

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



Summary of  
**FY 2004 BUDGET REQUEST**

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## Overview

### Strategic Plan

NASA's 2003 Strategic Plan builds on the Vision and Mission statements announced by the NASA Administrator in 2002.

NASA is transforming itself to better support science- and research-driven exploration of space. We are aligning ourselves with a long-term strategy that addresses humankind's most profound questions: How did we get here? Where are we going? Are we alone? NASA is uniquely capable of answering these questions.

- The Strategic Plan provides the basis for budget decisions, linking 10 Agency goals to 18 theme areas governed by our six Enterprises, including Education, our newest Enterprise.
- Congressional justification, called the *Integrated Budget Performance Document* (IBPD), has been revamped to integrate budget and performance information and link to the Strategic Plan.
- Budget release reflects unprecedented simultaneous release of three key documents: (1) Strategic Plan, (2) IBPD, and (3) Performance & Accountability Report, which provides performance results and the data to support our auditor's clean opinion of our financial statements.



### Transforming NASA

We have identified a number of transforming changes, discussed in our Strategic Plan, that are important ingredients for fulfilling our Vision and Mission.

- All investments will contribute to our goals and be traceable to the Vision and Mission. Every NASA program and project must be relevant to one or more goals and perform successfully against specific measures.
- Human space flight capabilities will be expanded to enable research and discovery. We will continue to expand human presence in space -- not as an end in itself, but as a means to further the goals of exploration, research, and discovery.
- Technology developments will be crosscutting. We will emphasize technologies with broad applications, such as propulsion, power, computation, communications, and information.
- Education and inspiration will be an integral part of all our programs. We have created an Education Enterprise, and we will track performance of our education programs the way we track all other NASA activities.
- We will operate as One NASA in pursuing our Vision and Mission and reinforce the shared commitment of all NASA employees to our common goals.
- We will pursue activities unique to our Mission *as only NASA can*. If NASA does not do them, they will not get done. If others are doing them, we should question why NASA is involved.

## Budget

NASA's FY 2004 budget request is \$15.469 billion, a \$469 million, or 3.1 percent increase, over the FY 2003 President's Budget.

- NASA's request includes \$337 million (\$4.0 billion over five years) for new initiatives.

<b>NEW INITIATIVES</b>		
(\$ in millions)	2004-08	
	2004	Total
<b>To Understand &amp; Protect Our Home Planet</b>		
Climate Change Research Acceleration	26	72
Aviation Security	21	196
National Airspace System Transition Augmentation	27	100
Quiet Aircraft Technology Acceleration	15	100
<b>To Explore the Universe &amp; Search for Life</b>		
Project Prometheus *	93	2,070
Optical Communications	31	233
Beyond Einstein Initiative	59	765
Human Research Initiative	39	347
<b>To Inspire the Next Generation of Explorers</b>		
Education Initiative	26	130
<b>TOTAL for Initiatives</b>	<b>337</b>	<b>4,013</b>

\* NOTE: Amount shown added to \$1 billion Nuclear Systems Initiative

- Initiatives represent strategic investments in breakthrough nuclear propulsion and power systems that will be demonstrated on an ambitious mission to Jupiter's moons; revolutionary communications technologies using laser light instead of radio waves to dramatically increase our ability to transmit information across the solar system; constellations of networked spacecraft that will probe the edge of black holes and the dark energy that is expanding the universe; research into the human factors of space travel that will enable safe human exploration beyond Earth; research into climate change targeted at high priority policy issues; new aeronautics technologies to enable safer, quieter, and more efficient air travel; and education programs to expand the number of students pursuing science and engineering careers.
- The budget maintains changes made in the FY 2003 Budget Amendment sent to Congress in November 2002, including additional resources for the International Space Station to successfully achieve U.S. core completion and support the station's newly prioritized research program; adding a fifth annual Space Shuttle launch; and supporting the Integrated Space Transportation Plan, which calls for development of an Orbital Space Plane, technologies for future launch systems, and a service life extension program to keep Shuttle flying longer.
- The budget is restructured to reflect the Strategic Plan, with two new accounts entitled *Science, Aeronautics, & Exploration (SA&E)*, which reflects our science- and research-driven agenda, and *Space Flight Capabilities*, which includes programs that enable the SA&E activities to succeed.
- Program budgets have been revamped to reflect full cost. This means institutional activities, such as personnel and facilities, are now included in the benefiting program's budget, reflecting the true cost of the program and enabling managers to make better economic decisions.

- Below is a list of our five-year budget broken down by three appropriation accounts, six Enterprises, and 18 themes. (NOTE: FY 2003 column is an estimate of the President's FY 2003 budget request in full cost for comparison purposes only against FY 2004).

By Appropriation Account	Est. Pres. Bud.					
By Enterprise	<u>FY 2003</u>	<b>FY 2004</b>	<u>FY 2005</u>	<u>FY 2006</u>	<u>FY 2007</u>	<u>FY 2008</u>
By Theme	(in full cost)					
<b>SCIENCE, AERONAUTICS &amp; EXPLORATION</b>	<b>7,101</b>	<b>7,661</b>	<b>8,269</b>	<b>8,746</b>	<b>9,201</b>	<b>9,527</b>
<b><u>Space Science</u></b>	<b>3,468</b>	<b>4,007</b>	<b>4,601</b>	<b>4,952</b>	<b>5,279</b>	<b>5,573</b>
Solar System Exploration	1,046	1,359	1,648	1,843	1,952	2,054
Mars Exploration	551	570	607	550	662	685
Astronomical Search for Origins	799	877	968	1,020	1,022	1,061
Structure & Evolution of the Univ.	398	432	418	428	475	557
Sun-Earth Connections	674	770	959	1,111	1,169	1,216
<b><u>Earth Science</u></b>	<b>1,610</b>	<b>1,552</b>	<b>1,525</b>	<b>1,598</b>	<b>1,700</b>	<b>1,725</b>
Earth System Science	1,529	1,477	1,440	1,511	1,606	1,629
Earth Science Applications	81	75	85	87	94	96
<b><u>Biological &amp; Physical Research</u></b>	<b>913</b>	<b>973</b>	<b>1,042</b>	<b>1,087</b>	<b>1,118</b>	<b>1,143</b>
Biological Sciences Research	304	359	399	453	456	481
Physical Sciences Research	351	353	392	380	409	401
Research Partnerships & Flight Supt	254	261	251	254	253	262
<b><u>Aeronautics *</u></b>	<b>949</b>	<b>959</b>	<b>932</b>	<b>939</b>	<b>934</b>	<b>916</b>
Aeronautics Technology	949	959	932	939	934	916
<b><u>Education</u></b>	<b>160</b>	<b>170</b>	<b>169</b>	<b>169</b>	<b>170</b>	<b>170</b>
Education	160	170	169	169	170	170
<b>SPACE FLIGHT CAPABILITIES</b>	<b>7,875</b>	<b>7,782</b>	<b>7,746</b>	<b>7,881</b>	<b>8,066</b>	<b>8,247</b>
<b><u>Space Flight</u></b>	<b>6,107</b>	<b>6,110</b>	<b>6,027</b>	<b>6,053</b>	<b>6,198</b>	<b>6,401</b>
Space Station	1,851	1,707	1,587	1,586	1,606	1,603
Space Shuttle	3,786	3,968	4,020	4,065	4,186	4,369
Space Flight Support	471	434	419	402	407	429
<b><u>Crosscutting Technologies *</u></b>	<b>1,768</b>	<b>1,673</b>	<b>1,720</b>	<b>1,828</b>	<b>1,868</b>	<b>1,846</b>
Space Launch Initiative	1,150	1,065	1,124	1,221	1,257	1,224
Mission & Science Measurement Tech	434	438	435	439	439	444
Innovative Tech Transfer Partnerships	183	169	161	168	172	179
<b>INSPECTOR GENERAL</b>	<b>25</b>	<b>26</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>31</b>
<b>TOTAL</b>	<b>15,000</b>	<b>15,469</b>	<b>16,043</b>	<b>16,656</b>	<b>17,297</b>	<b>17,806</b>
year to year increase		3.1%	3.7%	3.8%	3.8%	2.9%

