-to-end flight ready spacecraft plug-and-play software and hardware. ***FY 2012 OCO Plans:***	3.991	3.714	2.615	-	2.615
Title: Major Thrust 3. ***Description:*** Develop modeling, simulation, and analysis tools for space-based surveillance systems, space capability protection technologies, access/mobility technologies, and flight experiments.	6.705	5.231	4.611	-	4.611

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 632181: *Spacecraft Payloads*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
FY 2010 Accomplishments: Developed physics-to-engineering-to-engagement level models for systems engineering, technology trades, mission planning and operations, and utility analysis for systems-level analysis, experimental support, and concept of operations of flight programs. Completed integration of tools to model detection, identification, and characterization technologies for situational awareness. Refined and validated military utility and sensor analysis tools for external organizations. ***FY 2011 Plans:*** Develop graphic interfaces for simulation and analysis tools. Transition validated tools for use in customer flight programs. Apply lessons learned from analytical support, flight program participation, and external space organizations into refined modeling, simulation, and analysis tools that reduce cost and risk of flight programs and better model schedule limitations. ***FY 2012 Base Plans:*** Complete integration of autonomous flight software technologies with command, control, guidance, and navigation technologies. Apply additional physics-to-engineering-to-engagement level models for systems engineering, technology trades, mission planning and operations, and utility analysis to flight experiments in tactical, responsive, and space situational awareness (SSA) experiments and concepts. ***FY 2012 OCO Plans:***					
Title: Major Thrust 4. ***Description:*** Develop space infrared technology and hardened focal plane detector arrays to enable acquisition, tracking, and discrimination of hot targets, as well as "cold body" targets. ***FY 2010 Accomplishments:*** Further developed full focal plane array for exquisite imaging. Completed visible sensor development. Developed higher operating temperature sensors. Developed large format infrared sensors. ***FY 2011 Plans:*** Refine full focal plane array for exquisite imaging for space applications. Refine higher operating temperature sensor development and large format infrared sensor development. ***FY 2012 Base Plans:***	5.778	5.172	4.396	-	4.396

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 632181: *Spacecraft Payloads*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Develop full focal plane array for exquisite imaging for adaptive, comprehensive SSA. Initiate higher operating temperature, large format medium wavelength infrared sensor development for wide area, global access detection and tracking. ***FY 2012 OCO Plans:***					
Title: Major Thrust 5. ***Description:*** Develop spectral/polarimetric sensing and data exploitation demonstrations for military imaging and remote sensing applications. ***FY 2010 Accomplishments:*** Conducted studies and analyses of integrated radio frequency (RF)/optical/polarimetric sensing techniques. ***FY 2011 Plans:*** ***FY 2012 Base Plans:*** ***FY 2012 OCO Plans:***	1.552	-	-	-	-
Accomplishments/Planned Programs Subtotals	26.386	20.548	18.958	-	18.958

	FY 2010	FY 2011
Congressional Add: Micromachined Switches for Next-Generation Modular Satellites. ***FY 2010 Accomplishments:*** Conducted Congressionally-directed effort. ***FY 2011 Plans:***	2.390	-
Congressional Add: Domestic Manufacturing of 45nm Electronics. ***FY 2010 Accomplishments:*** Conducted Congressionally-directed effort. ***FY 2011 Plans:***	3.187	-
Congressional Add: Integrated Passive Electronic Components. ***FY 2010 Accomplishments:*** Conducted Congressionally-directed effort. ***FY 2011 Plans:***	1.354	-
Congressional Adds Subtotals	6.931	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 632181: *Spacecraft Payloads*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

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

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 633834: *Integrated Space Technology Demonstrations*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
633834: *Integrated Space Technology Demonstrations*	38.350	41.188	35.441	-	35.441	32.840	31.725	32.408	32.941	Continuing	Continuing

