

UNCLASSIFIED

PE NUMBER: 0603791F

PE TITLE: International Space Cooperative R&D

Exhibit R-2, RDT&E Budget Item Justification	DATE February 2007
---	------------------------------

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603791F International Space Cooperative R&D
---	---

Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
Total Program Element (PE) Cost	0.550	0.591	0.619	0.633	0.649	0.658	0.670	0.685	Continuing	TBD
5035 Intl Space Coop R&D	0.550	0.591	0.619	0.633	0.649	0.658	0.670	0.685	Continuing	TBD

In FY 2003, from PE 0603790F, 64NATO, NATO Coop R&D, space-related efforts transferred to PE 0603791F, 645035, Intl Space Coop R&D, in order to clearly identify space-related projects and funding.

(U) A. Mission Description and Budget Item Justification

These funds will be used to help implement space-related international cooperative research, development, and acquisition (ICRD&A) agreements with North Atlantic Treaty Organization (NATO) member states and major non-NATO allies (Argentina, Australia, Egypt, Bahrain, Israel, Japan, Jordan, and Rep. of Korea (South Korea), Kuwait, Morocco, New Zealand, Pakistan, Taiwan, Thailand, and Phillipines) and friendly foreign countries (Austria, Brazil, Bulgaria, Finland, India, Singapore, South Africa, Sweden, Switzerland, and Ukraine). The program implements the provisions of Title 10 U.S. Code, Section 2350a on NATO Cooperative Research and Development (R&D). The program was established to improve cooperation among NATO nations, and later major non-NATO allies, in research, development, and acquisition. The legislation authorized funds to significantly improve United States (US) and allied conventional defense capabilities by leveraging the best defense technologies, eliminating costly duplication of R&D efforts, accelerating the availability of defense systems, and promoting US and allied interoperability or commonality. The program will be reported as required by Title 10 U.S. Code, Section 2350a(f). This program element funds the implementation of space-related Air Force ICRD&A agreements in (1) Basic Research (2) Applied Research (3) Advanced Technology Development (4) Advanced Component Development and Prototypes (5) System Development and Demonstration and (6) RDT&E Management Support. This PE is designated in Budget Activity 4 because most of the ICRD&A projects support specific systems, include all efforts necessary to evaluate integrated technologies in as realistic an operating environment as possible to assess the performance or cost reduction potential of advanced technology, and help expedite technology transition from the laboratory to operational use.

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

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Previous President's Budget	0.566	0.575	0.612	0.625
(U) Current PBR/President's Budget	0.550	0.591	0.619	0.633
(U) Total Adjustments	-0.016			
(U) Congressional Program Reductions				
Congressional Rescissions	-0.016	-0.002		
Congressional Increases				
Reprogrammings				
SBIR/STTR Transfer		-0.017		
(U) <u>Significant Program Changes:</u>				

Exhibit R-2a, RDT&E Project Justification

DATE
February 2007

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)				PE NUMBER AND TITLE 0603791F International Space Cooperative R&D			PROJECT NUMBER AND TITLE 5035 Intl Space Coop R&D			
Cost (\$ in Millions)	FY 2006 Actual	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	Cost to Complete	Total
5035 Intl Space Coop R&D	0.550	0.591	0.619	0.633	0.649	0.658	0.670	0.685	Continuing	TBD
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0		

