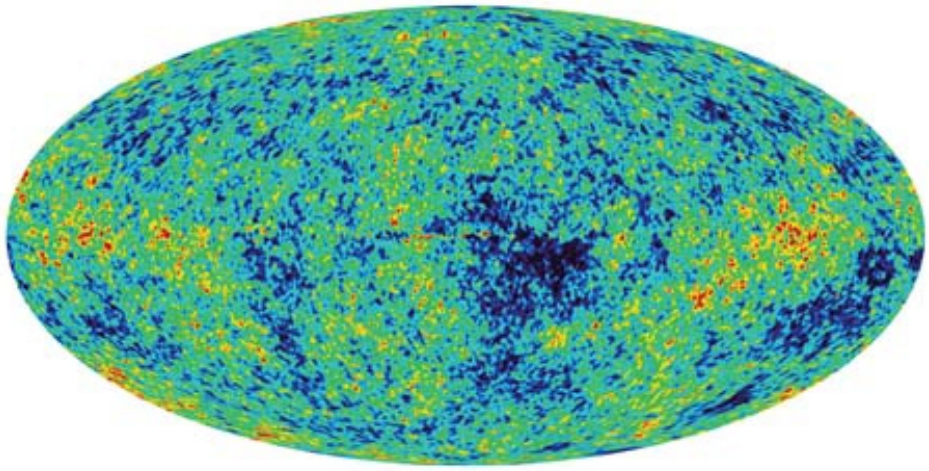
Theme: Structure and Evolution of the Universe



The First Detailed Full-Sky Image of the Oldest Light in the Universe - The Wilkinson Microwave Anisotropy Probe (WMAP) team has made the first detailed full-sky map of the oldest light in the universe. In this "baby picture" of the universe, colors indicate "warmer" (red) and "cooler" (blue) spots. WMAP resolves slight temperature fluctuations, which vary by only millionths of a degree. The oval shape is a projection to display the whole sky; similar to the way the globe of the Earth can be projected as an oval.

The microwave light captured in this picture is from 379,000 years after the Big Bang, over 13 billion years ago -- the equivalent of taking a picture of an 80-year-old person on the day of their birth. The new data support and strengthen the Big Bang and Inflation theories.

Structure and Evolution of the Universe

MAJOR EVENTS IN FY 2005

- Astro-E2, a powerful x-ray observatory developed jointly by the U.S. and Japan, will be launched.
- A host of missions, including the Chandra X-Ray Observatory, WMAP, and GALEX, will continue their operations and science investigations.

Theme: Structure and Evolution of the Universe

OVERVIEW

The universe is a dynamic, evolving place. It is governed by cycles of matter and energy, an intricate series of physical processes in which the chemical elements are formed and destroyed, and passed back and forth between stars and diffuse clouds. The Structure and Evolution of the Universe (SEU) Theme seeks to understand these cycles and how they created the conditions for our own existence.

How did the universe begin? Does time have a beginning and an end? Does space ever end? Einstein's theory of relativity replies to these ancient questions with three startling predictions: that the universe is expanding from a Big Bang; that black holes so distort space and time that time stops at their edges; and space itself contains some kind of energy that is pulling the universe apart. Observations confirm these remarkable predictions, the last finding being made only a few years ago. Yet Einstein's legacy is incomplete. His theory raises, but cannot answer, three profound questions: What powered the Big Bang?; What happens to space, time, and matter at the edge of a black hole?; What is the mysterious, invisible dark energy pulling the universe apart?

Missions	Goals supported by this Theme	Objectives supporting these Goals
To Explore the Universe and Search for Life	5. Explore the solar system and the universe beyond, understand the origin and evolution of life, and search for evidence of life elsewhere.	5.10 Discover what powered the Big Bang and the nature of the mysterious dark energy that is pulling the Universe apart.
		5.11 Learn what happens to space, time, and matter at the edge of a black hole.
		5.12 Understand the development of structure and the cycles of matter and energy in the evolving Universe.

RELEVANCE

The Structure and Evolution of the Universe Theme seeks to answer questions that humankind has been pondering for millennia: How did the universe begin? How will it end? What are the limits of matter and energy, of space and time? How did the universe we see arise, and what are the laws of nature that have permitted life to arise in the universe? These questions have been the basis of mythology and philosophy in the past. They have seemed unanswerable until now. Using cutting edge science and technology, the SEU missions seek the answers.

Education and Public Benefits
Black holes, the Big Bang, dark matter, and dark energy fascinate the American public, compel the attention of the news media and entertainment industry, and are central elements in K-12 science literacy standards and curricula. SEU seeks to provide the raw material for museum exhibits, planetarium shows, radio and other media outlets, and classrooms. SEU has already made a number of great strides towards meeting this goal. The touring museum exhibit "Cosmic Questions" attracted a record 300,000 visitors during its stay at the Boston Museum of Science, and the demand for the planetarium show "Journey to the Edge of Space and Time" was so great that the Delta College Planetarium and Learning Center extended its run by three months. In partnership with the University of California-Berkeley's Great Explorations in Math and Science program, SEU has developed "Invisible Universe," an educator's guide to gamma-ray bursts that is in alignment with national standards and can reach over one-quarter of our Nation's students. The SEU theme also enhances science education and science literacy through mission-specific tools such as educator workshops, lesson plans, and classroom materials.

IMPLEMENTATION

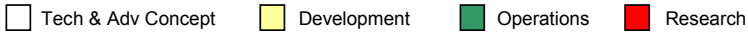
The Structure and Evolution of the Universe Theme is composed of many elements that work together to achieve the program's goals and objectives. Repeated management and scientific peer reviews ensure that each mission provides data in a cost-effective manner. In many cases, the data obtained from different missions are complementary, and are combined in cross-disciplinary studies by members of the scientific community.

Theme responsibility resides in the Space Science Enterprise at NASA Headquarters. Enterprise official is Dr. Ed Weiler, Associate Administrator for Space Science. Theme director and point of contact is Dr. Anne Kinney, Director of the Astronomy and Physics Division at Headquarters. This theme is in full compliance with NPG 7120.5B.