\* NOTE: Aerospace Technology Enterprise includes both Aeronautics and Crosscutting Technologies

**President’s Management Agenda**

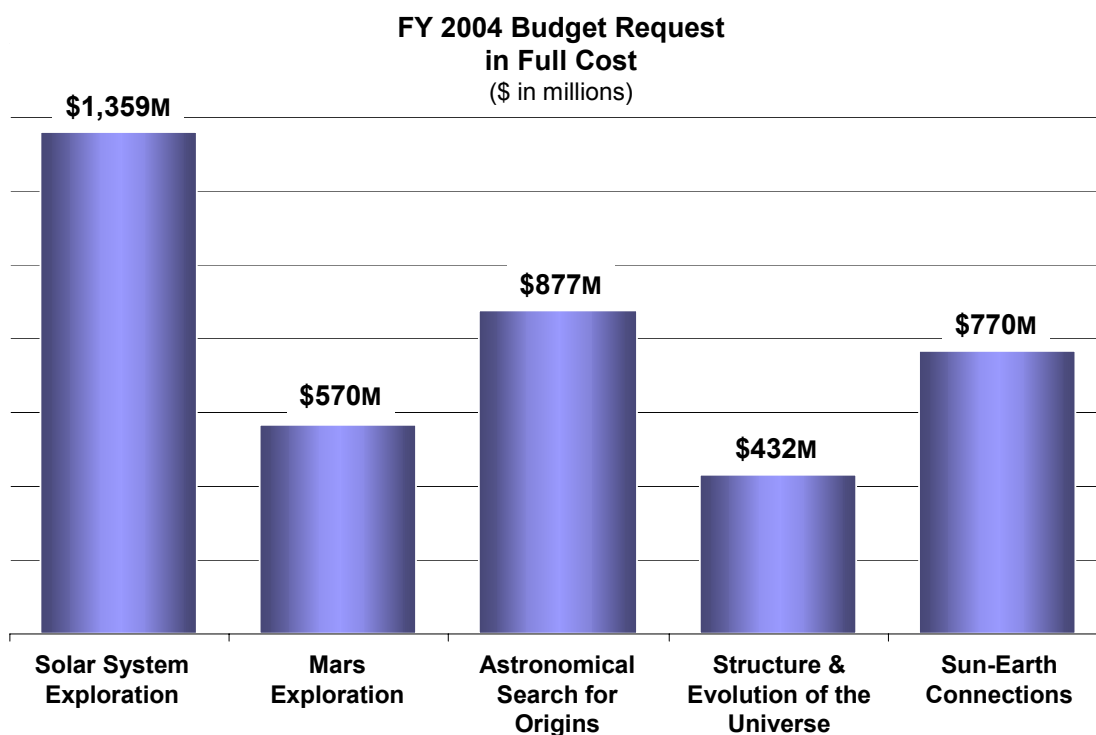
	<b>Human Capital</b>	<b>Competitive Sourcing</b>	<b>Financial Performance</b>	<b>E-Government</b>	<b>Budget and Performance Integration</b>
<b>Status</b>	<b>Y</b>	<b>R</b>	<b>R</b>	<b>R</b>	<b>Y</b>
<b>Progress</b>	<b>G</b>	<b>G</b>	<b>G</b>	<b>G</b>	<b>G</b>

The President’s Management Agenda includes five government-wide initiatives that promise to significantly improve the management of Federal agencies. OMB has rated agencies for performance using green, yellow, and red metrics, with green being best. In the second year of scoring, OMB raised the rating for Human Capital and Budget & Performance Integration from red to yellow, reflecting major improvements since last year. The scores represent NASA’s status and progress as of Dec. 31, 2002. Not reflected in the OMB scoring is the recent excellent news that our independent auditor has given NASA’s financial statement a clean opinion, a significant improvement from last year’s disclaimer. All five areas were given a green rating for progress in meeting milestones that demonstrate improvement. Highlights of each are summarized below.

- Human Capital: Begun to implement the strategic human capital plan, including a tracking system to identify workforce deficiencies across the Agency.
- Competitive Sourcing: Achieved the government-wide, 15 percent competitive sourcing goal, but still working on a plan to achieve the long-term, 50 percent goal.
- Financial Performance: Addressed all issues contained in the disclaimer opinion on NASA’s 2001 audit and given a clean opinion for 2002.
- E-Government: Addressing information technology security issues and reviewing and enhancing other IT investments.
- Budget & Performance Integration: Now budgeting for the full cost of programs and integrating budget and performance reports starting with FY 2004 Budget.

## Space Science Enterprise

The Space Science Enterprise seeks to answer fundamental questions about life in the universe: how it arose, what its mechanisms are, where in the solar system life may have originated or may exist today, and whether there are similar planetary environments around other stars where the signature of life can be found. The Enterprise also seeks to understand how the universe began and evolved, how stars and galaxies formed, and how matter and energy are entwined on the grandest scale. The Space Science Enterprise is comprised of five themes described below.