(U) A. Mission Description and Budget Item Justification

These funds will be used to help implement space-related international cooperative research, development, and acquisition (ICRD&A) agreements with North Atlantic Treaty Organization (NATO) member states and major non-NATO allies (Argentina, Australia, Egypt, Bahrain, Israel, Japan, Jordan, and Rep. of Korea (South Korea), Kuwait, Morocco, New Zealand, Pakistan, Taiwan, Thailand, and Phillipines) and friendly foreign countries (Austria, Brazil, Bulgaria, Finland, India, Singapore, South Africa, Sweden, Switzerland, and Ukraine). The program implements the provisions of Title 10 U.S. Code, Section 2350a on NATO Cooperative Research and Development (R&D). The program was established to improve cooperation among NATO nations, and later major non-NATO allies, in research, development, and acquisition. The legislation authorized funds to significantly improve United States (US) and allied conventional defense capabilities by leveraging the best defense technologies, eliminating costly duplication of R&D efforts, accelerating the availability of defense systems, and promoting US and allied interoperability or commonality. The program will be reported as required by Title 10 U.S. Code, Section 2350a(f). This program element funds the implementation of space-related Air Force ICRD&A agreements in (1) Basic Research (2) Applied Research (3) Advanced Technology Development (4) Advanced Component Development and Prototypes (5) System Development and Demonstration and (6) RDT&E Management Support. This PE is designated in Budget Activity 4 because most of the ICRD&A projects support specific systems, include all efforts necessary to evaluate integrated technologies in as realistic an operating environment as possible to assess the performance or cost reduction potential of advanced technology, and help expedite technology transition from the laboratory to operational use.

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

	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Hypersonic Airbreathing Propulsion Test Techniques (AEDC / Germany) - Planned project addresses US deficiencies in hypersonic test capabilities and diagnostic techniques, and will leverage German, tri-service, and Arnold AFB investments. The key component of this project will involve complementary testing of a hypersonic engine at Arnold AFB's Aerodynamic and Propulsion Test Unit (APTU) facility and the German Aerospace Center (DLR) High Enthalpy Göttingen (HEG) facility. Ancillary activities will include diagnostics and computer model development, application, and analysis. These activities are needed by the US to enhance conventional defense capabilities into hypersonic flight systems of the future. The Air Force Scientific Advisory Board (SAB) conducted report SAB-TR-00-03 on "Why and Whither Hypersonics research in the US Air Force", which recognized serious shortfalls in ground test facility hypersonic capabilities. The AF published Vision 2020: Global Vigilance, Reach and Power, stated a desire to control and exploit the full aerospace continuum.	0.203	0.050		
(U) Measurement of High-Latitude Ionospheric Structures and System Effects from Northeast Greenland (AFRL/Denmark) - Planned cooperative project to accurately model, simulate, recognize, and forecast	0.075	0.025		

Exhibit R-2a, RDT&E Project Justification

DATE

February 2007

BUDGET ACTIVITY

04 Advanced Component Development and Prototypes (ACD&P)

PE NUMBER AND TITLE

0603791F International Space
Cooperative R&D

PROJECT NUMBER AND TITLE

5035 Intl Space Coop R&D

(U) B. Accomplishments/Planned Program (\$ in Millions)	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
polar ionospheric conditions impacting DoD systems. The project will collect multi-instrument measurements of ionospheric conditions at Station Nord in Greenland for the purpose of furthering basic research into mechanisms creating ionospheric disturbances, improving high-latitude ionosphere models, simulations, and providing space weather situational awareness and forecast tools.				
(U) Cooperation In Navigation Warfare Technology Demonstrator and System Prototype Projects (PA) SMC/GP (GPS Joint Program Office) and ASD/NII/UK - Cooperative project to conduct collaborative studies and cooperatively develop advance counterSATNAV capabilities that can be employed from current and projected EA platforms. Developed technologies will be jointly tested to assure desired effects are achieved and that there is minimal fratricide impact on friendly forces. Additionally, an initial concept of employment or operations will be collectively developed and tested by the participants in order to assess optimal capabilities in varying threat situations.	0.143	0.093		
(U) Forecasting Communication and Navigation Disruptions due to Inonspheric Disturbance During Solar Minumum (AFRL/VSBX) and Australia - Planned cooperative project to collaborate with Australia to study ionospheric phenomena which impact communication, navigation and radio frequency (RF) surveillance systems. The key research focus will be on forecasting ionospheric disturbances and their impact on systems such as Ultra High Frequency (UHF) Satellite Communication (SATCOM) and GLOBAL Positioning System (GPS) navigation. Ionospheric phenomena had an adverse impact on DoD satellite communication and navigation systems in recent operations in Afghanistan and during Operation Iraqi Freedom (OIF); future military operations will almost certainly be conducted in regions where ionospheric disturbances occur and C31 systems may be vulnerable. The Communication/Navigation Outage Forecast System System (C/NOFS) Advance Concept Technical Demonstration (ACTD) is dedicated to providing space-based forecasts of the disturbances that cause impacts on radio frequency (RF) systems.	0.129	0.323	0.275	
(U) Multidemsional Diffusion of High Energy Radiation Belt Electrons (AFRL / UK) - High energy electrons constituting the radiation belts are a primary hazard for USAF and other satellites. They are often enhanced during geomagnetic storms, but not in a reliably predictable way. Thus, understanding and forecasting their behavior is a major research goal. The physics of the radiation belts is believed to be largely controlled by electromajnetic waves, which casue diffusion in the otherwise constant particle energy (E), equatorial pitch angle (a), and radial distance (L shell parameter). The wave amplitudes can become gratly enhanced during magnetic storms and substorms, leading to a rapid increase in particle energy and a rapid decrease in particle distance from the earth (through decrease in L, a0, or both),	0.000	0.100	0.125	0.225