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 U.S. Government laboratories, and industry. These technologies are integrated into system-level demonstrations that are used to test, evaluate, and validate the technologies in a relevant environment.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1. ***Description:*** Develop microsatellite technologies for integrated, robust, flexible, microsatellite demonstrations building on previous work and leveraging investments by other organizations. ***FY 2010 Accomplishments:*** Completed lightweight visible and infrared sensors development. Completed bus designs and began integration. ***FY 2011 Plans:*** Complete integration of experimental microsatellite for geosynchronous orbit. Complete design for next generation plug-and-play bus. ***FY 2012 Base Plans:*** Complete integration/test and space environmental testing in preparation for launch of experimental microsatellite for geosynchronous orbit, an important enabler of future operational SSA capability for the warfighter. Explore processes for rapid integration and test that can be employed to rapidly field capabilities addressing urgent warfighter needs. ***FY 2012 OCO Plans:***	38.350	41.188	35.441	-	35.441
Accomplishments/Planned Programs Subtotals	38.350	41.188	35.441	-	35.441

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 633834: *Integrated Space Technology Demonstrations*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

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

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 634400: *Space Systems Protection*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
634400: *Space Systems Protection*	7.891	5.316	4.513	-	4.513	6.763	7.203	7.805	7.929	Continuing	Continuing

Note

NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

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 radio frequency (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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1. ***Description:*** Multi-threat assessment tools to assess space-based electro-optical, and communication, and other responses to various candidate RF and laser countermeasures and directed energy threats. ***FY 2010 Accomplishments:*** Demonstrated additional subsystem performance in laboratory. Identified additional transition opportunities and prepared engineering models to assess performance. ***FY 2011 Plans:*** Conduct extensive engineering analysis and down select final systems. Perform subsystem testing of RF and laser countermeasures. ***FY 2012 Base Plans:*** Conduct algorithm development and performance simulation to synthesize sensor input from multiple sources, on-board and off-board, to provide executable defensively based situational awareness. ***FY 2012 OCO Plans:***	2.186	2.325	2.426	-	2.426
Title: Major Thrust 2.	2.074	1.297	0.837	-	0.837

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 634400: *Space Systems Protection*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Description: Develop passive satellite countermeasures and mitigation techniques for current and future threats to satellites. ***FY 2010 Accomplishments:*** Demonstrated enhanced subsystems performance through laboratory testing. Identified transition opportunities and prepared engineering models to assess of performance. ***FY 2011 Plans:*** Develop performance goals using engineering models. Begin design of flight demonstration unit for passive satellite countermeasures. ***FY 2012 Base Plans:*** Develop flight demonstration unit for passive satellite countermeasures. Work with transition partner to identify potential flight opportunity. ***FY 2012 OCO Plans:***					
Title: Major Thrust 3. ***Description:*** Develop visible and near-infrared laser protection technologies. NOTE: In FY 2011, this thrust is moving to PE 0602601F in order to better align the technology readiness of these efforts. ***FY 2010 Accomplishments:*** Built candidate systems and conducted space qualification testing. Identified transition opportunities and prepared engineering models of performance. ***FY 2011 Plans:*** ***FY 2012 Base Plans:*** ***FY 2012 OCO Plans:***	1.847	-	-	-	-
Title: Major Thrust 4. ***Description:*** Develop active satellite local space awareness technologies and exploitation tools for satellite systems. ***FY 2010 Accomplishments:***	1.784	1.217	0.950	-	0.950