Theme: Structure and Evolution of the Universe

IMPLEMENTATION SCHEDULE

Theme Element	Schedule by Fiscal Year 02 03 04 05 06 07 08 09 10	Purpose
Rossi X-ray Timing Explorer (RXTE)		Observe the high-energy worlds of black holes, neutron stars, x-ray pulsars and bursts.
Chandra X-ray Observatory (CXO)		Explore the hot, turbulent regions in space with images 25 times sharper than previous x-ray pictures.
XMM-Newton		Conduct sensitive X-ray spectroscopic observations of a wide variety of cosmic sources.
High Energy Transient Experiment (HETE-2)		Carry out a multiwavelength study of gamma ray bursts with UV, X-ray, and gamma ray instruments.
Wilkinson Microwave Anisotropy Probe (WMAP)		Probe the early universe by measuring the cosmic microwave background radiation over the full sky.
International Gamma Ray Astrophysics Laboratory (INTEGRAL)		Unravel the secrets of the highest-energy - i.e. the most violent - phenomena in the Universe.
Cosmic Hot Interstellar Plasma Spectrometer (CHIPS)		Study the "Local Bubble" of hot gas surrounding our Solar System.
Galaxy Evolution Explorer (GALEX)		Explore the origin and evolution of galaxies and the origins of stars and heavy elements.
Gravity Probe-B (GP-B)		Precisely measure an effect that is predicted by all viable relativistic theories of gravity.
Swift		Study the position, brightness, and physical properties of gamma ray bursts.
Astro-E2		Unravel complex, high-energy processes and the behavior of matter under extreme conditions.
Planck		Theories of the early universe and the origin of cosmic structure.
Herschel		Help solve the mystery of how stars and galaxies were born.
Gamma Ray Large Area Space Telescope (GLAST)		Study the high energy gamma rays from natural particle accelerators throughout the Universe.



No exceptions to NPG 7120.5B have been taken.

STATUS

RXTE, Chandra, XMM, HETE-2, WMAP, INTEGRAL, CHIPS and GALEX are operational and producing outstanding science. In 2003, spectacular WMAP images of the cosmic microwave background were released that precisely measure the age and content of the universe, Chandra observed evolution in x-ray jets in a galactic black hole binary, and HETE-2 observed one of the brightest and closest gamma ray bursts, providing convincing evidence that it was associated with a massive supernova explosion.

Theme: Structure and Evolution of the Universe

PERFORMANCE MEASURES

Outcomes/Annual Performance Goals (APGs)	
Outcome 5.10.1	*Search for gravitational waves from the earliest moments of the Big Bang.*
5SEU4	Successfully demonstrate progress in search for gravitational waves from the earliest moments of the Big Bang. Progress towards achieving outcomes will be validated by external review.
Outcome 5.10.2	*Determine the size, shape, and matter-energy content of the Universe.*
5SEU5	Successfully demonstrate progress in determining the size, shape, and matter-energy content of the universe. Progress towards achieving outcomes will be validated by external review.
Outcome 5.10.3	*Measure the cosmic evolution of dark energy.*
5SEU6	Successfully demonstrate progress in measuring the cosmic evolution of the dark energy, which controls the destiny of the universe. Progress towards achieving outcomes will be validated by external review
Outcome 5.11.1	*Determine how black holes are formed, where they are, and how they evolve.*
5SEU7	Successfully demonstrate progress in determining how black holes are formed, where they are, and how they evolve. Progress towards achieving outcomes will be validated by external review.
Outcome 5.11.2	*Test Einstein's theory of gravity and map space-time near event horizons of black holes.*
5SEU8	Successfully demonstrate progress in testing Einstein's theory of gravity and mapping space-time near event horizons of black holes. Progress towards achieving outcomes will be validated by external review.
Outcome 5.11.3	*Observe stars and other material plunging into black holes.*
5SEU9	Successfully demonstrate progress in observing stars and other material plunging into black holes. Progress towards achieving outcomes will be validated by external review.
Outcome 5.12.1	*Determine how, where, and when the chemical elements were made, and trace the flows of energy and magnetic fields that exchange them between stars, dust, and gas.*
5SEU10	Successfully demonstrate progress in determining how, where, and when the chemical elements were made, and tracing the flows of energy and magnetic fields that exchange them between stars, dust, and gas. Progress towards achieving outcomes will be validated by external review.
Outcome 5.12.2	*Explore the behavior of matter in extreme astrophysical environments, including disks, cosmic jets, and the sources of gamma-ray bursts and cosmic rays.*
5SEU1	Complete the integration and testing of the Gamma-ray Large Area Space Telescope (GLAST) spacecraft bus.
5SEU11	Successfully demonstrate progress in exploring the behavior of matter in extreme astrophysical environments, including disks, cosmic jets, and the sources of gamma-ray bursts and cosmic rays. Progress towards achieving outcomes will be validated by external review.
Outcome 5.12.3	*Discover how the interplay of baryons, dark matter, and gravity shapes galaxies and systems of galaxies.*
5SEU12	Successfully demonstrate progress in discovering how the interplay of baryons, dark matter, and gravity shapes galaxies and systems of galaxies. Progress towards achieving outcomes will be validated by external review.
Uniform Measures	
5SEU13	Complete all development projects within 110% of the cost and schedule baseline.
5SEU14	Deliver at least 90% of scheduled operating hours for all operations and research facilities.
5SEU15	At least 80%, by budget, of research projects will be peer-reviewed and competitively awarded.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Federal Advisory Committee	NAC	12/03	3/04	Review science strategy, program implementation strategy.
Federal Advisory Committee	SScAC	11/03	3/04	Review science strategy, program implementation strategy
National Academy of Sciences	Space Studies Board	7/00	7/10	Decadal Survey for Astronomy and Astrophysics
SScAC	SEU Subcommittee	10/03	2/04	Review science strategy, program implementation strategy

Theme: Structure and Evolution of the Universe

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	Change	FY 2005	Comments
Structure and Evolution of the Universe	**402.0**	**406.0**	**-28.3**	**377.7**	
Development	231.6	149.2	-26.2	123.0	
Gravity Probe-B	65.0				
Gamma-ray Large Area Space Telescope (GLAST)	57.3	115.0	-11.8	103.2	
Swift Gamma-Ray Burst Explorer	47.5				
Small Development Projects	61.8	34.2	-14.4	19.8	
Operations	8.4	10.3	-6.0	4.3	
Research	140.9	187.5	+22.5	210.0	
Technology	21.1	59.0	-18.6	40.4	

Indicates changes since the previous year's President's Budget Submit

Indicates budget numbers in full cost.