### Solar System Exploration



This theme seeks to understand how our own solar system formed and evolved and about possible life beyond Earth. The planets of our solar system and the ancient icy bodies far from the Sun are Rosetta stones that can tell unique stories about the evolution of our solar system. As we learn more about the origins of living systems on Earth and our solar system's planets and moons, we may learn that life has also arisen on some of them. Highlights for FY 2004 include:

#### Overall budget

FY 2004 request is \$1,359 million:

- \$177 million for three missions in development: MESSENGER mission to explore Mercury, DAWN mission to orbit around two asteroids, and Deep Impact mission to probe below the surface of a comet.
- \$130 million for New Frontiers program to explore the outer planets in the solar system, including funding for the New Horizons mission to Pluto and the Kuiper Belt.
- \$68 million for Astrobiology research to improve the ability to find and identify life on other planets.

### New Initiative – Project Prometheus

Request includes \$279 million for this new initiative (\$3 billion over five years). This consists of \$186 million (\$1 billion over five-years) from the Nuclear Systems Initiative introduced in FY 2003 and adds \$93 million (\$2 billion over five-years) for a first flight mission, Jupiter Icy Moon Orbiter, to be flown within a decade.

- Nuclear technology will enable unprecedented science data return through high power science instruments and advanced communications technology.
- Jupiter Icy Moon Orbiter will search for evidence of global subsurface oceans on Jupiter's three icy Galilean moons: Europa, Ganymede, and Callisto. These oceans may harbor organic material.
- Mission will set the stage for the next phase of exploring Jupiter and will open the rest of the outer solar system to detailed exploration.

### New Initiative – Optical Communications

Request includes \$31 million for this new initiative (\$233 million over five years).

- Offers potential for many orders of magnitude improvement in communication data rate. For example, using conventional radio frequency communications, the Mars Reconnaissance Orbiter will take 21 months to map 20 percent of the surface of Mars. In contrast, by using optical communications it will allow the *entire* surface to be mapped in 4 months.
- Critical technology exists, but must be demonstrated. Plan first demonstration at Mars in 2009 using telecom satellite around Mars that relays data to high-altitude Earth balloons. The balloon receiver technology will be demonstrated by the middle of this decade.
- Promises dramatic reduction in cost per byte of data returned and could, ultimately, replace the Deep Space Network.

### Major Events in 2004

- Deep Impact will launch in January 2004. Deep Impact will fire a projectile at comet Temple-1 to investigate the composition of the comet's interior.
- MESSENGER will launch in March 2004. MESSENGER will conduct a detailed investigation of Mercury, the least explored terrestrial planet.
- Stardust will encounter comet Wild-2 in January 2004 and collect dust samples that will be returned to Earth in 2006.
- Cassini arrives at Saturn in July 2004 following a seven-year journey.
- Genesis returns to Earth in September 2004 with its samples of the solar wind following its two-year "sunbath".

## **Mars Exploration**



This theme explores the mysteries of the history and present conditions on Mars. Dry and cold today, the Martian surface shows the traces of a wet and warmer past. Frozen water at its poles and hints of relatively recent liquid water flows make Mars the most likely place to seek evidence of ancient or present extraterrestrial life. Contrasts between the current and past geology, atmospheres, and magnetic fields of Mars and Earth promise insights into why these neighboring planets differ so much today. Advances in our understanding of Mars would be useful for future human exploration. Highlights for FY 2004 include:

### Overall budget

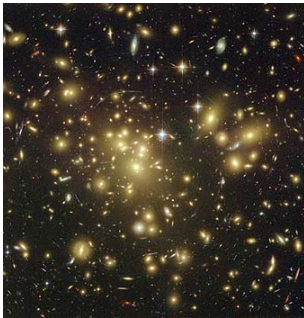
FY 2004 request is \$570 million:

- \$184 million for development of 2005 Mars Reconnaissance Orbiter, an orbiter that will map Martian surface features as small as a basketball (20-30 cm).
- \$29 million for 2007 Scout Mission, a unique opportunity for scientists and industry to compete and provide innovative ideas for Mars exploration.
- \$118 million for 2009 Mars Smart Rover/Lander, a rover that will traverse tens of kilometers over Mars and last over a year, digging and drilling for unique samples to study in its onboard laboratory.
- \$9 million (\$336 million over five-years) added for a new mission, a telecommunications satellite around Mars in 2009, to enhance science data return and demonstrate the first interplanetary optical communications link.

### Major Events in 2004

- Mars Exploration Rovers arrive at Mars in January 2004 and will begin science operations. The Rovers are designed to last for 90 days of surface operations and should travel about 600 meters during that time.
- Mars Reconnaissance Orbiter will begin integration and test in preparation for launch in 2005.

## **Astronomical Search for Origins**



This theme strives to answer two questions: Where did we come from? Are we alone? The theme seeks to observe the birth of the earliest galaxies and the formation of stars, find planetary systems in our region of the galaxy including those capable of harboring life, and learn whether life exists beyond our solar system. We need to understand the building blocks of life, the conditions necessary for life to persist, and the signatures it writes on the sky. By exploring the diversity of other worlds and searching for those that may harbor life, we hope to understand the origins of our own world. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$877 million:

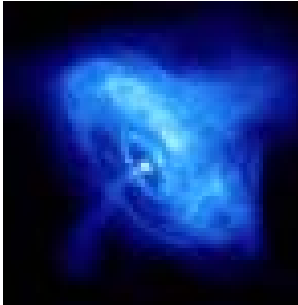
- \$239 million for Hubble Space Telescope operations as well as funding for a Shuttle servicing mission in 2005 and a Shuttle retrieval mission in 2010 as the Hubble ends its operations.
- \$255 million for development of James Webb Space Telescope planned for launch about 2010 and promising to build on the legacy of Hubble Space Telescope.
- \$80 million for development of Space Interferometry Mission planned for launch in 2009 to detect planets around other stars.

### 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.



## Structure and Evolution of the Universe



This theme seeks to understand the nature and phenomena of the universe. It seeks to understand the fundamental laws of space, time, and energy, and to trace the cycles that have created the conditions for our own existence. This objective is accomplished in part by observing signals from the Big Bang, mapping the extreme distortions of space-time near black holes, investigating galaxies, and understanding the most energetic events in the universe. We also must try to understand the mysterious dark energy that pervades the universe and determines its ultimate destiny. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$432 million:

- \$116 million for development of Gamma-ray Large Area Space Telescope (GLAST), a mission to study high-energy objects like black holes.

### New Initiative – Beyond Einstein

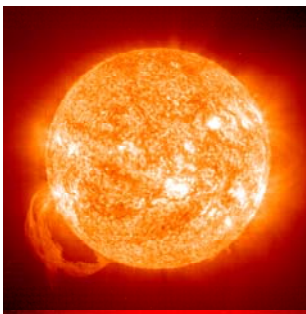
Request includes \$59 million for this new initiative (\$765 million over five years):

- Offers potential to answer three questions left unanswered by Albert Einstein's theories: What powered the Big Bang? What happens to space, time, and matter at the edge of a black hole? What is the mysterious dark energy expanding the universe?
- Laser Interferometer Space Antenna (LISA) will use three spacecraft "formation flying" 5 million kilometers apart in a triangle to observe the distortion of space due to gravity waves.
- Constellation-X will use a team of powerful X-ray telescopes working in unison to observe black holes, investigate "recycled" stellar material, and search for the "missing matter" in the universe; it will be 100 times more powerful than any single X-ray telescope that has come before it.
- Einstein Probes, a program that will begin later this decade, consists of fully and openly competed missions (in the manner of the Discovery, Explorers, and New Frontiers programs) to conduct investigations that benefit Structure and Evolution of the Universe science objectives.

