THEME: Astronomical Search for Origins

This giant pillar of gas and dust, called the Cone Nebula, resides in a turbulent star-forming region. Radiation from hot, young stars [located beyond the top of the image] has slowly eroded the nebula over millions of years. Over time, only the densest regions of the Cone will be left; inside these regions, stars and planets may form. The Advanced Camera took this picture for Surveys, which was installed aboard Hubble Space Telescope in March 2002. Such images provide critical evidence for our understanding of how stars and solar systems form.

ASTRONOMICAL SEARCH FOR ORIGINS

MAJOR EVENTS IN 2004

- Final preparations for Hubble Space Telescope Servicing Mission-4, which will launch in early 2005. Two new instruments will be installed on this mission: Wide Field Camera-3 and the Cosmic Origins Spectrograph.
- Final preparation for SOFIA airborne observatory first flight in April 2005.
- Initial science operations of Space Infrared Telescope Facility (SIRTF), the final mission of NASA's Great Observatory Program.

THEME: Astronomical Search for Origins (ASO)

OVERVIEW

Where did we come from? Are we alone? Astronomers search for answers by looking both far away -- towards the beginning of time -- to see galaxies forming, and close to home, searching for planetary systems like our own around nearby stars. NASA's Astronomical Search for Origins (ASO) is a series of closely linked missions that build on prior accomplishments in the quest for answers to these questions. As each mission makes radical advances in technology, innovations are fed forward, from one generation of missions to the next. In FY04, we will operate ongoing missions such as the Hubble Space Telescope (HST) and the Space Infrared Telescope Facility (SIRTF), and continue development of first and second generation follow-on missions, including the James Webb Space Telescope (JWST), Space Interferometry Mission (SIM), and Terrestrial Planet Finder (TPF).

Missions	Goals supported by this theme	Objectives supporting those goals
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 Understand how today's Universe of galaxies, stars, and planets came to be.
		5.11 Learn how stars and planetary systems form and evolve.
		5.12 Explore the diversity of other worlds, and search for those that might harbor life.
Inspire the Next Generation of Explorers	6. Inspire and motivate students to pursue careers in science, engineering and mathematics.	6.1, 6.2, 6.3, 6.4 (Supporting Role) See Education Programs for objectives.
	7. Engage the public in shaping and sharing the experience of exploration and discovery.	7.1 Improve the capacity of science centers, museums, and other institutions, through the development of partnerships, to translate and deliver engaging NASA content. (Supporting Role)
		7.5 Improve science literacy by engaging the public in NASA missions and discoveries, and their benefits, through such avenues as public programs, community outreach, mass media, and the Internet. (Supporting Role)

RELEVANCE

Knowing where we come from requires understanding how the universe began and how its subsequent evolution culminated in everything we are and observe today. Understanding whether we are alone in the cosmos depends upon our search for life-sustaining planets or moons, and our understanding of the diversity of life here on Earth. ASO programs are aimed at developing the technologies, building the instruments making the observations, and doing the science that will bring us the answers to our questions.

Education and Public Benefits
Over the last decade, few scientific endeavors have provided the world with more spectacular images or yielded more fascinating results than ASO's flagship: the Hubble Space Telescope (HST). As more sophisticated instruments have been added through the years, we have witnessed the birth of stars, begun to unravel the mysteries of black holes, and looked billions of years into our past. This flood of knowledge -- and questions -- has spread throughout the globe via front page press, television, websites, and school curricula at all levels. ASO will make significant contributions toward meeting national goals for the reform of science, math and technology education and the general elevation of scientific and technological literacy throughout the country.

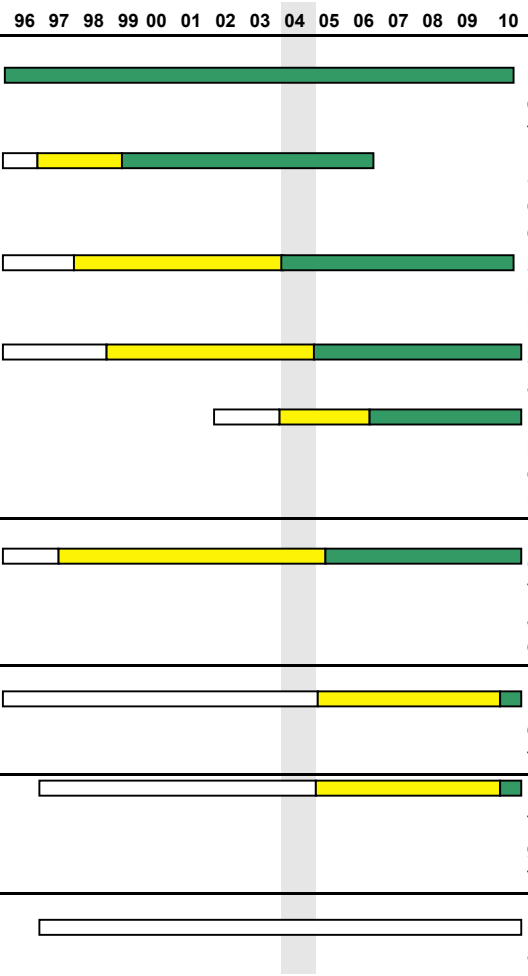
IMPLEMENTATION

The Astronomical Search for Origins 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 Office of Space Science at NASA HQ. Enterprise official is Dr. Edward Weiler, Associate Administrator for Space Science. Theme director and point of contact is Dr. Anne Kinney, Director of the Astronomy and Physics Division at NASA HQ. This theme is in full compliance with NPG 7120.5B.

THEME: Astronomical Search for Origins (ASO)

IMPLEMENTATION - CONTINUED

Strategy	Schedule by Fiscal Year (96 97 98 99 00 01 02 03 04 05 06 07 08 09 10)	Purpose
Precursor Missions		
Hubble Space Telescope (HST)		Provide a serviceable, state-of-the-art, orbiting observatory to study the history of the Universe.
Far Ultraviolet Spectroscopic Explorer (FUSE)		Study physical processes governing the evolution of galaxies; the origin and evolution of stars and planetary systems.
Space Infrared Telescope Facility (SIRTF)		Study the formation of stars, galaxies and planets via spectroscopy, high-sensitivity photometry and imaging.
Stratospheric Observatory for Infrared Astronomy (SOFIA)		Study the properties of interstellar space as well as planet and star formation.
Kepler		Explore the structure and diversity of planetary systems, with a special emphasis on detecting Earth-size planets in the habitable zone around other stars.
Ground-Based Mission		
Keck Interferometer		Characterize exo-zodiacal dust to support TPF design; direct detection of "hot Jupiters" and brown dwarfs; astronomic detection of planets.
First Generation Missions		
Space Interferometry Mission (SIM)		Detect planets outside the solar system by observing thousands of stars; serve as technological pathfinder for TPF.
James Webb Space Telescope (JWST)		Provide the next generation space telescope to observe the first stars and galaxies; determine the shape and fate of the Universe.
Second Generation Mission		
Terrestrial Planet Finder (TPF)		Find/characterize Earth-like planets around nearby stars.