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 634400: *Space Systems Protection*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Conducted in-depth study of current capabilities and analysis of data available to satellite operators. Demonstrated active subsystems through laboratory testing. Prepared engineering performance models. ***FY 2011 Plans:*** Develop performance goals using engineering models. Begin design of flight demonstration unit for potential SSA applications. ***FY 2012 Base Plans:*** Design on-orbit threat detection, assessment, and response software systems. Focus technology development effort on on-orbit intelligent control of on-orbit surveillance payloads. Explore technology for miniaturization of sensor concepts and improved dynamic sensitivity of sensor components. ***FY 2012 OCO Plans:***					
Title: Major Thrust 5. ***Description:*** Develop RF characterization methods and performance analysis technology. NOTE: This thrust has been broken out from other efforts due to increased interest in space superiority technologies. ***FY 2010 Accomplishments:*** ***FY 2011 Plans:*** Identify technology options that provide passive or active detection of satellites in the RF spectrum. Develop and complete engineering designs for systems used to support active space superiority technologies. Demonstrate subsystems through laboratory testing. ***FY 2012 Base Plans:*** Evaluate additional RF scanning techniques for potential active and/or passive threat detection capabilities. Develop prototype sub-system concepts. Begin fabrication of model Light Detection and Ranging laser sub-system for near-field tracking. ***FY 2012 OCO Plans:***	-	0.477	0.300	-	0.300
Accomplishments/Planned Programs Subtotals	7.891	5.316	4.513	-	4.513

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 634400: *Space Systems Protection*

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

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

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 635021: *Space Systems Survivability*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635021: *Space Systems Survivability*	4.734	3.845	3.277	-	3.277	3.302	3.467	3.606	3.666	Continuing	Continuing

Note

NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	3.916	3.845	3.277	-	3.277
Description: Develop technologies to provide improved space radiation and ionospheric hazard specification and forecasting. ***FY 2010 Accomplishments:*** Developed new standard model of radiation belts to specify space hazards for spacecraft design. Designed second-generation heliospheric imager as joint agency initiative. ***FY 2011 Plans:*** Complete initial version of new standard model of radiation belts. Begin space test of miniaturized space weather sensors. Complete design and begin construction of second-generation heliospheric imager as joint agency initiative. ***FY 2012 Base Plans:*** Develop advanced standard model of radiation belts, using data from recently launched space environment instruments. Complete trade studies to narrow alternatives for a second-generation heliospheric imager for detecting and tracking solar coronal mass ejections (CMEs) which threaten space systems and degrade communications. Complete development of a more precise CME propagation model to enhance space weather forecasting tools. ***FY 2012 OCO Plans:***					

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 635021: *Space Systems Survivability*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 2. ***Description:*** Develop technology to warn of spacecraft radiation, charging, and kinetic impact hazards and to provide space environment situational awareness and anomaly resolution capability. NOTE: In FY 2011, these efforts are moving to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts. ***FY 2010 Accomplishments:*** Developed engineering model of micrometeoroid impact detector as a component of a spacecraft anomaly resolution system. Initiated development of radiation dosimeter, spacecraft charge sensors, and common satellite interface architecture for spacecraft protection. ***FY 2011 Plans:*** ***FY 2012 Base Plans:*** ***FY 2012 OCO Plans:*** These efforts are moving to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.	0.818	-	-	-	-
Accomplishments/Planned Programs Subtotals	4.734	3.845	3.277	-	3.277

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

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

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 635083: *Ballistic Missiles Technology*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
635083: *Ballistic Missiles Technology*	11.789	5.256	5.260	-	5.260	5.256	5.487	6.356	6.460	Continuing	Continuing

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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1. ***Description:*** Develop, integrate, and demonstrate advanced navigation instrumentation applied to emerging vehicle designs and other technologies that sustain current strategic missile systems. ***FY 2010 Accomplishments:*** Performed verification and integration of demonstration units. Began advanced navigation instrument engineering model designs with common mission requirements for better accuracy, lower cost, increased robustness, and smaller size. Commenced initial planning for advanced guidance risk reduction ground and flight demonstrations. ***FY 2011 Plans:*** Develop, build, and test advanced navigation instrument engineering model. Reduce advanced guidance risk through ground testing, sled testing, and flight test planning. Initiate build and test of flight capable advanced guidance system demonstration units integrated with strategic vehicle designs and interfaces. ***FY 2012 Base Plans:*** Start follow-on effort to address next generation guidance and navigation technologies for future systems. Develop technologies that facilitate planned Analysis of Alternatives on next generation strategic weapons. ***FY 2012 OCO Plans:***	2.907	2.630	2.630	-	2.630
Title: Major Thrust 2. ***Description:*** Develop, integrate, and demonstrate navigation technologies with new vehicle designs to provide robust, flexible, lower cost solutions for sustaining current strategic missile systems.	2.907	2.626	2.630	-	2.630