### Major Events in 2004

- SWIFT gamma-ray burst explorer begins science operations following launch in late 2003.
- GLAST will conduct its Critical Design Review.

## Sun-Earth Connections



This theme investigates our Sun and how its structure and behavior affect Earth. The Sun's energy is responsible for the Earth's present ecosystem, but the Sun is a variable star. Its small variability profoundly affects the Earth. Changes in its long-term brightness cause ice ages, and its 11-year cycle of activity causes aurorae and other disturbances on the Earth. Solar flares affect the upper atmosphere and can damage satellites and disable the power distribution grid on the ground. The Sun is also our nearest star and is an ideal laboratory for basic physics and learning about other stars. Highlights for FY 2004 include:

Overall budget

FY 2004 request is \$770 million:

- \$166 million for development of STEREO and Solar Dynamics Observatory.
- \$212 million for future flight missions.

Major Events in 2004

- STEREO completes integration and test in preparation for launch in 2005. STEREO will use two identically equipped spacecraft to provide revolutionary 3-D imaging of Coronal Mass Ejections.
- Solar Dynamics Observatory enters implementation of development in January 2004. It is a cornerstone mission in the Living With a Star program. It will study the Sun's magnet field and the dynamic processes that influence space weather.

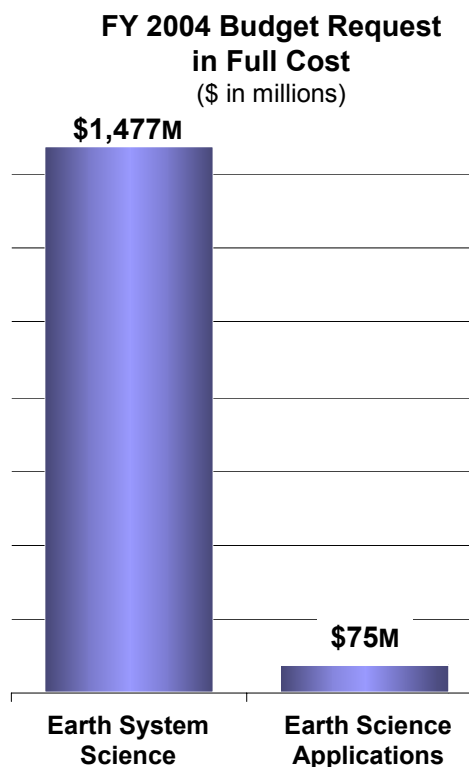
## Earth Science Enterprise

NASA's Vision to improve life here starts with the Earth Science Enterprise's study of planet Earth from space. The Enterprise seeks to understand and protect our home planet by advancing Earth system science and applying the results to improve prediction of climate, weather, and natural hazards. The Enterprise is comprised of two themes described below.

### Earth System Science



Within this theme, we are deploying and operating the first comprehensive constellation of Earth-observing research satellites designed to reveal interactions among Earth's continents, atmosphere, oceans, ice, and life. These interactions produce the conditions that sustain life on Earth. Data and information from our satellites enable researchers to understand the causes and consequences of global change and inform the decisions made by governments, businesses, and citizens to improve our quality of life. Highlights for FY 2004 include:



### Overall budget

FY 2004 request is \$1,477 million:

- The decrease in the budget from FY 2003 to FY 2004 is driven primarily by major development programs that are past their peak development spending and are preparing for launches in 2004 including AURA, Cloudsat, and Calipso.
- \$96 million for the NPOESS Preparatory Project (NPP) under development in partnership with National Oceanic and Atmospheric Administration and the Department of Defense (DOD). NPP transfers critical research instruments to operational agencies and maintains data continuity for NASA-sponsored scientific investigations.
- \$60 million for the Landsat data continuity mission, which is an innovative program to seek partnerships with industry to continue receiving critical land remote sensing data.
- \$524 million for research and modeling that help answer critical scientific questions on climate change to aid policy and economic decision-makers.

### New Initiative – Climate Change Research Initiative Acceleration

Request includes \$26 million for this new initiative (\$72 million over five years)

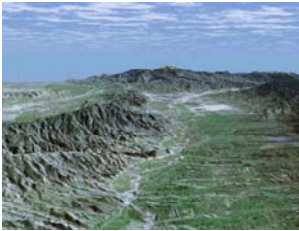
- Accelerates evaluation of non-carbon dioxide (CO<sub>2</sub>) impact on climate change. These factors potentially have as much or more influence as CO<sub>2</sub>, which is the focus of most studies, and can be reduced with far less economic impact and with added benefits to public health and agriculture.
- To greatly enhance our ability to evaluate non-CO<sub>2</sub> forcings, an advanced polarimeter instrument will be flown to measure methane, tropospheric ozone, aerosols and black carbon. Tropospheric ozone, black carbon (soot), and aerosols are also important public health factors.

- Advanced polarimeter will be launched in the 2007 timeframe, which is about four years earlier than planned.

#### Major Events in 2004

- Launches of Aura, Cloudsat, and Calipso satellites in 2004. The Aura mission will study Earth's ozone, air quality, and climate. Cloudsat will measure the structure of clouds from space to better quantify their key role in the Earth's water cycle and climate system. Calipso, coupled with Aura and the advanced polarimeter, will help determine the role of aerosols in climate, reducing one of the largest uncertainties in climate models.
- Use satellite observations to provide daily and seasonal global atmospheric water vapor, rainfall, snowfall, sea-ice, and ice-sheet maps and use these observations to improve the scientific understanding and models of water cycle through the Earth system.
- Use satellite-derived localized temperature and moisture profiles, with unprecedented accuracy and global coverage, to improve predictive capabilities of regional weather models.
- Assimilate satellite and in situ observations into a variety of ocean, atmosphere, and ice models for purposes of estimating the state of Earth's seasonal and decadal climate.
- Demonstrate the benefits of formation flying multiple satellites in a constellation for the first time (i.e. creating a super-satellite) to enable generation of integrated science information products, e.g., aerosol distribution, optical thickness and properties to assess their total effect on climate aerosols.