Theme: Structure and Evolution of the Universe
Development: Gravity Probe-B

PURPOSE

Objectives	Performance Measures
5.11	5SEU8,13

The purpose of Gravity Probe-B (GP-B) is to verify certain extraordinary predictions of Einstein's theory of general relativity. This is the most accepted theory of gravitation and of the large-scale structure of the universe. General relativity is a cornerstone of our understanding of the physical world, and consequently of our interpretation of observed phenomena. An experiment is needed to explore and test more precisely the predictions of Einstein's theory in two areas: (1) a measurement of the "dragging of space" by rotating matter; and (2) a measurement of space-time curvature known as the "geodetic effect." The dragging of space has never been directly measured, and the geodetic effect needs to be measured more precisely. The precision required to make these measurements can only be achieved in space. Whether the experiment confirms or contradicts Einstein's theory, its results will be of the highest scientific importance. The measurements of both the frame dragging and geodetic effects will allow Einstein's theory to be either rejected or given greater credence. The effect of invalidating Einstein's theory would be profound, and would call for major revisions of our concepts of physics and cosmology.

OVERVIEW

The GP-B experiment will check, very precisely, tiny changes in the direction of spin of four gyroscopes contained in an Earth satellite orbiting at a 400-mile altitude directly over the poles. So free are the gyroscopes from disturbance that they will provide an almost perfect space-time reference system. They will measure how space and time are warped by the presence of Earth, and, more profoundly, how Earth's rotation drags space-time around with it.

GP-B's launch date is under review, but the mission will launch no earlier than April 2004. These changes will be documented in NASA's Initial FY 2004 Operating Plan.

PROGRAM MANAGEMENT

GP-B is a single-project program with program responsibility delegated to the Marshall Space Flight Center. The Agency Program Management Council (PMC) has GP-B governing responsibility. Enterprise official is Dr. Ed Weiler, Associate Administrator for Space Science at HQ. The Theme Director and the Point of Contact is Dr. Anne Kinney, Director of the Astronomy and Physics Division at HQ. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline for this technical commitment was made in 3/1998 and is detailed in the GP-B Program Commitment Agreement (PCA).

Technical Specifications	FY 2005 President's Budget	Change from Baseline
Geodetic Accuracy	Less than 0.5 milliarcseconds per year.	--
Cryogenic Temperature	Maintained at less than -271 degrees Celsius for at least 16 months.	--
Data Gathering	At least 12 months.	--
Data Telemetry	To Stanford University or backup site.	--

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Payload/SC Integration	Oct-01	Oct-99	+2.0 years
Launch	Nov-03 (delayed to NET 4-04)	Oct-00	Delay TBD

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Stanford University is responsible for the scientific payload, and will provide spacecraft tracking and communications. Stanford also subcontracts with Ball Aerospace and Lockheed Martin Astronautics for the rest of the flight hardware. Ball provided the cryogenic dewar, and Lockheed Martin is providing the spacecraft and telescope. In FY 2003, direct procurement represented 100% of budget authority. Changes since FY 2004 President's Budget: None.

Theme: Structure and Evolution of the Universe
Development: Gravity Probe-B

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	6%	Industry	7%
Cost Reimbursable	92%	Sole Source	94%	Government	0%
Fixed Price	3%		100%	NASA Intramural	4%
Grants	0%			University	88%
Other	5%	Sci Peer Review	100%	Non Profit	1%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition - Major	Selection	Goals
None - all major acquisitions are in place.	n/a	n/a

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Space Science. External: None. Changes since FY 2004 Pres. Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Annual Review	Independent Review Team	1/03		Annual review, with focus on mission operations.
Acceptance Review	Independent Review Team	6/03		Assess vehicle readiness for delivery.

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	619.4	65.0	14.6	22.1	6.5					727.6	
Development	619.4	65.0								684.4	
Operations			1.1							1.1	
Mission Ops and Data Analysis			13.5	22.1	6.5					42.1	
Changes since 2004 PRESBUD	+0.1	+36.1		+16.3	+6.5					+59.0	
Development	+0.1	+45.3								+45.4	Launch Delay
Operations		-2.0								-2.0	
Mission Ops and Data Analysis		-7.2	-0.1	+16.3	+6.5					+15.5	MO&DA combined
FY2004 PRESBUD	619.3	28.9	14.6	5.8						668.6	
Development	619.3	19.7								639.0	
Operations		2.0	1.1							3.1	
Data Analysis		7.2	13.6	5.8						26.6	
Initial Baseline	550.4									550.4	
Development	529.6									529.6	
Operations	3.0									3.0	
Data Analysis	17.8									17.8	

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Structure and Evolution of the Universe
Development: Gamma-ray Large Area Space Telescope (GLAST)

PURPOSE

Objectives	Performance Measures
5.12	5SEU1,11,13

The Gamma-Ray Large Area Space Telescope (GLAST) program improves our understanding of the structure of the universe, from its earliest beginnings to its ultimate fate, and explores the limits of gravity and energy in the universe. GLAST measures the direction, energy, and arrival time of celestial high-energy gamma rays. The goal of GLAST is to map the sky with 50 times the sensitivity, with corresponding improvement in resolution and coverage, of previous high-energy gamma-ray missions.

OVERVIEW

GLAST will provide new insights into the sources of gamma-ray bursts and high-energy cosmic gamma-rays, and reveal the nature of astrophysical jets and relativistic flows. GLAST will provide a new tool to study how black holes, notorious for pulling matter in, can accelerate jets of gas outward at fantastic speeds. Physicists will be able to observe the effects of subatomic particles at energies far greater than those seen in ground-based particle accelerators. They will also gain insight into the puzzling question of how energetic gamma-rays are produced in the magnetosphere of spinning neutron stars. Perhaps the biggest return will come from understanding the nature of the high-energy gamma-ray sources that have escaped correlation at other wavelengths; these unidentified high-energy sources constitute the bulk of the 273 sources known. GLAST is a collaboration with the Department of Energy, France, Italy, Sweden, Japan and Germany. Due to the withdrawal of international partners and Large Area Telescope (LAT) rebaselining, GLAST will not launch until May 2007. These changes will be reflected in NASA's Initial FY 2004 Operating Plan.