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 635083: *Ballistic Missiles Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
FY 2010 Accomplishments: Completed hardware procurement and initiated the build and test of advanced navigation instrumentation and range safety devices with new vehicle design interfaces. Performed qualification testing of designs against validated system level interfaces. Began dynamic and hostile environments analysis and testing of common advanced navigation instrumentation in support of strategic missile system development. ***FY 2011 Plans:*** Complete qualification testing of designs against validated system level interfaces. Complete build and continue test and evaluation of advanced navigation instrumentation and range safety devices with new vehicle design interfaces. Integrate advanced guidance technologies with common vehicle designs and interfaces focused on lower cost solutions with increased accuracy, flexibility, and robustness. ***FY 2012 Base Plans:*** Build and test Advanced Inertial Measurement engineering model for enhanced ground testing and preparation for flight test. Focus integration studies of advanced technologies into strategic systems to reduce cost and increase security, robustness, accuracy, and flexibility. ***FY 2012 OCO Plans:***					
Accomplishments/Planned Programs Subtotals	5.814	5.256	5.260	-	5.260

	FY 2010	FY 2011
Congressional Add: Ballistic Missile Technology. ***FY 2010 Accomplishments:*** Conducted Congressionally-directed effort. ***FY 2011 Plans:***	1.593	-
Congressional Add: Florida National Guard Total Force Integration. ***FY 2010 Accomplishments:*** Conducted Congressionally-directed effort. ***FY 2011 Plans:***	2.390	-
Congressional Add: P-Net Ballistic Missile Technology.	1.992	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 635083: *Ballistic Missiles Technology*

	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	5.975	-

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

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

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force			DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 63682J: *Spacecraft Vehicles*	

COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
63682J: *Spacecraft Vehicles*	10.771	7.552	7.187	-	7.187	8.099	7.923	6.775	6.887	Continuing	Continuing

Note

NOTE: In FY 2011, some technology development efforts have moved to PE 0602601F, Space Technology, in order to better align the technology readiness of these efforts.

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.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Title: Major Thrust 1.	2.359	1.978	1.468	-	1.468
Description: Develop power generation space technologies such as multi-junction solar cells, thin-film solar cells, lightweight solar cell arrays, and radiation resistant solar cell modules. ***FY 2010 Accomplishments:*** Demonstrated large area solar cells based on the inverted metamorphic structure. Developed integration schemes and module technology for inverted metamorphic solar cells. Conducted environmental testing of inverted metamorphic solar cells. ***FY 2011 Plans:*** Demonstrate module technology traceable to greater than 300 watts/kilograms (W/kg) arrays. ***FY 2012 Base Plans:*** Extend inverted metamorphic (IMM)-based solar cell development toward 35-37%. Conduct maturity development of quantum dot-enhanced IMM solar cells. ***FY 2012 OCO Plans:***					
Title: Major Thrust 2.	0.818	0.706	1.651	-	1.651