Link to Program Implementation Plans — Tech. & Adv. Concept; Development; Operations

Tailoring
No exceptions to NPG 7120.5B have been taken.

STATUS

- ASO carried out HST Servicing Mission 3B, including installation of Advanced Camera for Surveys (ACS), new solar arrays, Power Control Unit (PCU), and cryocooler for the Near Infrared Camera and Multi-Object Spectrometer (NICMOS).
- ASO accepted delivery of SOFIA's German-made telescope.
- SIRTF cryogenic telescope assembly delivered for integration into spacecraft.

For more detailed status information: http://origins.jpl.nasa.gov/

PERFORMANCE MEASURES

Annual Performance Goals	
	OUTCOME: A well managed program in accordance with Agency implementing strategies.
4ASO1	Each Development project will complete its current phase within 10% of total life-cycle cost as shown in the table below.
4ASO2	Each Research project will allocate 75% of its funding competitively during FY04.
4ASO3	ASO will complete all of its missions within 10% of their baseline schedules.
5.10.1	OUTCOME: Understand how today's Universe of galaxies, stars, and planets came to be.
4ASO4	Successfully demonstrate progress in learning how the cosmic web of matter organized into the first stars and galaxies and how these evolved into the stars and galaxies we see today. Progress towards achieving outcomes will be validated by external review.

THEME: Astronomical Search for Origins (ASO)

Annual Performance Goals - Continued	
4ASO5	Demonstrate progress in understanding how different galactic ecosystems of stars and gas formed and which ones might support the existence of planets and life. Progress towards achieving outcomes will be validated by external review.
5.11.1	OUTCOME: Learn how stars and planetary systems form and evolve.
4ASO6	Successfully demonstrate progress in learning how gas and dust become stars and planets. Progress towards achieving outcomes will be validated by external review.
4ASO7	Successfully demonstrate progress in observing planetary systems around other stars and comparing their architectures and evolution with our own. Progress towards achieving outcomes will be validated by external review.
5.12.1	OUTCOME: Explore the diversity of other worlds and search for those that might harbor life.
4ASO8	Successfully demonstrate progress in characterizing the giant planets orbiting other stars. Progress towards achieving outcomes will be validated by external review.
4ASO9	Successfully demonstrate progress in finding out how common Earth-like planets are and seeing if any might be habitable. Progress towards achieving outcomes will be validated by external review.
4ASO10	Successfully demonstrate progress in tracing the chemical pathways by which simple molecules and dust evolve into the organic molecules important for life. Progress towards achieving outcomes will be validated by external review.
4ASO11	Successfully demonstrate progress in developing the tools and techniques to search for life on planets beyond our solar system. Progress towards achieving outcomes will be validated by external review.
6.1.1	OUTCOME: Kindergarten through graduate students will be more proficient in science, technology, engineering, and mathematics (STEM).
4ASO12	Provide opportunities for students to work directly with NASA space science missions, facilities, and data.
6.2.1	OUTCOME: More students from diverse communities motivated to pursue careers in STEM.
4ASO13	Provide new opportunities for participation in the space science program by an increasingly diverse population, including opportunities for minorities and minority universities to compete for and participate in space science missions, research, and education programs.
6.3.1	OUTCOME: Improve quality of STEM instruction.
4ASO14	Provide high quality educational materials and teacher training based on Theme content and focused on national curriculum standards.
4ASO15	Provide exhibits, materials, workshops, and personnel at national and/or regional education and outreach conferences.
6.4.1	OUTCOME: More students prepared to enter the STEM workforce.
4ASO16	Provide education opportunities offered through OSS research awards and other NASA research and education programs.
7.1.1	OUTCOME: Improve the capacity of science centers, museums, and other institutions, through the development of partnerships, to translate and deliver engaging NASA content.
4ASO17	Through partnerships with major science museums or planetariums, put on display or on tour major exhibitions or planetarium shows based on Theme content.
4ASO18	Provide materials and technical expertise to support the development of exhibits and programs at science museums and planetariums.
7.2.1	OUTCOME: Engage the public in NASA missions and discoveries through such avenues as public programs, community outreach, mass media, and the Internet.
4ASO19	Seek out and capitalize on special events and particularly promising opportunities in the Theme science program to bring space science to and involve the public in the process of scientific discovery.

THEME: Astronomical Search for Origins (ASO)

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Nat'l Acad. of Sciences	Space Studies Board	7/02	N/A	Review effectiveness and quality of the program.
Advisory Council	NAC	9/02	3 times/year	Review science/program implementation strategies.
	SSAC	8/02	3 times/year	Review science/program implementation strategies.
	Origins Subcomm.	9/02	3 times/year	Review science/program implementation strategies.

BUDGET

Budget Authority ($millions)	FY02	FY03	Chng	FY04	Comments
Astronomical Search for Origins	**650.1**	**698.1**	**+178.9**	**877.0**	
Development	344.0	258.7	-16.5	242.2	
HST	170.2	138.9	-2.5	136.4	
SOFIA	38.0	46.9	+7.8	54.7	
SIRTF	131.5	47.4	-47.4		Mission preparing for launch in April 2003.
Kepler	4.3	25.5	+25.6	51.1	Project in formulation.
Operations	8.5	9.7	+14.9	24.6	
Research	115.7	145.9	+53.1	198.9	Includes ramp-up for beginning of SIRTF research.
Technology & Advanced Concepts	181.9	283.8	+127.4	411.2	Includes JWST, SIM, and TPF increases.

Note: For all formats, the FY 02 column reflects the FY 2002 Congressional Operating Plan dated 9/30/02. The FY 03 column reflects the FY 2003 President's Budget Submit (PBS) as Amended. The Change column includes both programmatic and full cost adjustments. FY 2004 column is in full cost.

Indicates budget numbers in full cost.

Indicates changes since the FY 2003 President's Budget Submit.

FY 2002, FY 2003, Prior and BTC are not in full cost.