PROGRAM MANAGEMENT

GLAST is a single-project program with program responsibility delegated to the Goddard Space Flight Center. Enterprise official is Dr. Ed Weiler, Associate Administrator for Space Science at NASA HQ. The Theme Director and point of contact is Dr. Anne Kinney, Director of the Astronomy and Physics Division at HQ. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline for this technical commitment is the Formulation Authorization Document (FAD).

Technical Specifications	FY 2005 President's Budget	Change from Baseline
LAT - Large Area Telescope - Collection Area	Peak effective area 8000 sq. centimeters	--
LAT - Large Area Telescope - Energy Range	30 MeV - 100 GeV	--
LAT - Large Area Telescope - Sensitivity (5 sigma)	<0.000000009 photons/sq cm/second	--
Operational Capability	5-yr. life, pointing and scanning modes, immediate burst notice to ground.	--
GBM - GLAST Burst Monitor - Collection Area	40-110 sq. centimeters (depends on photon energy and off-axis angle)	--
GBM - GLAST Burst Monitor - Energy Range	10 keV - 25 MeV	--
GBM - GLAST Burst Monitor - Spatial Resolution	15 degrees for burst alerts, 3 degrees after final processing	--

Schedule	FY 2005 President's Budget	Change from Baseline
Non-Advocate Review	June-03	+ 3 mos
Preliminary Design Review	June-03	+ 4 mos
Critical Design Review	Feb-04	--
Launch	Sep-06 (delayed to May 2007)	None 9/06 (delay adds 8 months)

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Major acquisitions for GLAST are the Large Area Telescope (LAT) at Stanford University and the GLAST Burst Monitor (GBM) at Marshall Space Flight Center. Spectrum Astro Inc. will provide the spacecraft. The Science Operations Center

will be a NASA solicitation or Goddard Space Flight Center (GSFC) development. Guest Observers will be selected via a NASA solicitation. The Mission Operations Center will be managed in-house by GSFC. Changes since FY 2004 President's Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	100%	Industry	46%
Cost Reimbursable	88%	Sole Source	0%	Government	0%
Fixed Price	5%		100%	NASA Intramural	10%
Grants	0%			University	26%
Other	7%	Sci Peer Review	100%	Non Profit	18%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition - Major	Selection	Goals
None - all major procurements are in place	n/a	n/a

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Space Science. External: Collaboration with Dept. of Energy, France, Italy, Japan, Sweden and Germany. Changes since FY 2004 President's Budget: withdrawal of international partners.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Confirmation Review	Agency PMC	12/03		Authorization to proceed to development phase.
Critical Design Review	Center PMC		6/04	Critical Design Review.
Independent Annual Review	IRT	6/03	6/04	Outside Review.

Theme: Structure and Evolution of the Universe
Development: Gamma-ray Large Area Space Telescope (GLAST)

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	45.8	57.3	115.0	103.2	100.7	63.6	49.4	24.3	192.6	751.9	
Pre-Development	45.8	55.6								101.4	
Development		1.8	115.0	103.2	100.5	41.9	26.8	5.9		395.0	
Mission Ops and Data Analysis					0.2	21.7	22.6	18.4	192.6	255.5	
Changes since 2004 PRESBUD	+12.6	-11.9	-0.7	+16.6	+9.5	+3.2	+24.3	+24.3	+20.1	+97.9	
Pre-Development	+15.5	+55.6								+71.0	Withdrawal of International Partners
Development	-2.9	-67.5	-0.7	+16.6	+9.3	+3.3	+26.8	+5.9		-9.3	Withdrawal of International Partners
Operations						-5.5	-5.8		-28.2	-39.4	Withdrawal of International Partners
Mission Ops and Data Analysis					+0.2	+5.4	+3.2	+18.4	+48.3	+75.6	Withdrawal of International Partners/MO&DA combined
FY2004 PRESBUD	33.3	69.2	115.7	86.6	91.2	60.4	25.1		172.5	654.0	
Pre-Development	30.3									30.3	
Development	2.9	69.2	115.7	86.6	91.2	38.6				404.3	
Operations						5.5	5.8		28.2	39.4	
Data Analysis						16.3	19.4		144.3	179.9	

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Structure and Evolution of the Universe
Development: Swift Gamma-ray Burst Explorer

PURPOSE

Objectives	Performance Measures
5.12	5SEU11,13

Studying approximately 500 gamma-ray bursts in its two-year prime mission, Swift has the capability to determine the origin of the still-mysterious gamma-ray bursts, and to use them to probe the conditions that existed in the early universe. Swift is the first mission to focus on studying the afterglow from gamma-ray bursts. Swift will determine redshifts for most of the bursts that it detects (allowing NASA to know how far away they are and how bright they are in absolute terms), and will also provide detailed multi-wavelength light curves for the duration of the afterglow (allowing NASA to probe the physical environment in which the event took place).

OVERVIEW

Swift is a NASA medium-size Explorer (MIDEX) mission being developed by an international collaboration for launch in 2004. Foreign participation includes Italy and the United Kingdom. The Swift mission consists of three science instruments; Burst Alert Telescope (BAT); X-Ray Telescope (XRT); and the UltraViolet/Optical Telescope (UVOT). The Swift spacecraft is being built by Spectrum Astro and will be launched on a Delta 2420. In recent months SWIFT has experienced technical difficulties which will result in schedule and cost increases. These will be fully documented in NASA's Initial FY 2004 Operating Plan.

PROGRAM MANAGEMENT

Swift is a NASA medium size Explorer (MIDEX) mission with project responsibility delegated to Goddard Space Flight Center. Enterprise official is Dr. Ed Weiler, Associate Administrator for SSE at HQ. The Theme Director and the point of contact is Dr. Anne Kinney, Director of the Astronomy and Physics Division at HQ. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The technical commitment was made in 02/01 and is detailed in the SWIFT Level I Requirements Document appended to the Explorers Program Plan.