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
APPROPRIATION/BUDGET ACTIVITY 3600: *Research, Development, Test & Evaluation, Air Force* BA 3: *Advanced Technology Development (ATD)*	R-1 ITEM NOMENCLATURE PE 0603401F: *Advanced Spacecraft Technology*	PROJECT 63682J: *Spacecraft Vehicles*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Description: Develop technologies for long-life, efficient, low-vibration, lightweight mechanical cryocoolers and integration components for space applications. ***FY 2010 Accomplishments:*** Provided continued support of missile launch detection thermal and cryogenic efforts. Developed non-moving parts compressor using proton biased membrane technology. Developed low-vibration conductance, cross gimbal 35K cooling loop interface to support space tracking missions. Expanded technology development of satellite cryogenic interface requirements and improved technologies to support space tracking applications. ***FY 2011 Plans:*** Support of missile launch detection thermal and cryogenic SSA missions. Develop a non-moving parts compressor using proton biased membrane technology. Design a low-vibration conductance, cross gimbal 35K cooling loop interface to support space tracking missions. Advance technology development of satellite cryogenic interface requirements and improved technologies to support space tracking applications. ***FY 2012 Base Plans:*** Work to reduce size, weight, and power requirements, ease integration, and increase reliability of cryocoolers and supporting payload thermal management systems for very large format focal plane arrays for missile warning capability and for responsive, modular systems. Evaluate passive versus active cooling, based on heat loads, power requirements, size, and payload thermal modeling. Provide correlated computer modeling results to industry to improve overall cryocooler design. ***FY 2012 OCO Plans:***					
Title: Major Thrust 3. ***Description:*** Develop composites for launch vehicle and spacecraft structures and space applications, such as launch vehicle shrouds, thermal protection structures, and space antennas. ***FY 2010 Accomplishments:*** Demonstrated symbiotic structural technologies for space applications through sub-scale laboratory testing or sub-orbital launch demonstration. Developed thermal management testbed for space structures developed for responsive space class satellites. Initiated development of rapid fabrication processes to build tailored spacecraft panels in days rather than weeks. ***FY 2011 Plans:***	2.167	2.350	1.417	-	1.417

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Demonstrate novel deployable structural architectures. Demonstrate novel optical structures in relevant sub-system environment. Develop rapid fabrication processes to build tailored spacecraft panels in days, rather than weeks, and demonstrate and test rapidly fabricated engineering model panels. ***FY 2012 Base Plans:*** Complete development of thermal management testbed for space structures developed for responsive space satellites. Initiate development of system-level deployable architectures for advanced optical systems and low-cost RF reflectors. ***FY 2012 OCO Plans:***					
Title: Major Thrust 4. ***Description:*** Develop technologies for spacecraft structural controls and mechanisms for on-orbit applications. ***FY 2010 Accomplishments:*** Finished development and integration of advanced estimation algorithms for improved local situational awareness. Began development of guidance, navigation, and control hardware for rapid integration and test. ***FY 2011 Plans:*** Develop advanced guidance, navigation, and control hardware such as control moment gyroscopes and reaction wheels for rapid integration and test. Increase performance of hardware systems while maintaining rapid integration capability. Begin development of hardware testbed for verifying performance of guidance, navigation, and control hardware systems. ***FY 2012 Base Plans:*** Transition high accuracy star tracker flight unit for use in customer flight program. Refine SSA camera tracking software in preparation for 2013 flight test. Design an autonomous mission manager for flight autonomy and on on-orbit planning systems. Implement flight-like processors with hardware-in-the-loop to increase technology readiness levels. ***FY 2012 OCO Plans:***	3.037	2.518	2.651	-	2.651
Accomplishments/Planned Programs Subtotals	8.381	7.552	7.187	-	7.187

	FY 2010	FY 2011
Congressional Add: Small Responsive Spacecraft at Low-Cost.	2.390	-

Exhibit R-2A, RDT&E Project Justification: PB 2012 Air Force		DATE: February 2011
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	FY 2010	FY 2011
FY 2010 Accomplishments: Conducted Congressionally-directed effort.		
FY 2011 Plans:		
Congressional Adds Subtotals	2.390	-

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
• Activity Not Provided: *Title Not Provided*	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Continuing	Continuing

D. Acquisition Strategy

N/A

E. Performance Metrics

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