THEME: Astronomical Search for Origins (ASO)

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THEME: Astronomical Search for Origins (ASO)

DEVELOPMENT: Hubble Space Telescope (HST)

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
5.10, 5.11, 5.12, 6.1, 6.2 ,6.3, 6.4, 7.1, 7.2		4ASO1,3-8,12-19

Since 1990, the Hubble Space Telescope has used its pointing precision, powerful optics and state-of-the-art instruments to explore the visible, ultraviolet and near-infrared regions of the electromagnetic spectrum. With the addition of new instruments currently under development for Servicing Mission 4, Hubble will continue to investigate the formation, structure and evolution of stars and galaxies, studying the history of the universe, and providing a space-based research facility for optical astronomy. HST has already rewritten the textbooks of astronomy, and is expected to do so until decommissioned.

OVERVIEW

Extending HST's operational life to 2010 requires instrument upgrades to keep the observatory at the forefront of astronomical research throughout the duration of the mission. During Servicing Mission 3B in March 2002, astronauts installed the Advanced Camera for Surveys (ACS) and a cryo-cooler that brought the Near Infrared Camera and Multi-Object Spectrometer (NICMOS) back to life. In 2004, Servicing Mission 4 will add the Cosmic Origins Spectrograph (COS) and Wide Field Camera 3 (WFC3). COS will allow Hubble to observe high-energy activities at near- and mid-ultraviolet wavelengths, such as those found in hot new stars and Quasi stellar objects (quasars). WFC3 will employ the latest charge-coupled device (CCD) technology to extend imaging capability through 2010. In addition to these new instruments, support continues for routine servicing activities, including development of replacement batteries, gyros, and an aft shroud cooling system. Modification and upkeep of ground operations systems, as well as mission development for the telescope's eventual retrieval, are also ongoing.

Link to Hubble Homepage for more information.

PROGRAM MANAGEMENT

GSFC is responsible for HST project management, including mission and science operations, servicing missions, and all associated development activities. Supporting Centers are Johnson Space Center for shuttle flight services and Kennedy Space Center for launch operations. The HST program consists of two distinct projects: the Operations and Ground Systems Project, and the Flight Systems and Servicing Project. Both are governed by the GSFC Program Management Council. The Agency Program Management Council has oversight responsibility for the the program. 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 Astronomy and Physics at NASA HQ. This program is in full compliance with NPG-7120.5B.

TECHNICAL COMMITMENT

The baseline technical commitment was made in 10/1999 and is detailed in the HST Program Commitment Agreement.

Technical Specifications	FY04 President's Budget	Change from Baseline
Mission Life	15+ years	--
Science Instruments	up to 5	--
Stellar Energy within 0.1 arcsec	70%	--
Image Jitter	< .012 arcsec RMS/24 hr	--
Pointing Error	< .03 arcsec	--

Schedule	FY04 President's Budget	Change from Baseline
Servicing Mission 4	CY04	1999 baseline CY03
Retrieval Mission	CY10	--

THEME: Astronomical Search for Origins (ASO)

DEVELOPMENT: Hubble Space Telescope (HST)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Replacement and refurbishment of existing flight equipment is handled via contracts with the original manufacturers. Major acquisitions for SM4 are the Cosmic Origins Spectrograph (COS) and the Wide Field Camera 3 (WFC3). COS is being developed by Ball Aerospace, with the University of Colorado acting as Principal Investigator. WFC3 is a facility-class instrument being built by a team of scientific and technical personnel at GSFC in collaboration with the Space Telescope Science Institute, JPL, and Ball Aerospace, making use of hardware, software, and development experience from previous Hubble instruments. **Changes since FY03 Pres. Budget: None.**

Current Acquisitions	Actual *	Selection Method	Actual *	Performer	Actual *
Cooperative Agreements	0%	Full & Open Competition	55%	Industry	67%
Cost Reimbursable	93%	Sole Source	45%	Government	1%
Fixed Price	5%		100%	NASA Intramural	0%
Grants	1%			University	2%
Other	1%	Sci Peer Review	100%	Non Profit	30%
* as % of FY02 direct procurement	100%	* as % of FY02 direct procurement		* as % of FY02 direct procurement	

Future Acquisitions - Major	Selection	Goals
None for hardware development - all major acquisitions are in place. See also ASO Operations and Research sections.	N/A	N/A

AGREEMENTS

Internal:

1. OSF Form 1628 between the Office of Space Flight (OSF) and the Office of Space Science (OSS) to provide launch services to conduct servicing missions, signed May 4, 1990.
2. OSF/Space Communications -- agreement between OSF and OSS to provide HST ground systems development, maintenance, and flight-related telecommunications services. Revision 7, September 21, 1990.

External: NASA-ESA Memorandum of Understanding, dated October 7, 1977, and including Riders 1, 1A, 1B, and 2.

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Independent Implementation	IPAO/IRT	Aug-02	25-Oct-02	To ensure compliance with PCA-defined technical, cost and schedule thresholds.

BUDGET / LIFE CYCLE COST

These figures include all costs associated with program completion in 2012, including a servicing mission in 2004 and retrieval in 2010.

Budget Authority ($ in millions)	FY02	FY03	FY04	FY05	FY06	FY07	FY08	BTC	Total	Comments
FY 2004 President's Budget	256.2	228.2	238.9	142.5	147.9	168.5	219.1	452.6		
Development	170.2	138.9	136.4	43.0	43.7	62.8	110.0	175.9		*BTC numbers are not in full cost; they include marginal Shuttle costs plus HST return mission.
Operations	5.3	5.1	8.8	7.0	7.3	7.6	8.1	16.8		
Data Analysis	80.7	84.2	93.7	92.5	96.8	98.1	100.9	259.9		
Changes since FY03 Pres. Budget	-1.5		+74.3	+16.9	+17.3	+33.6	+219.1	+452.6		***Reason for Change:***
Development	-1.8		+63.1	+12.2	+12.1	+29.7	+110.0	+175.9	+401.2	Full cost; added 08 & BTC.
Operations	+0.3		+3.5	+1.5	+1.7	+1.7	+8.1	+16.8	+33.6	Full cost; added 08 & BTC.
Data Analysis			+7.7	+3.2	+3.4	+2.2	+100.9	+259.9	+377.3	Full cost; added 08 & BTC.
FY 2003 President's Budget	257.7	228.2	164.6	125.6	130.6	134.9				
Development	172.0	138.9	73.3	30.8	31.6	33.1				
Operations	5.0	5.1	5.3	5.5	5.6	5.9				
Data Analysis	80.7	84.2	86.0	89.3	93.4	95.9				

Indicates budget numbers in full cost.

Indicates changes since the FY 2003 President's Budget Submit.

FY 2002, FY 2003, Prior and BTC are not in full cost.