Technical Specifications	FY 2005 President's Budget	Change from Baseline
Determine the Origin of GRB	Detect and image 300 (+10%).	--
Number of GRBs Observed	Baseline of 300/Minimum of 200.	---
Number of Afterglows Studied	Baseline 200/Mimimum 75.	--
Mission Life	2 years	-1 year
Operations	All GRB positions will be made available within seconds of their generation. Processed data will be available within 30 minutes.	--

Schedule	FY 2005 President's Budget	Change from Baseline
Start of Implementation	February 2001	--
Mission Critical Design Review	July 2001	--
Complete spacecraft integration and testing	October 2002	-9 Months
NSI Instrument Delivery	November 2002	--
BAT Instrument Delivery	August 2003	+ 6 Months
Launch	January 2004 (delay TBD)	+4 Months (+delay TBD)

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

The Swift project has three instruments: the Burst Alert Telescope built by Goddard Space Flight Center (GSFC); and the X-Ray Telescope and UV/Optical Telescope which are built by Penn State University. The Principal Investigator is located at GSFC. The spacecraft provider is Spectrum Astro Inc. Swift will be launched on a Delta 7320 from the Kennedy Space Center. Operations will be conducted at the Mission Operation Center at PSU. Archive sites are in the USA, UK, and Italy. Changes since FY 2004 President's Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	60%	Industry	80%
Cost Reimbursable	57%	Sole Source	40%	Government	0%

Theme: Structure and Evolution of the Universe
Development: Swift Gamma-ray Burst Explorer

Fixed Price	24%		100%	NASA Intramural	2%
Grants	0%			University	18%
Other	19%	Sci Peer Review	100%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition - Major	Selection	Goals
none - all major procurements are in place	n/a	n/a

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for the Space Science Enterprise. External: International agreements are with the United Kingdom for the UVOT and XRT, and with Italy for the XRT and ground system support. Changes since FY 2004 President's Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Confirmation Review	GSFC	2/01	2/01	Approval to proceed into development.
Mission Operation Review	GSFC	8/02		To certify all operations are ready to proceed.
Mission Readiness Review	GSFC		12/03	Verify readiness for launch.

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	139.2	47.8	6.2	5.5	5.0	3.2				206.9	
Development	139.2	47.5								186.7	
Operations			3.0							3.0	
Mission Ops and Data Analysis		0.3	3.2	5.5	5.0	3.2				17.2	
Changes since 2004 PRESBUD		+13.7		+0.2	+5.0	+3.2				+22.1	
Development		+14.0								+14.0	instruments overruns
Operations				-2.1						-2.0	3 month launch delay
Mission Ops and Data Analysis		-0.3		+2.2	+5.0	+3.2				+10.1	3 month launch delay/MO&DA combined
FY2004 PRESBUD	139.2	34.1	6.2	5.3						184.8	
Development	139.2	33.5								172.7	
Operations			3.0	2.1						5.0	
Data Analysis		0.6	3.2	3.3						7.1	
Initial Baseline	123.0	33.7	3.9	3.2	3.0					166.8	
Development	123.0	33.7								156.7	
Operations			2.6	1.9	2.0					6.5	
Data Analysis			1.3	1.3	1.0					3.6	

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Structure and Evolution of the Universe
Development: Small Development Projects

PURPOSE

Objectives	Performance Measures
5.11, 5.12	5SEU9-11,13

SEU Small Development Projects include relatively low-cost missions that pursue the objectives of the Theme. Herschel will solve the mystery of how stars and galaxies are born, while Planck will examine the first light that filled the universe after the Big Bang. Astro-E2 will investigate the creation of chemical elements, what happens when matter falls into black holes, and the heating of gas to x-ray-emitting temperatures.

OVERVIEW

The following are missions in development that are included in SEU Small Projects: Herschel will be an infrared telescope used to study galaxy formation and evolution in the early universe; the nature of active galaxy power sources; star forming regions and interstellar medium physics in the Milky Way and other galaxies. Herschel is led by the European Space Agency (ESA). Planck will study the global characteristics of the universe (age, composition, topology, etc.) by its precision all-sky measurement of the cosmic microwave background. Planck is led by the European Space Agency (ESA). Astro-E2 is a Japanese x-ray astronomy mission, developed at the Institute of Space and Astronautical Science (ISAS) in collaboration with U.S. (NASA/GSFC, MIT) and Japanese institutions. The Spectroscopy and Photometry of the IGM's [InterGalactic Medium] Diffuse Radiation (SPIDR) project was terminated in FY 2003 because, after an independent and external review, it was determined that SPIDR would not achieve the sensitivity originally proposed.

PROGRAM MANAGEMENT

Astro-E2 project responsibility is delegated to the Goddard Space Flight Center. Herschel and Planck project responsibility is delegated to the Jet Propulsion Laboratory. Enterprise official is Dr. Ed Weiler, Associate Administrator for Space Science at NASA HQ. The Theme Director and the point of contact is Dr. Anne Kinney, Director of the Astronomy and Physics Division at NASA HQ. These projects are in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The technical commitment for each individual project is established in its Program Plan.

Technical Specifications	FY 2005 President's Budget	Change from Baseline
Herschel	700 hours science per year.	--
Planck	1 1/2 years mission life.	--
Astro-E2	detect X-rays with energies ranging from 0.4 to 700 keV.	--
SPIDR	Terminated	Terminated

Schedule	FY 2005 President's Budget	Change from Baseline
Astro-E2	Launch February 2005	--
Herschel	Launch 2007	--
Planck	Launch 2007	--
SPIDR	Terminated	Terminated

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Herschel - ESA mission; launch on Ariane 5 with Planck. Planck - ESA mission; launch on Ariane 5 with Herschel. Astro-E2 - Japanese mission; launch from Japan, on an M5 with a redesigned first stage.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	10%	Full & Open Competition	100%	Industry	40%
Cost Reimbursable	40%	Sole Source	0%	Government	15%
Fixed Price	50%		100%	NASA Intramural	15%
Grants	0%			University	30%
Other	0%	Sci Peer Review	100%	Non Profit	0%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
None- all major acquisitions are in place.	N/A	N/A

Theme: Structure and Evolution of the Universe
Development: Small Development Projects

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Space Science. External: Herschel and Planck are ESA (European Space Agency) missions. Astro-E2 is a Japanese mission. Changes since FY 2004 President's Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Other				International missions are not normally subjected to independent reviews.