### **Earth Science Applications**



Within this theme, NASA works with other Federal agencies to apply our research results and Earth observation information products to applications of national priority. We have identified applications where our partner agencies have decision support systems, such as weather prediction models and near-airport terrain databases, that are being improved based on NASA research and technological innovations. For each application, joint applications research and demonstrations are under way or being developed. In addition, the theme develops crosscutting solutions that advance the use of NASA information and technology across a range of potential new applications. Highlights for FY 2004 include:

#### Overall budget

FY 2004 request is \$75 million:

- Theme completely revamped to focus on 12 specific applications of national priority where other agencies' decision support systems can be markedly improved based on NASA-provided data and information. Competitive, merit-review will be the hallmark of extramural project selection.

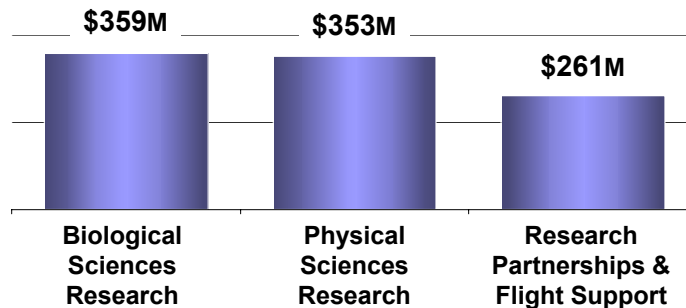
#### Major Events in 2004

- Benchmark improvement to at least two national applications: air quality and agricultural productivity.
- Competitively select projects for the Research, Education, Applications Solutions Network (REASoN) program to serve national priorities.

## Biological and Physical Research Enterprise

NASA's Biological and Physical Research Enterprise conducts interdisciplinary fundamental and applied research to address opportunities and challenges of human exploration of space. The space environment offers a unique laboratory in which to study biological and physical processes. Access to space allows scientists to conduct research under conditions that have no parallel in the history of science. Experiments that take advantage of this environment extend from basic biology to quantum mechanics and from fundamental research to research with near-term applications in medicine and industry. The Biological and Physical Research Enterprise is comprised of three themes.

### FY 2004 Budget Request in Full Cost (\$ in millions)



### New Initiative – Human Research Initiative

Request includes \$39 million for this new initiative (\$347 million over five years). Of the total, \$25 million is directed towards Biological Science Research (\$283 million over five years) and \$14 million towards Physical Sciences Research (\$64 million over five years). Goals include:

- Certify crew safety for missions beyond low-Earth orbit over 100 days by mitigating the highest risks.
- Enable knowledge and technology to reduce mass to orbit and beyond for life support by a factor of three by 2010.

### Biological Sciences Research



Within this theme, we determine ways to support a safe, human presence in space. Space flight exposes humans to physiological and psychological health risks from radiation, reduced gravity, and isolation. We are researching how to define and control these risks. This theme also conducts research and development to improve the performance of life support systems. It includes a basic biology research component that seeks both to pursue fundamental biological research questions and produce results that can support advanced methods for enabling human exploration of space. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$359 million:

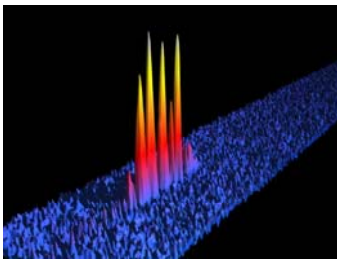
- \$210 million for Bioastronautics Research. In response to ReMAP prioritization, expands planned ground research program in countermeasures development by \$27 million, which includes an increase of approximately \$20 million in funding for the National Space Biomedical Research Institute from \$10 million to \$30 million and a \$7 million increase through the new Human Research Initiative. The initiative also starts a flight program in high priority areas of advanced human support technology by adding \$18 million.

- \$149 million for Fundamental Space Biology. In response to ReMAP prioritization, adds \$20 million for habitat holding rack development, cell culture unit and ground based research, and animal and plant habitats for research on the Space Station Centrifuge.
- Adds \$12 million to ensure adequate levels of reserves for Space Station hardware development and research operations.

#### Major Events in 2004

- Twenty-five biological sciences flight experiments scheduled to be conducted on the Space Shuttle and Space Station.
- Habitat Holding Rack flight hardware available by September 2004.

### **Physical Sciences Research**



This theme supports research that takes advantage of the unique environment of space to expand our understanding of the fundamental laws of nature. We also support applied physical science research to improve safety and performance for human exploration and research that has applications in terrestrial industry. Highlights for FY 2004 include:

#### Overall budget

FY 2004 request is \$353 million:

- Responds to the ReMAP prioritization external study by realigning Physical Sciences Research funds. Provides adequate funding and reserve levels for the major PSR International Space Station Research Capability Development facility class space flight hardware, while reducing funding for lower priority areas such as biomolecular technology, and structural biology future facility class space flight hardware, and level II program management support. Increases funding for research of strategic importance to NASA's long-range goals, including radiation protection and basic research in power and propulsion technologies. Rephases deployment of Low Temperature Microgravity Physics Facility consistent with the availability of the Japanese Experiment Module (JEM) Exposed Facility.
- Reallocates \$11 million in FY 2004 reserves to ensure adequate levels of reserves for Space Station hardware development (Fluids and Combustion Facility, Low Temperature Microgravity Physics Facility, and Materials Science Research Rack) and research operations.
- Reallocates \$28 million for Space Station research equipment initial deployment of the Combustion Integration Rack (CIR) component of the Fluids and Combustion Facility (\$22 million) and Materials Science Research Rack (MSRR) (\$6 million).

#### Major Events in 2004

- Six physical sciences flight experiments to be conducted on the Space Shuttle and Space Station.
- Delivery of the first major PSR research facility rack to the International Space Station, the Combustion Integrated Rack (CIR) on ULF-2. Beginning of prime research facility operations on the ISS, a new phase of Space Station utilization.
- Fluids Integrated Rack (FIR) flight hardware available by August 2004.

## Research Partnerships and Flight Support



This theme establishes policies and allocates space resources to encourage and develop research partnerships in the pursuit of NASA missions and Enterprise scientific objectives. This research supports product development on Earth and leverages industry resources to accelerate progress in our strategic research areas. Ultimately, research partnerships may support development of an infrastructure that can be applied to human exploration. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$261 million:

- \$49 million for Space Product Development. Restructures program by aligning industrial partnerships with NASA mission needs and Enterprise scientific objectives. Will review the existing research partnership centers to determine those centers to be retained. The focus will remain on the flight program.
- As part of FY 2003 Budget Amendment, provides funding for additional research/logistics missions to Space Station beginning in FY 2006. Of the total \$113 million over five-years added to budget for these research missions, Space Product Development has \$4 million over five years and Multi-User Systems and Support has \$93 million. The remaining \$16 million is distributed between Biological Sciences Research and Physical Sciences Research.
- \$212 million for Multi-User Systems and Support funding.
- Space Product Development budget was augmented by two activities: (1) the transfer of the Anti-Matter Spectrometer program management and budget from Physical Sciences Research; and (2) the consolidation of the Enterprise Support program content and budget, previously diffused across various programmatic components.