THEME: Astronomical Search for Origins (ASO)

DEVELOPMENT: Stratospheric Observatory for Infrared Astronomy (SOFIA)

PURPOSE

Objectives (Reference 2003 Strategic Plan)	Performance Measures
5.11, 5.12, 6.1, 6.2 ,6.3, 6.4, 7.1, 7.2	4ASO1,3,6-7,10,12-19

The SOFIA program extends the range of astrophysical observations significantly beyond that of previous infrared airborne observatories through increases in sensitivity and angular resolution. SOFIA will be used to study many different kinds of astronomical objects and phenomena, including: star birth and death; solar system formation; complex molecules in space; planets, comets, and asteroids in our solar system; nebulae and dust in galaxies; and black holes at the centers of galaxies.

OVERVIEW

SOFIA will be an astronomical observatory consisting of a 2.5m aperture telescope permanently installed in a specially modified Boeing 747 aircraft. The aircraft, with its open-port telescope provided through a partnership with the German Aerospace Center (DLR), will provide routine access to nearly all of the visual, infrared, far-infrared, and submillimeter parts of the spectrum. It will operate from Moffett Federal Airfield in Northern California as well as from deployment sites in the Southern Hemisphere and elsewhere, as dictated by its astronomical targets. With its ground basing , the observatory will be able to incorporate, via a peer-review process, new or upgraded instruments over its lifetime. This will allow additional science and the testing and introduction of cutting edge technologies. Most of the instruments will be designed and built by graduate students and postdoctoral scientists, led by an experienced Principal Investigator, in universities throughout the United States. SOFIA will serve as a training ground for the next generations of instrument builders well into the 21st century, while producing new instrumentation important to NASA's future space observatories. SOFIA will have an active Education & Public Outreach Program, which will include flying educators along with astronomers.

Go to SOFIA Homepage for more information: http://sofia.arc.nasa.gov

PROGRAM MANAGEMENT

SOFIA is a single-project program with program responsibility delegated to the Ames Research Center. The Space Science Enterprise Program Management Council (PMC) has SOFIA governing responsibility. 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 Astronomy and Physics at NASA HQ. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline for this technical commitment was made in 9/2000 and is detailed in the SOFIA PCA.

Technical Specifications	FY04 President's Budget	Change from Baseline
Effective aperture of telescope:	2.5 meters	--
Telescope wavelength range:	0.3 to 1,600 microns	--
Optical image quality:	80 % of visible wavelength encircled energy, from a point source within a 1.5 arcsecond diameter at the focal plane.	--
Image stability of telescope:	1.1 arcsec root mean square (rms) at first science flight.	--
	0.2 arcsec rms 3 yrs after first science flight.	--
Operational capability:	Operate in observing configuration for 6 hours or more at altitudes of at least 41,000 feet. Provide 960 research hours per year beginning in the third year of operation.	--
Science Instruments:	8 science instruments at beginning of operations, 15 after 5yrs, up to 40 investigation teams per year.	--

Schedule	FY04 President's Budget	Change from Baseline
Start of Formulation	Oct-91	--
Start of Implementation	Mar-96	--
Telescope Delivery for Installation	Sep-02	+10 mos
Operations Readiness Review	Mar-05	+28 mos
First Science Flight	Apr-05	+29 mos
Data Proprietary Period	1 yr after receipt by investigators	--
Observatory Operational Lifetime	20 years	--

THEME: Astronomical Search for Origins (ASO)

DEVELOPMENT: Stratospheric Observatory for Infrared Astronomy (SOFIA)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Major acquisitions for SOFIA are: science investigations; aircraft systems and Operations Center development; MOU with the German Aerospace Center (DLR) for Telescope Assembly; and science operations (5 years with 5 year option). Seven instruments were selected for development in September 1997. Calls for proposal (CFPs) to be issued: science instrument development as needed; annually for observing time. Universities Space Research Association (USRA) selected in 1996 as prime contractor for the aircraft, operations center, and first 5 years of operations, with L3 Systems and United Airlines as key subs. **Changes since FY03 Pres. Budget: None.**

Current Acquisitions	Actual *	Selection Method	Actual *	Performer	Actual *
Cooperative Agreements	0%	Full & Open Competition	100%	Industry	75%
Cost Reimbursable	83%	Sole Source	0%	Government	
Fixed Price	0%		100%	NASA Intramural	9%
Grants	0%			University	11%
Other	17%	Sci Peer Review	100%	Non Profit	5%
* as % of FY02 direct procurement	100%	* as % of FY02 direct procurement		* as % of FY02 direct procurement	100%

Future Acquisitions - 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: Provision of the Telescope Assembly and support for observatory operations from the German Aerospace Center (DLR), according to NASA/DARA Memorandum of Understanding, signed December 1996. (Note: DARA was subsequently absorbed into DLR.)

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Independent Annual Review	IRT	1-Jun-02	1-Jun-03	Assure compliance with PCA defined technical, cost and schedule parameters.

BUDGET / LIFE CYCLE COST

Budget Authority ($ in millions)	Prior	FY02	FY03	FY04	FY05	FY06	FY07	FY08	BTC	Total	Comments
FY 2004 Pres. Bud. (LCC)	233.4	38.0	46.9	54.7	51.2	55.3	57.4	59.7		596.6	
Development	233.4	38.0	46.9	54.7						373.0	
Operations					32.9	36.1	37.5	39.2	Cont.	145.6	
Data Analysis					18.4	19.2	19.8	20.5	Cont.	77.9	
Changes since FY03 Pres. Bud.				+13.4	+12.4	+12.5	+13.1	+59.7		+111.1	***Reason for Change:***
Development				+13.4						+13.4	Full cost
Operations					+9.7	+9.8	+10.1	+39.2		+68.7	Full cost
Data Analysis					+2.8	+2.7	+2.9	+20.5		+28.9	Full cost
FY 2003 President's Budget	233.4	38.0	46.9	41.3	38.8	42.8	44.3			485.5	Cost growth due to science
Development	233.4	38.0	46.9	41.3						359.6	instrument and aircraft aperature
Operations					23.2	26.3	27.4		Cont.	76.9	tech challenges, and added scope
Data Analysis					15.6	16.5	16.9		Cont.	49.0	(data archive).
Initial Baseline	234.8	36.6	38.0	38.9	40.1	41.3				429.7	FY 1998 President's Budget.
Development	234.8									234.8	Operations and DA to continue for
Operations		36.6	38.0	38.9	40.1	41.3					20 years.

Indicates budget numbers in full cost.

Indicates changes since the FY 2003 President's Budget Submit.

FY 2002, FY 2003, Prior and BTC are not in full cost.