BUDGET/LIFE CYCLE COST

Budget Authority ($ millions)	Prior	FY03	FY04	FY05	FY06	FY07	FY08	FY09	BTC	Total	Comments
FY2005 PRESBUD	214.8	61.8	34.2	19.8	12.7	11.2				354.5	
Herschel	51.2	20.2	11.7	6.1	6.5	6.1				101.8	
Planck	25.3	12.4	12.4	7.7	6.1	5.0				68.9	
Astro-E2	12.8	11.6	10.0	5.9						40.4	
Future and Other Payloads		0.1	0.1	0.1	0.1	0.1				0.5	
CHIPS	24.1	1.3								25.4	
INTEGRAL	11.4	0.5								11.9	
GALEX	88.9	6.2								95.2	
SPIDR	1.0	9.5								10.5	
Changes since 2004 PRESBUD	+19.7	+39.4	-23.9	-12.0	+0.3	+0.2				+23.7	
Herschel		+4.8	-0.1	+0.1	+0.1	+0.1				+5.1	
Planck		+7.5	-0.1	+0.2	+0.1	+0.1				+7.8	
Astro-E2	-0.6	+11.6	-0.1	+0.6						+11.6	New SMEX Selection
Future and Other Payloads	-0.1									-0.1	
CHIPS	+17.7	-0.2								+17.5	Instrument Complications
GALEX	+1.8	+6.2								+8.1	Instrument Complications
SPIDR	+0.8	+9.5	-23.7	-12.9						-26.3	Mission Terminated
FY2004 PRESBUD	195.1	22.4	58.1	31.8	12.4	11.0				330.8	
INTEGRAL	11.4	0.5								11.9	
Herschel	51.2	15.4	11.8	6.0	6.4	6.0				96.7	
Planck	25.3	4.9	12.5	7.5	6.0	4.9				61.1	
Astro-E2	13.4		10.1	5.3						28.8	
CHIPS	6.4	1.5								7.9	
GALEX	87.1									87.1	
SPIDR	0.2		23.7	12.9						36.7	
Future and Other Payloads	0.1	0.1	0.1	0.1	0.1	0.1				0.6	

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Structure and Evolution of the Universe
Operations

PURPOSE

Objectives	Performance Measures
5.10, 5.11, 5.12	5SEU4-12,14

Maximize the scientific return from NASA's investment in spacecraft and other data collection sources by conducting efficient and reliable operations of the data-collecting hardware, which produces data that allow scientists to make new discoveries.

OVERVIEW

The following SEU missions are expected to be operating during FY 2005: The Rossi X-ray Timing Explorer (RXTE) was launched into low Earth orbit on December 30, 1995. RXTE observes the fast-moving, high-energy worlds of black holes, neutron stars, x-ray pulsars and bursts of x-rays. NASA's Chandra X-ray Observatory (CXO) was launched and deployed by Space Shuttle Columbia on July 23, 1999. Chandra utilizes mirrors in conjunction with four science instruments to capture and probe x-rays from astronomical sources, such as the remnants of exploded stars. The High Energy Transient Explorer (HETE-2) was launched October 9, 2000 and studies gamma ray bursts (GRBs) with ultraviolet, x-ray, and gamma ray instruments. The Wilkinson Microwave Anisotropy Probe (WMAP) was launched June 30, 2001. WMAP is mapping the temperature fluctuations of cosmic microwave background radiation (radiation left over from the Big Bang). GALEX was launched April 28, 2003, and will use an ultraviolet telescope during its two-year mission to explore the origin and evolution of galaxies and the origins of stars and heavy elements. CHIPS, launched January 12, 2003, is studying the local bubble of hot gas surrounding our Solar System. Gravity Probe B's (GP-B) launch date is under review, but it will be no earlier than April 2004. GP-B will test two predictions of Albert Einstein's general theory of relativity. The Swift Gamma Ray Burst Explorer is scheduled for a 2004 launch. Swift will produce arcsecond positions and multiwavelength light curves for gamma ray burst afterglows. Operations of XMM-Newton are provided by the European Space Agency.

Starting in FY 2005, the operations funding for GP-B, the Rossi X-ray Timing Explorer (RXTE), WMAP, Swift, and the Gamma ray Large Area Space Telescope (GLAST) will be combined with the Data Analysis funding for those missions (see Enterprise summary section for more information).

For more information, link to the Office of Space Science missions homepage.
http://spacescience.nasa.gov/missions/index.htm

PROGRAM MANAGEMENT

Enterprise official is Dr. Ed Weiler, Associate Administrator for Space Science at NASA HQ. Theme Director and point of contact is Dr. Anne Kinney, Director of the Astronomy and Physics Division at NASA HQ. CXO is managed by the Marshall Space Flight Center. GP-B is managed by Stanford University. RXTE, HETE-2, WMAP, GALEX, and Swift are managed by Goddard Space Flight Center. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline for all SEU missions is defined in their respective Program Commitment Agreements (PCAs) or equivalent documentation.

Technical Specifications
All missions will meet Level I specifications as identified in each mission's respective program plan.

Mission	Launch Date	Comments
Chandra	July 23, 1999	Mission Extended from 5 to 10 yrs.
GALEX	April 28, 2003	28 months of ops.
GP-B	November 2003	launch delayed (TBD).
WMAP	June 30, 2001	Mission Extended
RXTE	December 30, 1995	Mission Extended
Swift	January 2004	launch delayed (TBD).
XMM-Newton	December 10, 1999	Ops duration ESA's prerogative
CHIPS	January 12, 2003	Mission ends July 2005.
INTEGRAL	October 17, 2002	Ops duration ESA's prerogative
HETE-2	October 9, 2000	Mission Extended

Theme: Structure and Evolution of the Universe
Operations

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

The prime contractor for Chandra operations is the Smithsonian Astrophysical Observatory (SAO). The contract for Chandra was renewed in FY 2003 for a period of five years. RXTE and WMAP were operated by Lockheed Martin through the Consolidated Space Operations Contract (CSOC), which expired in December 2003 and was replaced by seven new contracts at NASA HQ and the Centers. Lockheed Martin also operated GALEX until after the CSOC recompetition. GP-B will be operated by Stanford University. In FY 2003, direct procurement represented 100% of budget authority. Changes since FY 2004 President's Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	0%	Full & Open Competition	35%	Industry	33%
Cost Reimbursable	87%	Sole Source	65%	Government	0%
Fixed Price	13%			NASA Intramural	5%
Grants	0%		100%	University	0%
Other	0%	Sci Peer Review	100%	Non Profit	62%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
None.		