Exhibit R-2a, RDT&E Project Justification

DATE
February 2007

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603791F International Space Cooperative R&D	PROJECT NUMBER AND TITLE 5035 Intl Space Coop R&D
--	--	---

(U) B. Accomplishments/Planned Program (\$ in Millions)	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
which increases the risk to satellites in medium or low earth orbit. Wave-particle interactions are also a dominant lost mechanism for energetic electrons, so the detailed evolution of the particle distribution depends on a complex balance of several diffusion rates.				
(U) Atmospheric Specification and Neutral Density Models (AFRL / Taiwan) - This effort is to improve specification of the ionosphere/thermosphere with the ultimate goal of improved atmospheric neutral density forecast.	0.000	0.000	0.219	0.408
(U) Total Cost	0.550	0.591	0.619	0.633

(U) C. Other Program Funding Summary (\$ in Millions)	<u>FY 2006</u> <u>Actual</u>	<u>FY 2007</u> <u>Estimate</u>	<u>FY 2008</u> <u>Estimate</u>	<u>FY 2009</u> <u>Estimate</u>	<u>FY 2010</u> <u>Estimate</u>	<u>FY 2011</u> <u>Estimate</u>	<u>FY 2012</u> <u>Estimate</u>	<u>FY 2013</u> <u>Estimate</u>	<u>Cost to</u> <u>Complete</u>	<u>Total Cost</u>
(U) N/A										

(U) **D. Acquisition Strategy**
A principal goal of the International Space Cooperative R&D program is to effectively utilize the aggregate resources invested by the US and our allies in space-related R&D. This program element provides the critical funding incentive needed to pursue space-related ICRD&A agreements and helps to (a) leverage USAF and allied resources through cost sharing and economies of scale; (b) exploit the best US and allied technologies for equipping coalition forces; (c) demonstrate areas of commonality or interoperability with our allies; and (d) accelerate the availability of defense technology and systems. Candidate projects are reviewed and approved by the USD(AT&L). An international agreement defining project objectives, responsibilities and costs is required prior to release of funds. To obtain these funds and ensure service commitment, projects are selected from existing or new space-related RDT&E programs funded in the Future Years Defense Plan (FYDP). Project offices must show matching funds and contributions from associated program elements and equitable allied funding. As appropriate, funding responsibility for out-year requirements and follow-on efforts are transferred to the project office and associated program elements. Most contracts are awarded after full and open competition.

UNCLASSIFIED

Exhibit R-3, RDT&E Project Cost Analysis

DATE
February 2007

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603791F International Space Cooperative R&D	PROJECT NUMBER AND TITLE 5035 Intl Space Coop R&D
---	---	--