THEME: Astronomical Search for Origins (ASO)

DEVELOPMENT: Space Infrared Telescope Facility (SIRTF)

PURPOSE

Objectives (Reference 2003 Strategic Plan)	Performance Measures
5.10, 5.11, 6.1, 6.2, 6.3, 6.4, 7.1, 7.2	4ASO1, 4ASO3-7, 4ASO12-19

SIRTF will explore the nature of the cosmos through the unique windows available in the infrared portion of the electromagnetic spectrum. These windows allow investigators to explore:
- The cold Universe by viewing heat radiation from objects that are too cool to radiate at optical and ultraviolet wavelengths;
- The hidden Universe by penetrating into dusty regions which are too opaque for exploration in the other spectral bands;
- The distant Universe by virtue of the cosmic expansion, which shifts the ultraviolet and visible radiation from distant sources into the infrared.

OVERVIEW

Consisting of a 0.85-meter telescope and three cryogenically-cooled science instruments, SIRTF will be the largest infrared telescope ever launched into space. SIRTF will obtain images and spectra by detecting the infrared energy, or heat, radiated by objects in space. Most of this infrared radiation is blocked by the Earth's atmosphere and cannot be observed from the ground. Because infrared is primarily heat radiation, the telescope must be cooled to near-absolute zero (-459 degrees Fahrenheit or -273 degrees Celsius) so that it can observe infrared signals from space without interference from the telescope's own heat. Also, the telescope must be protected from the heat of the Sun and the infrared radiation emitted by the Earth. To do this, SIRTF will carry a solar shield and will be launched into an Earth-trailing solar orbit. SIRTF is the final mission in NASA's Great Observatories Program, following the Hubble Space Telescope, Compton Gamma Ray Observatory, and Chandra X-ray Observatory.

SIRTF is scheduled for launch in the first half of FY 2003. NASA's FY 2004 budget request includes funding for SIRTF under Operations and Data Analysis; no funds are requested for Development.

Go to SIRTF Homepage for more information: http://sirtf.caltech.edu

PROGRAM MANAGEMENT

SIRTF is a single-project program with program responsibility delegated to the Jet Propulsion Laboratory. The Agency Program Management Council (PMC) has SIRTF governing responsibility. Enterprise Official is Dr. Edward Weiler, Associate Administrator for Space Science at NASA HQ. Theme Director and point of contact is Anne Kinney, Director of Astronomy and Physics at NASA HQ. This program is in full compliance with NPG-7120.5B requirements.

TECHNICAL COMMITMENT

The baseline for this commitment was made in 3/1998 and is detailed in the SIRTF Program Commitment Agreement.

Technical Specifications	FY04 President's Budget	Change from Baseline
Effective aperture of telescope:	85 centimeters	--
Telescope operating temperature:	5.5 degrees Kelvin (~ -268 Celsius)	--
Imaging capability:	3-180 microns	--
Spectroscopy capability:	5-100 microns	--
Pointing accuracy/stability:	5/0.3 arcseconds	--
Focal plane instruments:	3	--
Cryogenic lifetime:	minimum: 2.5 years, goal: 5 years	--

Schedule	FY04 President's Budget	Change from Baseline
Start of Implementation	Apr-98	--
Critical Design Review	Sep-98	--
Launch	Apr-03	+16 mos

THEME: Astronomical Search for Origins (ASO)

DEVELOPMENT: Space Infrared Telescope Facility (SIRTF)

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Major acquisitions for SIRTF are: Lockheed Martin, Sunnyvale CA (spacecraft); Ball Aerospace, Boulder CO (cryogenic telescope assembly); and Cornell University, the University of Arizona, the Smithsonian Astronomical Observatory (science instruments), and GSFC. JPL performs work on the project through NASA's contract with the California Institute of Technology.

Changes since FY03 Pres. Budget: None.

Current Acquisitions	Actual *	Selection Method	Actual *	Performer	Actual *
Cooperative Agreements	0%	Full & Open Competition	81%	Industry	47%
Cost Reimbursable	100%	Sole Source	19%	Government	0%
Fixed Price	0%		100%	NASA Intramural	0%
Grants	0%			University	53%
Other	0%	Sci Peer Review	100%	Non Profit	0%
* as % of FY02 direct procurement	100%	* as % of FY02 direct procurement		* as % of FY02 direct procurement	100%

Future Acquisitions - Major	Selection	Goals
1. 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 FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Indep. Implementation Review	SIRTF IRT	Oct-02	TBD	Assess program readiness, risks, and mitigation plans.
Software Flight Readiness	SIRTF IRT	Oct-02	TBD	Ensure software (flight and science) will operate as planned.
Monthly status reports	SIRTF IRT	Sep-02	TBD	Communicate IRT concerns and address in timely manner.

BUDGET / LIFE CYCLE COST

Budget Authority ($ in millions)	Prior	FY02	FY03	FY04	FY05	FY06	FY07	FY08	BTC	Total	Comments
FY 2004 President's Budget	511.5	131.5	79.1	78.4	77.2	76.3	75.8	65.3	75.5	1170.6	
Development	467.7	127.5	29.7	0.0	0.0	0.0	0.0	0.0	0.0	624.9	
Launch Vehicle	43.8	4.0	17.7	0.0	0.0	0.0	0.0	0.0	0.0	65.5	
Operations		0.0	3.2	14.4	14.0	13.5	13.7	13.3	8.6	80.6	
Data Analysis		0.0	28.5	64.0	63.2	62.9	62.1	52.0	66.9	399.6	
Changes since FY 03 Pres. Budget		+18.5	+0.0	+9.9	+7.2	+6.3	+2.0	+65.3	-79.6	+29.6	***Reason for Change:***
Development		+36.2	-17.7							+18.5	Launch delay and overrun.
Launch Vehicle		-17.7	+17.7							+0.0	Launch delay.
Operations				+7.1	+7.7	+8.2	+7.2	+13.3	-0.5	+42.9	Launch delay, transfer from DA.
Data Analysis				+2.8	-0.5	-1.8	-5.2	+52.0	-79.1	-31.8	Transfer to Ops.
FY 2003 President's Budget	511.5	113.0	79.1	68.5	70.0	70.0	73.8	0.0	155.1	1141.0	Spacecraft and instrument cost
Development	467.7	91.3	47.4							606.4	growth and delays (e.g. software,
Launch Vehicle	43.8	21.7								65.5	dewar); increased testing reqs.
Operations			3.2	7.3	6.3	5.3	6.5		9.1	37.7	Covers up to 7 years.
Data Analysis			28.5	61.2	63.7	64.7	67.3		146.0	431.4	Covers up to 7 years.
Initial Baseline	508.3	70.2	70.0	0.0	0.0	0.0	0.0	0.0	240.0	888.5	3/98 PCA, FY 99 PFP
Development	453.5	19.2								472.7	including Phase A.
Launch Vehicle	54.8	11.0								65.8	
Operations and Data Analysis		40.0	70.0						240.0	350.0	Ops not broken out from DA; covered 5 years.