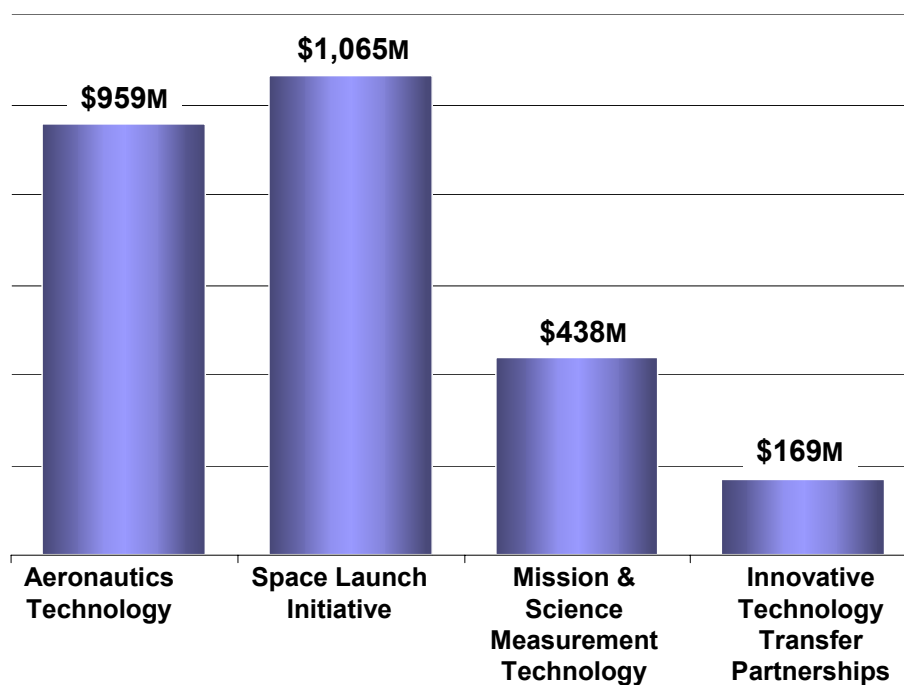
### Major Events in 2004

- Twelve flight experiments from Space Product Development scheduled to be conducted on the Space Shuttle and Space Station.
- Multi-User Systems and Support will be involved in preparation of CIR and Express Research launches to Station in July 2004 and Europe's five research racks and two attached payloads planned for launch with the Columbus Module in October 2004, the first international partner laboratory module to be deployed on the Space Station.

## Aerospace Technology Enterprise

The Aerospace Technology Enterprise contributes to the NASA Vision by pioneering and developing advanced technologies. These technologies, in turn, improve the air transportation system, access to space, and science missions. This Enterprise helps others use NASA technology for non-aerospace commercial purposes and develops technology partnerships with industry and academia outside traditional aerospace fields. The Aerospace Technology Enterprise is comprised of four themes described below.

**FY 2004 Budget Request  
in Full Cost  
(\$ in millions)**



### Aeronautics Technology



This theme plays a key role in creating a safer, more secure, environmentally friendly and efficient air transportation system, increasing performance of military aircraft, and developing new uses for science or commercial missions. This theme also enhances the Nation's security through its partnerships with the DOD and Federal Aviation Administration (FAA). Research areas include advanced propulsion technologies, lightweight high-strength adaptable structures, adaptive controls, advanced vehicle designs, and new collaborative design and development tools. In collaboration with the FAA, research is conducted in air traffic management technologies for new automation tools and concepts of operations. Highlights for FY 2004 include:



### Overall budget

FY 2004 request is \$959 million:

- \$169 million for Aviation Safety and Security projects aimed at reducing accident and fatality rates.
- \$217 million for Airspace Systems projects to provide technologies that can dramatically increase the capacity and mobility of the Nation's air transportation system.
- \$574 million for Vehicle Systems projects focused on development of breakthrough technologies for future aircrafts and air vehicles.

### New Initiative – Aviation Security

Request includes \$20 million for this new initiative (\$195 million over five years):

- Addresses critical aviation security needs that NASA is uniquely qualified to provide.
- Develops technology for commercial aircraft and airspace protection, including development of damage-tolerant structures and autonomous and reconfigurable flight controls technology to prevent aircraft from being used as weapons and to protect against catastrophic loss of the aircraft in the event of damage from sabotage or explosives.

### New Initiative – National Airspace System Transition Augmentation

Request includes \$27 million for this new initiative (\$100 million over five years):

- Enables technology, in cooperation with FAA, to transition to a next-generation National Airspace System that would increase the capacity, efficiency, and security of the system to meet the mobility and economic-growth needs of the Nation, reducing delays and increasing air transportation efficiency.

### New Initiative – Quiet Aircraft Technology Acceleration

Request includes \$15 million for this new initiative (\$100 million over five years):

- Accelerate development and transfer of technologies that will reduce perceived noise in half by 2007 compared to the 1997 state-of-the-art.
- Fully implemented throughout the system, eliminates unacceptable noise outside the boundary of the airport.

### Major Events in 2004

- Experimentally demonstrate a highly-efficient, light-weight compressor to decrease engine emissions.
- Complete validation and assessment of NASA-developed decision-support air traffic controller aids in support of the FAA's Operational Evolution Plan.
- Prototype inherently failure resistant engine components to improve aircraft safety.

## **Space Launch Initiative**



This theme ensures safe, affordable, and reliable access to space. New space transportation capabilities are needed to ensure that America continues its leadership in space. The theme gives special emphasis to NASA's unique needs, including crew escape and survival systems. It helps create a more secure world by collaborating with the DOD on critical access to space and hypersonics technologies that support future civil and military aerospace missions. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$1,065 million:

- \$550 million for Orbital Space Plane program to develop a crew return capability from Space Station by 2010 and crew transfer capability atop an expendable launch vehicle by 2012. Funding supports technology demonstrators such as X-37 and advanced design studies.
- \$515 million for Next Generation Launch Technology program to meet NASA's future space launch needs. Funding includes advanced kerosene engine development and hypersonic propulsion research and testing.

### Major Events in 2004

- Test flight of DART vehicle to demonstrate autonomous rendezvous technology between a chase vehicle and an on-orbit satellite.
- Drop test of X-37 vehicle from carrier aircraft to demonstrate autonomous landing capability as a precursor to a possible orbital demonstration.
- Preliminary design review of Orbital Space Plane to support a full-scale development decision.