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Space Science. External: None. Changes since FY 2004 President's Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Senior Review	External panel	6/02	7/04	Consider mission extensions and funding levels for operating SEU spacecraft.
Working Group of Fed. Advisory Committee	Science Archives Working Group	10/03	4/04	Review continuing performance of missions ops and report to parent committee.

Theme: Structure and Evolution of the Universe
Operations

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	8.4	10.3	4.3	
Chandra	3.8	4.2	4.3	
RXTE	1.8	1.3		
MAP	1.2			
GP-B		1.1		
SWIFT		3.0		
SWAS	0.6			
GALEX	0.9	0.7		
Changes since 2004 PRESBUD	-2.4			
Chandra		-0.1		
RXTE	-1.4			
MAP	-0.2			
GP-B	-2.0			
SWAS	+0.6			
GALEX	+0.7			
FY2004 PRESBUD	10.7	10.3		
Chandra	3.8	4.3		
RXTE	3.3	1.3		
MAP	1.4			
GP-B	2.0	1.1		
SWIFT		3.0		
GALEX	0.2	0.7		

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Structure and Evolution of the Universe
Research

PURPOSE

Objectives	Performance Measures
5.10, 5.11, 5.12	5SEU4-12,14-15

The Research program involves the study of cosmology (the large scale structure of the universe), the evolution of stars and galaxies (including the Milky Way and objects with extreme physical conditions), and an examination of the ultimate limits of gravity and energy in the universe.

OVERVIEW

The SEU research program supports SEU Research & Analysis (R&A) and the analysis of data (DA) from the SEU operating missions, the provision of suborbital balloons for payloads that can use them to achieve their science objectives, and the science data tools and archives needed to perform the research. Data Analysis programs are tied to specific missions, which are focused on the achievement of specific strategic objectives. The scope of R&A programs is generally wider because they must provide the new theories and instrumentation that enable the next generation of flight missions. The alignment of Research programs with SEU strategic goals is ensured through two mechanisms. First, NASA Research Announcements soliciting R&A proposals contain explicit prioritization criteria with respect to Enterprise objectives. Second, the entire R&A program is reviewed triennially to assess scientific quality and productivity of the major components and to adjust plans to best support Enterprise goals. Data Analysis programs have traditionally been performed by mission instrument teams and interdisciplinary scientists competitively selected for an individual mission for the lifetime of that mission. The Data Analysis program also includes annual, open and competitive solicitations to all missions that can accommodate "guest investigations." The balloon program within the SEU theme area supports twenty-plus missions a year and offers capabilities and benefits for scientific research that cannot be duplicated by other methods.

Starting in FY 2005, the operations funding for GP-B, the Rossi X-ray Timing Explorer (RXTE), WMAP, Swift, and the Gamma ray Large Area Space Telescope (GLAST) will be combined with the Data Analysis funding for those missions (see Enterprise summary section for more information).

PROGRAM MANAGEMENT

NASA Headquarters is responsible for the SEU Research program. Enterprise official is Dr. Ed Weiler, Associate Administrator for Space Science at Headquarters. Theme Director and point of contact is Dr. Anne Kinney, Director of the Astronomy and Physics Division at Headquarters. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

Baselines for research are consistent with those defined in individual Research Announcements released by OSS. Data Analysis baselines are defined by the Program PCA or equivalent document.

Technical Specifications	FY 2005 President's Budget	Change from Baseline
Building on the NASA Strategic Plan, the OSS Strategic Plan process specifies a series of goals, strategic objectives and research focus areas. The OSS Strategic Plan draws from the Astronomy and Physics Decadal Survey (NRC), as well as roadmap activities conducted by the SEU Subcommittee. All selection processes and reviews of elements of the SEU research program use these strategic items as guideposts for selection and/or continuation. Proposals must relate to these strategic items.		

Schedule	FY 2005 President's Budget	Change from Baseline
Beyond Einstein Foundation Science	Yearly in July	--
Balloon Program Research Opportunities In Space Science (ROSS)	Campaigns run all year	--
Data Analysis Senior Reviews	Every Two Years	--
R & A Research Opportunities In Space Science (ROSS)	Yearly in Feb.	--

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

The Research & Analysis (R&A), Data Analysis (DA) and balloons programs make awards following peer reviewed competitions under NASA Research Announcements (NRAs), Announcements of Opportunity (AOs), and Cooperative Agreement Notices (CANs). The balloon program has a prime contractor selected via competitive procurement through a request for proposals. In FY 2003, direct procurement represented 100% of budget authority. Changes since FY 2004 President's Budget: None.

Theme: Structure and Evolution of the Universe
Research

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	5%	Full & Open Competition	98%	Industry	4%
Cost Reimbursable	32%	Sole Source	2%	Government	2%
Fixed Price	1%			NASA Intramural	9%
Grants	49%		100%	University	76%
Other	13%			Non Profit	9%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
Beyond Einstein Foundation Science	Late 2004	100% Science Peer Review
Annual Chandra call for proposals	March 2004	100% Science Peer Review
Annual R&A research announcement	Late 2003	100% Science Peer Review

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Space Science. External: Two missions in Data Analysis (XMM and INTEGRAL) involve agreements with the European Space Agency. Changes since FY 2004 President's Budget: None.

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Working Group of Fed. Advisory Committee	A&P Working Group	10/03	4/04	Review performance of research program and report findings to parent committee.