Indicates budget numbers in full cost.
Indicates changes since the FY 2003 President's Budget Submit.
FY 2002, FY 2003, Prior and BTC are not in full cost.

THEME:	Astronomical Search for Origins (ASO)
DEVELOPMENT:	Kepler

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
5.11, 5.12, 6.1, 6.2, 6.3, 6.4, 7.1, 7.2		4ASO1,3,7-9, 12-19

The scientific goal of the Kepler mission is to explore the structure and diversity of planetary systems, with a special emphasis on detecting Earth-size planets in the habitable zones around other stars. The Kepler mission's specific objectives include: (1) determine the frequency of terrestrial and larger planets in or near the habitable zones of a wide variety of spectral types of stars; (2) determine the distribution of planet sizes and their orbital semi-major axes (half the longest diameter of the orbit); (3) estimate the frequency and orbital distribution of planets in multiple-stellar systems; and (4) determine the distributions of semi-major axis, albedo, size, mass, and density of short-period giant planets. The Kepler mission will continuously and simultaneously observe over 100,000 target stars.

OVERVIEW

The Kepler spacecraft will be launched into an Earth-trailing, heliocentric orbit similar to that of SIRTF. Following a 30-day period during which the photometer and spacecraft are characterized, Kepler begins acquiring its scientific data. It is expected that "hot Jupiters" (giant gas planets) in short period orbits will be identified after the first month of observation. During the first year, terrestrial planets with orbital periods shorter than that of Mercury -- as well as a wide range of larger planets with similar periods -- should be detected. Finally, the anticipated identification of Earth-size planets in the habitable zones of other star systems will begin during the third year of the Kepler mission.

Link to Kepler Homepage for more information: http://www.kepler.arc.nasa.gov

PROGRAM MANAGEMENT

Kepler is a project in the Discovery Program with project responsibiity delegated to the Principal Investigator (PI) at the Ames Research Center. The JPL Program Management Council (PMC) has Kepler governing responsibility. Enterprise Official is Dr. Edward Weiler, Administrator for Space Science at NASA HQ. Theme Director and point of contact is Dr. Anne Kinney, Director of Astronomy and Physics at NASA HQ. The program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline for this technical commitment will be set at Confirmation Review.

Technical Specifications	**FY04 President's Budget**	**Change from Baseline**
Photometer:	0.95-m aperture	--
Primary mirror:	1.4 m dia., 85% lightweighted	--
Detectors:	42 CCDs - 2200 x 1024 pixels	--
Mass:	903 kg	--
Power:	613 W	--
Launch Vehicle	D2925-10L (Delta II)	--
Mission lifetime:	4 years of flight	--
Telemetry:	Ka-and X-band	--

Schedule	**FY04 President's Budget**	**Change from Baseline**
Start of Implementation:	4th Qtr 2004	--
Critical Design Review:	3rd Qtr 2005	--
Launch:	Oct-07	--

THEME: Astronomical Search For Origins (ASO)

DEVELOPMENT: Kepler

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Ames Research Center (ARC) provides the Principal Investigator (PI), Deputy PI and some members of the science team. ARC acquires the other science team members through grants and contracts as appropriate. The Jet Propulsion Laboratory (JPL) provides the project management, mission assurance and project system engineering. Ball Aerospace and Technology Corporation provides the spacecraft, photometer and mission operations center. **Changes since FY03 Pres. Budget: None.**

Current Acquisitions	Actual *	Selection Method	Actual *	Performer	Actual *
Cooperative Agreements	100%	Full & Open Competition	100%	Industry	95%
Cost Reimbursable	0%	Sole Source	0%	Government	
Fixed Price	0%		100%	NASA Intramural	5%
Grants	0%			University	0%
Other	0%	Sci Peer Review	100%	Non Profit	0%
* as % of FY02 direct procurement	100%	* as % of FY02 direct procurement		* as % of FY02 direct procurement	100%

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

AGREEMENTS

Internal: The project is not dependent on other NASA activities outside of the control of the Associate Administrator for Space Science.

External: None.

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Confirmation Assessment	HQ/OSS	N/A	TBD	Approval to continue to Phase C/D.
Independent Assessment	Disc. PO	N/A	TBD	CDR Review; ATLO (Pre-Environmental Review).

BUDGET / LIFE CYCLE COST

Budget Authority	Prior	FY02	FY03	FY04	FY05	FY06	FY07	FY08	BTC	Total	Comments
FY 2004 President's Budget		4.3	25.5	51.1	133.6	113.8	62.1	26.1		416.4	Baseline to be established at Confirmation Review; project not yet in implementation.
Development		4.3	25.5	48.3	105.5	87.6	39.5	11.1		321.8	
Launch Vehicle				2.7	28.1	26.2	22.6			79.5	
Operations								11.5		11.5	
Data Analysis								3.6		3.6	
Changes since FY 03 PBS		+4.3	+25.5	+51.1	+133.6	+113.8	+62.1	+26.1		+416.4	***Reason for Change:***
Development		+4.3	+25.5	+48.3	+105.5	+87.6	+39.5	+11.1		+321.8	New mission selection
Launch Vehicle				+2.7	+28.1	+26.2	+22.6			+79.5	
Operations								+11.5		+11.5	
Data Analysis								+3.6		+3.6	
FY 2003 President's Budget (LCC)											N/A - selected 12/01.
Initial Baseline (LCC)											TBD (See above).

Indicates budget numbers in full cost.
Indicates changes since the FY 2003 President's Budget Submit.
FY 2002, FY 2003, Prior and BTC are not in full cost.

THEME: Astronomical Search for Origins (ASO)

OPERATIONS

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
5.10, 5.11, 5.12		4ASO4-11

Maximize the scientific return from NASA's investment in spacecraft and other data collection sources by efficiently and reliably operating the data-collecting hardware that enables scientific discoveries.

OVERVIEW

ASO Operations currently supports the Hubble Space Telescope (HST) and the Far Ultraviolet Spectroscopic Explorer (FUSE). HST provides a serviceable, state-of-the-art, orbiting observatory to study the history of the Universe. FUSE studies physical processes governing the evolution of galaxies, as well as the origin and evolution of stars and planetary systems. The Space Infrared Telescope Facility is planned for launch in spring 2003, and will study the formation of stars, galaxies and planets via spectroscopy, high-sensitivity photometry and imaging.

For more information on HST, go to: http://hubble.gsfc.nasa.gov/index.html
For more information on FUSE, go to: http://fuse.pha.jhu.edu/
For more information on SIRTF, go to: http://sirtf.caltech.edu

PROGRAM MANAGEMENT

Enterprise official is Dr. Edward Weiler, Associate Administrator for Space Science. Theme Director and point of contact is Dr. Anne Kinney, Director of Astronomy and Physics at NASA HQ. HST and FUSE are managed by the Goddard Space Flight Center. SIRTF is managed by the Jet Propulsion Laboratory. This program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

The baseline is documented in the Program Commitment Agreement for each ASO mission.