## **Mission and Science Measurement Technologies**



This theme is responsible for developing crosscutting technology for a variety of aviation and space applications, such as communications, power and propulsion systems, micro-devices and instruments, information technology, nanotechnology, and biotechnology. These technology advances will have the potential to open a new era in aviation and allow space missions to expand our knowledge of Earth and the universe. Our technologies are unique to NASA because we focus on space mission applications. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$438 million:

- \$233 million for Computing, Information, and Communications Technologies program including intelligent and autonomous systems for science exploration missions.
- \$44 for Engineering for Complex Systems program including develop of engineering tools to improve safety and mission success.
- \$161 million for Enabling Concepts and Technologies program including development of revolutionary technologies in support of NASA's other Enterprises.

### Major Events in 2004

- Demonstrate technologies for millimeter precision formation flying.
- Demonstrate spacecraft communications technologies achieving 1Gbps or greater for near Earth, and 1Mbps or greater for deep space applications.
- Demonstrate lightweight, sub-kilowatt ion engine for small spacecraft.
- Develop prototype workstation that provides capability to identify, track, and trade-off risk.

## Innovative Technology Transfer Partnerships



Under this theme, we will work to develop partnerships with industry and academia to develop new technology that supports Enterprise programs. We will also transfer NASA technology to U.S. industry and enhance NASA technology objectives through the Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) programs. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$169 million:

- \$5 million for Enterprise Engine being introduced to create partnerships with innovators to sponsor dual use technologies to further NASA's Mission and meet our future technology needs.
- \$29 million for discontinuing the existing commercial technology promotion efforts and, instead, recompeting and refocusing our technology transfer programs to maximize benefits to the taxpayer.
- \$135 million for SBIR/STTR programs.

### Major Events in 2004

- Award SBIR and STTR grants.
- Establish partnerships with innovators under the operation of the Enterprise Engine.

## Education Enterprise

Education, our newest Enterprise, was established in 2002 to inspire more students to pursue the study of science, technology, engineering and mathematics, and ultimately to choose careers in aeronautics and space-related fields. This new Enterprise will unify the educational programs in NASA's other five enterprises and at the 10 field centers under a *One NASA Education* vision. NASA Education will permeate and be embedded within all the Agency's activities. The Education Enterprise includes the Education Programs theme.

**FY 2004 Budget Request  
in Full Cost  
(\$ in millions)**

**\$170M**

**Education  
Programs**

### Education Programs



The Education Enterprise will provide unique teaching and learning experiences, as only NASA can, through the Agency's research and flight capabilities. Students and educators will be able to work with NASA and university scientists to use real data to study the Earth, explore Mars, and conduct other scientific investigations. They will work with our engineers to learn what it takes to develop the new technology required to reach the farthest regions of the solar system and to live and work in space. It is important that the next generation of explorers represents the full spectrum of the U.S. population, including minority students and those from low-income families. To ensure the diversity in NASA's workforce, our educational programs pay particular attention to under-represented groups.

NASA Education will support our Nation's universities to educate more students in science and engineering by providing meaningful research and internship opportunities for qualified students, plus a roadmap for students to seek NASA careers. Highlights for FY 2004 include:

#### Overall budget

FY 2004 request is \$170 million:

- \$78 million for education programs including the continuation of pipeline development programs for students at all educational levels and the continuation of the Space Grant/EPSCOR programs, providing a national link with the higher education community.
- \$92 million for minority university research and education including funding opportunities for minority institutions to increase the number and percentage of state-certified mathematics, science, or technology teachers.
- Education Enterprise funding is coordinated with an estimated \$55 million in education-related funding managed by the five other NASA Enterprises.

#### New Initiative – Education Initiative

Request includes \$26 million for this new initiative (\$130 million over five years):

- \$2 million for the Educator Astronaut Program that will select teachers and transport them into space to inspire and motivate students.
- \$13 million for the NASA Explorer Schools Program that will provide target middle schools with a customized and sustained learning environment using NASA's most recent discoveries and latest technologies to garner greater interest in science and engineering careers.
- \$9 million for Scholarship for Service that will link scholarship with service at a NASA Center and help NASA better attract top students into our workforce.
- \$2 million for Explorer Institutes, NASA's direct link with the informal education community (science centers and museums) through openly competed grants.

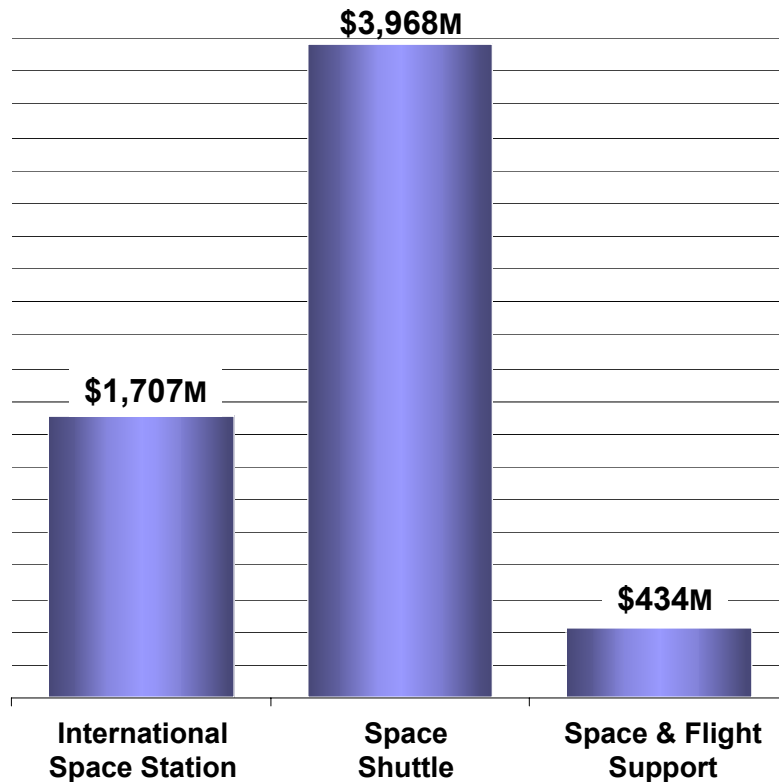
Major Events in 2004

- New solicitation for the university research center program that will further expand and strengthen the research capacity of minority institutions.
- Selection of the first class of educator astronauts.
- Pilot implementation of approximately 50 Explorer Schools.
- Initiate Explorer Institutes linking the informal education community to NASA's programs.
- Implement pilot scholarship for service.

## Space Flight Enterprise

The Space Flight Enterprise provides many critical enabling capabilities that make possible much of the science, research, and exploration achievements of the rest of the Agency. The Space Flight Enterprise does this through three themes described below.