<u>(U) Cost Categories</u> (Tailor to WBS, or System/Item Requirements) (\$ in Millions)	<u>Contract Method & Type</u>	<u>Performing Activity & Location</u>	<u>Total Prior to FY 2006 Cost</u>	<u>FY 2006 Cost</u>	<u>FY 2006 Award Date</u>	<u>FY 2007 Cost</u>	<u>FY 2007 Award Date</u>	<u>FY 2008 Cost</u>	<u>FY 2008 Award Date</u>	<u>FY 2009 Cost</u>	<u>FY 2009 Award Date</u>	<u>Cost to Complete</u>	<u>Total Cost</u>	<u>Target Value of Contract</u>
<u>(U) Product Development</u>														
AFRL Hanscom AFB, MA	TBD											Continuing	TBD	TBD
AFRL, WPAFB				0.420	Oct-06	0.236	Oct-07	0.254	Oct-08	0.258	Oct-09	Continuing	TBD	TBD
AEDC/DO												Continuing	TBD	TBD
SMC, LAAFB, CA				0.130	Oct-06	0.355	Oct-07	0.365	Oct-08	0.375	Oct-09	Continuing	TBD	TBD
Subtotal Product Development			0.000	0.550		0.591		0.619		0.633		Continuing	TBD	TBD
Remarks:														
<u>(U) Support</u>														
AFRL, WPAFB	TBD											Continuing	TBD	TBD
None													0.000	
Subtotal Support			0.000	0.000		0.000		0.000		0.000		Continuing	TBD	TBD
Remarks:														
<u>(U) Test & Evaluation</u>														
TBD	TBD											Continuing	TBD	TBD
None													0.000	
Subtotal Test & Evaluation			0.000	0.000		0.000		0.000		0.000		Continuing	TBD	TBD
Remarks:														
<u>(U) Management</u>														
Subtotal Management			0.000	0.000		0.000		0.000		0.000			0.000	0.000
Remarks:														
<u>(U) Total Cost</u>			0.000	0.550		0.591		0.619		0.633		Continuing	TBD	TBD

UNCLASSIFIED

Exhibit R-4, RDT&E Schedule Profile

DATE

February 2007

BUDGET ACTIVITY

04 Advanced Component Development and Prototypes (ACD&P)

PE NUMBER AND TITLE

0603791F International Space
Cooperative R&D

PROJECT NUMBER AND TITLE

5035 Intl Space Coop R&D

Name of ICR&D Project & Int'l Agreement Schedule	Fiscal Year	Start Date	END IA	PE
Impacts of Space environment...	FY03	07/06/04	07/05/09	63791F
Measurement of High-Latitude Ionospheric...	FY04	09/27/05	09/26/11	63791F
Hypersonic Airbreathing Propulsion Test	FY04			63791F
Cooperation Navigation Warfare Technology	FY05			63791F
Forecasting Communication and Navigation Disruptions Due to Ionospheric Disturbances	FY06			63791F
Multidimensional Diffusion of High Energy Radiation Belt Electrons	FY07			63791F
Atmospheric Specification and Neutral Density Models	FY08			63791F

R-1 Line Item No. 48

Page-6 of 7

Project 5035

Exhibit R-4 (PE 0603791F)

704

UNCLASSIFIED

UNCLASSIFIED

Exhibit R-4a, RDT&E Schedule Detail	DATE February 2007
--	------------------------------

BUDGET ACTIVITY 04 Advanced Component Development and Prototypes (ACD&P)	PE NUMBER AND TITLE 0603791F International Space Cooperative R&D	PROJECT NUMBER AND TITLE 5035 Intl Space Coop R&D
---	---	--

(U) <u>Schedule Profile</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>	<u>FY 2009</u>
(U) Forecasting Comm. and Navigation Disruption due to Ionospheric Disturbances During Solar Minimum		1Q		
(U) - Project Agreement signed		1Q		
(U) Cooperation in Navigation Warfare Technology		1Q		
(U) - Project Agreement signed		2-3Q		
(U) - Data collection begins			2-4Q	1-4Q
(U) Measurement of High-Latitude Ionospheric Structures and System Effects		1Q		
(U) - Project agreement signed		2-3Q		
(U) - Data collection begins			2-4Q	1-4Q
(U) Atmospheric Specification and Neutral Density Models			1Q	
(U) - Project agreement signed			2-3Q	
(U) - Data collection begins			3-4Q	
(U) Multidimensional Diffusion of High Energy Radiation Belt Electrons		1Q		
(U) - Project Agreement Signed		2Q		
(U) - Data collection begins			1-4Q	1-4Q