Technical Specifications	FY04 President's Budget	Change from Baseline
All missions will meet Level I specifications as identified in the Program Plan.		--

Schedule	FY04 President's Budget	Change from Baseline
Hubble Space Telescope	Operate until 2010, or until the end of safe recoverable status.	--
Far Ultraviolet Spectroscopic Explorer	Operate through 2006.	--
Space Infrared Telescope Facility	Operate up to 7 years after launch (planned for 4/03).	--

THEME: Astronomical Search for Origins (ASO)

OPERATIONS

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

The prime contractor for HST operations is the Consolidated Space Operations Contractor, Lockheed Martin Space Operations. FUSE operations are performed by the Johns Hopkins University. SIRTF operations will be performed by the Jet Propulsion Laboratory. In FY02, direct procurement represented 100% of budget authority. **Changes since FY03 Pres. Budget: None.**

Current Acquisitions	Actual *	Selection Method	Actual *	Performer	Actual *
Cooperative Agreements	0%	Full & Open Competition	100%	Industry	66%
Cost Reimbursable	100%	Sole Source		Government	0%
Fixed Price	0%		100%	NASA Intramural	0%
Grants	0%			University	0%
Other	0%	Sci Peer Review	100%	Non Profit	34%
* as % of FY02 direct procurement	100%	* as % of FY02 direct procurement		* as % of FY02 direct procurement	100%

Future Acquisitions - Major	Selection	Goals
CSOC recompetition	late 2003	100% Full & Open Competition

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator of Space Science.

External: None.

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Senior Review	Ext. panel	June '02	Summer '04	To consider mission extensions and funding levels for operating ASO spacecraft that have completed their prime mission, based on science productivity and cost.

BUDGET

Budget Authority ($ in millions)	FY02	FY03	FY04	Comments
FY 2004 President's Budget	8.5	9.7	24.6	
HST Operations	5.3	5.1	8.8	
SIRTF Operations		3.2	14.4	
SOFIA Operations				
FUSE Operations	3.2	1.4	1.5	
Kepler Operations				
Changes since FY 03 Pres. Budget	+1.4		+10.6	***Reason for Change:***
HST Operations	+0.3		+3.5	full cost
SIRTF Operations			+7.1	revised estimates
SOFIA Operations				full cost
FUSE Operations	+1.1		+0.1	recovery from spacecraft anomaly
Kepler Operations				new mission selection

Indicates budget numbers in full cost.

Indicates changes since the FY 2003 President's Budget Submit.

FY 2002 and FY 2003 are not in full cost.

THEME: Astronomical Search for Origins (ASO)

RESEARCH

PURPOSE

Objectives (Reference 2003 Strategic Plan)	Performance Measures
5.10, 5.11, 5.12, 6.1, 6.2, 6.3, 6.4, 7.1, 7.2	4ASO2, 4ASO4-19

The Research Program provides fundamental data analysis for operating ASO missions including HST, SIRTF, and FUSE. The Research Program also supports fundamental research and analysis vital to the successful completion of strategic goals and objectives.

OVERVIEW

The ASO research program supports ASO Reseach and Analysis (R&A) and the analysis of data (DA) from the ASO operating missions, and the science data tools and archives needed to perform the research. DA 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 Reseach programs with ASO 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 (DA) 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 DA program also includes annual, open and competitive solicitations to all missions that can accommodate "guest investigations."

OSS Research Opportunities Site	http://research.hq.nasa.gov/code_s/code_s.cfm
Space Science Missions Site	http://spacescience.nasa.gov/missions/index.htm
Hubble Site	http://hubble.stsci.edu/

PROGRAM MANAGEMENT

NASA Headquarters is responsible for the ASO Research Program. 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. 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 the Office of Space Science. Data Analysis baselines are defined by the Program PCA or equivalent document.

Technical Specifications	FY04 President's Budget	Change from Baseline
The NASA Strategic Plan has incorporated results of the OSS Strategic Planning process, which 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 the road mapping activities by the Astronomical Search for Origins Subcommittee. All selections processes and reviews of the elements of the ASO research program use these strategic items as guide posts for selection and/or continuation. Proposals for research must relate to these strategic items.		--

Schedule	FY04 President's Budget	Change from Baseline
R & A		
Research Opportunities In Space Science (ROSS)	Yearly in February	--
Data Analysis		
Senior Reviews	Every Two Years	--

THEME: Astronomical Search for Origins (ASO)

RESEARCH

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

The Research and Analysis (R&A) and Data Analysis (DA) programs make awards following peer reviewed competitions under NASA Research Announcements (NRAs), Announcements of Opportunity (AOs) and Cooperative Agreement Notices (CANs). In FY 02, direct procurement represented 100% of budget authority.

Changes since FY 03 Pres. Budget: None.

Current Acquisitions	Actual *
Cooperative Agreements	1%
Cost Reimbursable	32%
Fixed Price	7%
Grants	49%
Other	11%
* as % of FY02 direct procurement	100%

Selection Method	Actual *
Full & Open Competition	98%
Sole Source	2%
	100%
Sci Peer Review	100%
* as % of FY02 direct procurement	

Performer	Actual *
Industry	3%
Government	4%
NASA Intramural	7%
University	71%
Non Profit	15%
* as % of FY02 direct procurement	100%

Future Acquisitions - Major	Selection	Goals
Annual R&A research announcement	Late 2003	100% Science Peer Review
Annual HST call for proposals	April 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: HST Data Analysis involves agreements with the European Space Agency.

Changes since FY03 Pres. Budget: None.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
MO&DA Senior Review	Sr. Review committee	June '02	Summer '04	To recommend approval and funding level for extending the science investigations of the operating ASO missions.
R&A peer review	Peer review committee	Summer '02	Summer '03	To review ASO proposals responding to the annual R&A announcement.

BUDGET

Budget Authority ($ in millions)	FY02	FY03	FY04	Comments
FY 2004 President's Budget	115.7	145.9	198.9	
ASO R&A	22.3	23.6	29.3	
ASO Data Analysis	93.4	122.3	169.7	
Changes since FY 03 PBS	-2.1		+16.1	***Reason for Change:***
ASO R&A			+2.0	full cost
ASO Data Analysis	-2.1		+14.1	full cost

Indicates budget numbers in full cost.

Indicates changes since the FY 2003 President's Budget Submit.

FY 2002 and FY 2003 are not in full cost.