### FY 2004 Budget Request in Full Cost (\$ in millions)



### International Space Station



This theme supports activities for establishing a permanent human presence in Earth orbit – the International Space Station. The Space Station provides a long-duration habitable laboratory for science and research activities to investigate the limits of human performance, expand human experience in living and working in space, and enable commercial development of space. The Space Station will allow unique, long-duration, space-based research in cell and developmental biology, plant biology, human physiology, fluid physics, combustion science, materials science, and fundamental physics. It will also provide a unique platform for observing the Earth's surface and atmosphere, the Sun, and other astronomical objects. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$1,707 million:

- Funding drops as planned as development activities near an end and on-orbit operations and research becomes the focus of the program.
- Maintains proposal in FY 2003 Budget Amendment including additional funds for reserves plus funding Node 3 and Environmental Closed Life Support System (ECLSS) in FY 2004.
- Continues significant progress toward resolving the Space Station management and cost control issues that confronted the program at the end of 2001. Many changes based on recommendations of the ISS Management and Cost Evaluation (IMCE) task force have increased NASA's confidence in achieving success with the U.S. Core Complete station.
- A new management team is in place with the authority to control program content, to ensure station capabilities are driven by science requirements, and to make the appropriate decisions as the program moves from development into its operational phase.
- The development of NASA's integrated financial management core system and a management information system are progressing on schedule.
- The Space Station program is well on its way to completing work on the U.S. Core Complete configuration. Flight elements undergoing ground integration and test are proceeding on schedule, and the last U.S. flight element is scheduled for delivery to NASA by the spring of 2003.

### Major Events in 2004

- Achieve U.S. core complete by spring 2004.
- 12 U.S. racks available for research.
- Expect awards for new contract opportunities for Space Station support.

## **Space Shuttle**



This theme builds on the Shuttle's primacy as the world's most reliable and versatile launch system. The shuttle, first launched in 1981, provides the only capability in the United States for human access to space. In addition to transporting people, materials, and equipment, the Space Shuttle allows astronauts to service and repair satellites and build the Space Station. The Space Shuttle can be configured to carry different types of equipment, spacecraft, and scientific experiments that help scientists understand and protect our home planet, explore the universe, and inspire the imagination of the American people. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$3,968 million:

- Supports steady state flight rate of five per year .
- Provides \$379 million (\$1.7 billion over five-years) for Space Shuttle Service Life Extension, a program to improve safety and infrastructure needs to allow flying Space Shuttle into the next decade.
- Exploring all alternatives for competitive sourcing of Shuttle flight operations following the conclusion of the current Space Flight Operations Contract in order to best fly safely, meet flight schedule, and improve the existing Shuttle system.

### Major Events in 2004

- Five flights focused on Space Station assembly.
- Space Shuttle Main Engine Health Management System ready for first flight.

## Space and Flight Support



This theme encompasses Space Communication, Launch Services, Rocket Propulsion Testing, and Advanced Systems. Space Communications consists of two programs: the Tracking and Data Relay Satellite System (TDRSS), which supports the Space Shuttle, Expendable Launch Vehicles, and research aircraft; and the NASA Integrated Services Network, which provides telecommunications services at facilities such as flight support networks, mission control centers and science facilities, and administrative communications networks for NASA Centers. The Launch Services program focuses on meeting the Agency's launch and payload processing requirements by assuring safe and cost effective access to space via the Space Shuttle. The Rocket Propulsion Testing Program supports a core of highly trained test and engineering crews and test facilities. The Advanced Systems Program includes studies of human and robotic exploration of space. Highlights for FY 2004 include:

### Overall budget

FY 2004 request is \$434 million:

- \$125 million for Space Communications budget. Continues support for formulation phase of TDRS Continuation project.
- \$142 million for oversight of expendable launch vehicle flights and supporting payload carriers for Shuttle launches.
- \$62 million for rocket propulsion testing.
- \$85 million for environmental compliance including \$44 million for Plum Brook cleanup.

### Major Events in 2004

- Commence Plum Brook reactor building demolition and disposal.
- Award of the Space Mission Communication and Data Service Procurement, the follow-on to the Consolidated Space Operations Contract (CSOC).



## Institutional Investments

As a function of full cost management, the following institutional investments are included in the preceding Enterprise budgets as either direct program charges or as Center or Corporate General & Administrative (G&A) charges. Full cost provides us the unique opportunity to garner insight into these costs. These areas are included in the summary below to provide visibility into the resources for these activities.

### Center G&A

Center G&A costs include Center security, ground maintenance, fire protection, business computing, public affairs, institutional construction of facilities, human resources, procurement, budgeting, accounting, equal opportunity, legal, public relations, educational outreach, medical services, and logistics support. FY 2004 highlights include:

- \$1.097 billion total for FY 2004 allocated as shown in the graphic below:
- Includes \$24 million additional funding for enhanced security.

(\$ in millions)	<u>FY 2004</u>
Ames Research Center	129
Glenn Research Center	100
Dryden Flight Research Center	41
Goddard Space Flight Center	171
Johnson Space Center	159
Kennedy Space Center	169
Langley Research Center	143
Marshall Space Flight Center	146
<u>Stennis Space Center</u>	<u>39</u>
<i>Total, Center G&amp;A</i>	<i>1097</i>

### Corporate G&A

Corporate G&A costs include headquarters operations and Agency-wide functions. FY 2004 highlights include:

- \$613 million total for FY 2004 as shown in the table below:

(\$ in millions)	<u>FY 2004</u>
Headquarters Corporate Activities	293
Corporate IFMP	126
Agency Operations	68
Safety and Mission Assurance	35
Chief Engineer	33
Chief Information Officer	22
Center-based Corporate (e.g., payroll)	12
Construction of Facilities	11
Security Management	8
<u>Chief Health and Medical Officer</u>	<u>4</u>
<i>Total, Corporate G&amp;A</i>	<i>613</i>

- Includes \$126 million for the Integrated Financial Management Program (IFMP), which plans to complete implementation of the core module by summer 2003, and additional modules by 2006.

### **Workforce**

FY 2004 highlights include:

- \$2.107 billion for salaries and benefits in support of 18,693 full-time equivalent (FTE) civil service employees compared to 18,471 FTEs in FY 2002 and estimated 18,837 FTEs in FY 2003.

### **Construction of Facilities**

FY 2004 highlights include:

- \$248 million for Construction of Facilities (CoF).
- Includes \$64 million for program direct CoF, carried in program budgets.
- Includes \$173 million for institutional CoF, carried within Center G&A.
- Includes \$10 million for a Facility Demolition initiative, carried within Corporate G&A, to remove unused buildings at the NASA field centers.

### **Environmental Compliance**

FY 2004 highlights include:

- \$85 million for environmental compliance, including \$44 million for Plum Brook cleanup.