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	140.9	187.5	210.0	
R&A	26.6	28.5	30.3	
Mission Operations & Data Analysis	96.3	76.4	88.3	
Balloons	18.0	27.1	24.3	
Other		55.5	67.1	
Changes since 2004 PRESBUD	-13.1	+0.9		
R&A	-0.4	-0.1		Rephase
Mission Operations & Data Analysis	+96.3	+76.4		Rephase
Balloons	+4.0	+1.8		Antarctica Infrastructure
Other		+55.5		
DA	-113.0	-132.7		
FY2004 PRESBUD	154.0	186.6		
R&A	27.0	28.6		
DA	113.0	132.7		
Balloons	14.0	25.3		

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Structure and Evolution of the Universe
Technology and Advanced Concepts

PURPOSE

Objectives	Performance Measures
5.10, 5.11, 5.12	5SEU4-12

The SEU Technology and Advanced Concepts effort develops advanced technologies needed for specific science missions. This process begins with mission studies - the first phase of the flight program development process. In this phase, scientists work collaboratively with technologists and mission designers to develop the most effective alignment of technology development programs with future mission requirements. This collaboration enables intelligent technology investment decisions through detailed analysis of the trade-offs between design considerations and cost.

OVERVIEW

SEU's Technology and Advanced Concept efforts are extremely diverse. The program works with and actively seeks input from scientists and engineers in academia, government, and industry. SEU follows an integrated strategy that coordinates technology development for different programs and leverages technology advancement to ensure a maximum return on investment. The SEU technology development program will support the Beyond Einstein missions -- the Laser Interferometer Space Antenna (LISA) and Constellation-X (Con-X). Beyond Einstein is critical to achieving two objectives in the NASA Strategic Plan: to discover what powered the Big Bang and the nature of the mysterious dark energy that is pulling the universe apart; and to learn what happens to space, time, and matter at the edge of a black hole. Technology and Advanced Concepts also includes funding for the Extreme-Universe Space Observatory (EUSO), a new Explorer mission selected in FY 2003 and currently in pre-development. EUSO is led by ESA and will investigate radiations produced under the most extreme physical conditions in the universe. These are conditions beyond our present understanding, and they may be related to the early history of the Big Bang and the grand unification of the fundamental forces of nature.

Consistent with the SEU program needs, four technology areas which merit special attention have been identified, given their broad applicability across Enterprises. These areas are: advanced cryogenic systems, formation flying, high performance optics, and next generation detectors.

With regard to the challenges presented by the Beyond Einstein missions, LISA will consist of three spacecraft flying 5 million kilometers (km) apart in the shape of an equilateral triangle. The objective of LISA is to observe gravitational waves, including gravitational waves generated in the vicinity of the very massive black holes found in the centers of many galaxies. Some of the project's technology development areas include: inertial sensors; electrical discharge system to remove charges induced by cosmic rays; a disturbance reduction system consisting of micro-newton thrusters to keep the three spacecraft precisely centered; an interferometry system; pointing accuracy to less than 10 nano-radian; and a high power laser. Con-X is another example of how the Beyond Einstein program is pushing the frontiers of technological advancement. The mission will consist of a set of x-ray telescopes in space that work together to become 100 times more powerful than any previous x-ray telescope. Con-X will utilize two sets of extremely high performance x-ray telescope systems incorporating x-ray micro-calorimeters on each of four satellites; these instruments must be cooled to 50 millikelvin (a fraction of a degree above absolute zero) by cryogenic coolers.

Due to reductions in near-term budgets for LISA and Con-X, NASA is currently reassessing launch dates. As a result of the reprioritized agency activities, the FY 2005 and outyear budgets for Con-X and LISA have been reduced. The impacts to these programs will be full assessed as part of the development of the FY 2006 budget. In addition, the Einstein Probes, medium-size missions, which were to have begun concept studies in FY 2004, have been indefinitely deferred.

PROGRAM MANAGEMENT

The Beyond Einstein program responsibility resides at Goddard Space Flight Center (GSFC). The Program Management Council (PMC) has governing responsibility. Each SEU mission will execute the NASA formulation sub-process per NPG 7120.5B to provide high confidence that it will be ready to proceed into implementation. Enterprise official is Dr. Edward Weiler, Associate Administrator for Space Science at NASA HQ. Theme Director and Point of Contact is Dr. Anne Kinney, Director of the Astronomy and Physics Division at NASA HQ.

TECHNICAL COMMITMENT

Project technical baselines are defined by the individual Formulation Authorization Document (FAD), Program Commitment Agreement (PCA), or equivalent documentation. The FAD is in preparation.

Schedule	FY 2005 President's Budget	Change from Baseline
LISA	TBD	no baseline established until confirmation
Con-X	TBD	no baseline established until confirmation

Theme: Structure and Evolution of the Universe
Technology and Advanced Concepts

Acquisition Strategy and Performing Organizations

The LISA Project Management Office is jointly managed by NASA (GSFC and the Jet Propulsion Laboratory) and European Space Agency, with NASA having the lead for the day-to-day activity. Responsibility for LISA's mission success is jointly shared between NASA and ESA at all levels. Con-X is being managed solely out of GSFC. In FY 2003, direct procurement represented 100% of budget authority. Changes since FY 2004 President's Budget: None.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	8%	Full & Open Competition	69%	Industry	10%
Cost Reimbursable	24%	Sole Source	31%	Government	16%
Fixed Price	10%		100%	NASA Intramural	39%
Grants	0%			University	27%
Other	58%	Sci Peer Review	100%	Non Profit	8%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
Con-X Spect. X-ray Telescope flt mirror assembly dev. stdy	FY06	100% Full and Open Competition, 100% Fixed Price
LISA Phase A Study contracts	FY05	100% Full and Open Competition, 100% Fixed Price

Agreements

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator for Space Science. External: LISA currently has a LOA with the European Space Agency (ESA). Changes since FY 2004 President's Budget: None.

Independent Reviews

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Con-X / LISA Independent Implementation	TRIP	3/03		To ensure compliance with defined technical, cost, and schedule thresholds.
LISA Independent Implementation	IRT	6/03	9/04	To ensure compliance with defined technical, cost, and schedule thresholds.

Budget/Life Cycle Cost

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	21.1	59.0	40.4	
CON-X	12.8	23.4	12.0	
LISA	7.3	25.1	19.0	
Other	1.0	10.5	9.4	
Changes since 2004 PRESBUD	-0.4	-1.9		
CON-X		-0.1		Rephase
LISA		-10.3		Rephase
Other	-0.4	+8.5		
FY2004 PRESBUD	21.5	60.9		
CON-X	12.8	23.5		
LISA	7.3	35.4		
Other	1.4	2.0		

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.