THEME: Astronomical Search for Origins (ASO)

TECHNOLOGY AND ADVANCED CONCEPTS

PURPOSE

Objectives	Reference 2003 Strategic Plan	Performance Measures
5.10, 5.11, 5.12		4ASO4-9, 11

The ASO Technology and Advanced Concepts program includes future missions in formulation, and the development of advanced technologies needed for specific science missions. This process begins with mission studies - the first phase of flight program development. 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. In ASO, future missions will seek to detect and characterize distant planetary bodies around other stars, probe ever farther into the deepest reaches of space with increasing resolution, and bring us new understanding of the nature of matter and energy. Technologies critical to the success of these missions include interferometry, high performance sensors, lightweight large-aperture reflectors, cryocoolers for infrared detectors, and autonomous information technology.

OVERVIEW

ASO projects in this phase of implementation during FY04 include the James Webb Space Telescope (JWST), the Space Interferometry Mission (SIM), and the ground-based Keck Interferometer, as well as various smaller efforts, such as the Large Binocular Telescope Interferometer (LBTI). In keeping with the Search for Origins theme, technology development from these missions will serve as stepping stones for eventual launch of the Terrestrial Planet Finder (TPF). The StarLight flight segment has been cancelled, as it was not clear that TPF will require a space-based interferometry demonstration, while ground-based StarLight work has continued in support of the program.

JWST promises to expand upon the legacy of the Hubble Space Telescope, focusing on previously unobserved periods in the development of the Universe (one million to several billion years old). Projects comprising the Navigator Program (including the Space Interferometry Mission, the Terrestrial Planet Finder, and the Keck Interferometer) will seek to detect and characterize Earth-like planets, understand the formation and distribution of planetary systems in our galaxy, and contribute to understanding the formation and evolution of stars, planets and galaxies. For example, by observing thousands of stars, SIM will detect planets through high-resolution and starlight nulling imagery, and serve as a science and technological pathfinder for TPF.

PROGRAM MANAGEMENT

Program responsibility has been delegated to GSFC for the James Webb Space Telescope, and to Jet Propulsion Laboratory (JPL) for the Navigator Program. The Agency Program Management Council (PMC) has governing responsibility for flight projects; at the time of SRR, the Enterprise Governing Program Management Council has oversight for Navigator ground-based projects. 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 Astronomy and Physics at NASA HQ. With the minor exceptions noted in the Navigator Program PCA, this program is in full compliance with NPG7120.5B.

TECHNICAL COMMITMENT

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

Technical Specifications	FY04 President's Budget	Change from Baseline
Space Interferometry Mission (SIM)	3 Michelson Stellar Interferometers; 5 year mission life; 10 year goal	No established baseline until confirmation.
James Webb Space Telescope (JWST)	6m-class segmented active optic; wavelength range 0.6 to 28 microns	No established baseline until confirmation.
Terrestrial Planet Finder (TPF)	IR Interferometer or Visible Coronagraph	No established baseline until confirmation.
Keck Interferometer	Two 10m telescopes and four 1.8m outriggers; 85-meter baseline between telescopes	--

THEME: Astronomical Search for Origins (ASO)

TECHNOLOGY AND ADVANCED CONCEPTS

TECHNICAL COMMITMENT - CONTINUED

Schedule	FY04 President's Budget	Change from Baseline
Space Interferometry Mission (SIM)	December 2009 Launch	No established baseline until confirmation.
James Webb Space Telescope (JWST)	June 2010 Launch	No established baseline until confirmation.
Terrestrial Planet Finder (TPF)	Launch TBD	No established baseline until confirmation.
Keck Interferometer	Operational through 2020	--

ACQUISITION STRATEGY & PERFORMING ORGANIZATIONS

Major acquisitions for JWST include observatory development, with Northrop Grumman Space Technology (formerly TRW) as prime contractor; instrument complement to be acquired under AO.

Navigator acquisition strategy relies on the capabilities of JPL, universities, and other NASA Centers to develop "first application" technologies. Additionally, the program will develop strategic collaborations with appropriate technical entities to acquire proven hardware and promote technology transfer. Where an industrial firm has a unique capability, it may be engaged to develop first technology applications.

Current Navigator participants include Lockheed-Martin Missles and Space, TRW Space and Electronics Group, Ball Aerospace and Technologies, Boeing-SVS, Eastman Kodak, Goodrich Coorporation, CalTech, University of Arizona, MIT, CA Association for Research in Astronomy (CARA), Princeton University and others.
Changes since FY03 Pres. Budget: None.

Current Acquisitions	Actual *	Selection Method	Actual *	Performer	Actual *
Cooperative Agreements	4%	Full & Open Competition	80%	Industry	12%
Cost Reimbursable	74%	Sole Source	20%	Government	
Fixed Price	4%		100%	NASA Intramural	16%
Grants	1%			University	64%
Other	17%	Sci Peer Review	100%	Non Profit	8%
* as % of FY02 direct procurement	100%	* as % of FY02 direct procurement		* as % of FY02 direct procurement	100%

Future Acquisitions - Major	Selection	Goals
1. JWST Operations - STScI	FY2003	Sole Source
2. TPF Technology Demonstration Mirror	Q2 FY03	Full & Open Competition
3. TPF Cryocooler	Q2 FY03	Full & Open Competition

THEME: Astronomical Search for Origins (ASO)

TECHNOLOGY AND ADVANCED CONCEPTS

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator of Space Science.

External: Memorandum of Understanding (MOU) exists between TPF and the European Space Agency's (ESA) Darwin mission.

Changes since FY 2003 President's Budget: None.

INDEPENDENT REVIEWS

Types of Review	Performer	Last Review	Next Review	Purpose
Indep. Implementation Reviews	IRT/IPAO	Aug-02	Nov-02	To ensure compliance with defined technical, cost and schedule thresholds (PCAs, Roadmaps).

BUDGET

Budget Authority ($ in millions)	FY02	FY03	FY04	Comments
FY 2004 President's Budget	181.9	283.8	411.2	
SIM	37.7	39.5	79.8	
JWST	83.6	126.2	254.6	
TPF	15.0	19.7	44.2	
StarLight	17.2	67.3		Flight segment cancelled.
Keck	6.4	9.3	9.8	
Other	22.0	21.8	22.7	
Changes since FY 03 Pres. Budget	-21.4		-56.2	
SIM	+2.8		-5.2	
JWST	-8.5		+38.6	
TPF	-2.8		+24.2	
StarLight	-11.5		-119.6	Flight segment cancelled.
Keck	+0.2		+0.1	
Other	-1.6		+5.6	

Indicates budget numbers in full cost.
Indicates changes since the FY 2003 President's Budget Submit.
FY 2002 and FY 2003 are not in full cost.