

# NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

## Federal Funds

### General and special funds:

#### HUMAN SPACE FLIGHT

(INCLUDING TRANSFER OF FUNDS)

For necessary expenses, not otherwise provided for, in the conduct and support of human space flight research and development activities, including research, development, operations, support and services; maintenance; construction of facilities including repair, rehabilitation, revitalization and modification of facilities, construction of new facilities and additions to existing facilities, facility planning and design, environmental compliance and restoration, and acquisition or condemnation of real property, as authorized by law; space flight, spacecraft control and communications activities including operations, production, and services; program management; personnel and related costs, including uniforms or allowances therefor, as authorized by U.S.C. 5901-5902; travel expenses; purchase and hire of passenger motor vehicles; not to exceed \$20,000 for official reception and representation expenses; and purchase, lease, charter, maintenance and operation of mission and administrative aircraft, **[\$5,462,900,000]** \$7,296,000,000, to remain available until September 30, [2002] 2003, of which amounts as determined by the Administrator for salaries and benefits; training, travel and awards; facility and related costs; information technology services; science, engineering, fabricating and testing services; and other administrative services may be transferred to the Science, Aeronautics and Technology account in accordance with section 312(b) of the National Aeronautics and Space Act of 1958, as amended by Public Law 106-377: Provided, That the authorized funding level for the International Space Station through fiscal year 2006 shall not exceed \$8,197,300,000 except in amounts equal to budget reductions in other Human Space Flight programs. (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 2001, as enacted by section 1(a)(1) of P.L. 106-377.)

#### Program and Financing (in millions of dollars)

Identification code 80-0111-0-1-252	2000 actual	2001 est.	2002 est.
<b>Obligations by program activity:</b>			
Direct program:			
00.01 Space station .....	2,530	2,057	2,043
00.02 Payload and ELV support .....	99	99	96
00.03 Investments and support .....	123	123	1,271
00.04 Space shuttle .....	3,001	3,079	3,167
00.05 Payload and utilization operations .....	160	14	.....
00.06 Space operations .....	.....	.....	458
00.07 Safety, mission assurance & engineering .....	.....	.....	46
09.01 Reimbursable program .....	164	163	201
10.00 Total new obligations .....	5,855	5,535	7,282
<b>Budgetary resources available for obligation:</b>			
21.40 Unobligated balance carried forward, start of year .....	368	167	246
22.00 New budget authority (gross) .....	5,652	5,614	7,497
22.10 Resources available from recoveries of prior year obligations .....	2	.....	.....
23.90 Total budgetary resources available for obligation .....	6,022	5,781	7,743
23.95 Total new obligations .....	-5,855	-5,535	-7,282
24.40 Unobligated balance carried forward, end of year .....	167	246	461
<b>New budget authority (gross), detail:</b>			
Discretionary:			
40.00 Appropriation .....	5,511	5,463	7,296
40.76 Reduction pursuant to P.L. 106-113 .....	-23	.....	.....
40.77 Reduction pursuant to P.L. 106-554 (0.22 percent) .....	.....	-12	.....
43.00 Appropriation (total discretionary) .....	5,488	5,451	7,296
Spending authority from offsetting collections:			
68.00 Offsetting collections (cash) .....	169	163	201
68.10 Change in uncollected customer payments from Federal sources .....	-5	.....	.....

68.90	Spending authority from offsetting collections (total discretionary) .....	164	163	201
70.00	Total new budget authority (gross) .....	5,652	5,614	7,497
<b>Change in unpaid obligations:</b>				
Unpaid obligations, start of year:				
72.40	Unpaid obligations, start of year .....	1,652	1,833	1,784
72.95	Uncollected customer payments from Federal sources, start of year .....	-25	-20	-20
72.99	Obligated balance, start of year .....	1,627	1,813	1,764
73.10	Total new obligations .....	5,855	5,535	7,282
73.20	Total outlays (gross) .....	-5,666	-5,584	-7,030
73.40	Adjustments in expired accounts (net) .....	-6	.....	.....
73.45	Recoveries of prior year obligations .....	-2	.....	.....
74.00	Change in uncollected customer payments from Federal sources .....	5	.....	.....
Unpaid obligations, end of year:				
74.40	Unpaid obligations, end of year .....	1,833	1,784	2,036
74.95	Uncollected customer payments from Federal sources, end of year .....	-20	-20	-20
74.99	Obligated balance, end of year .....	1,813	1,764	2,016
<b>Outlays (gross), detail:</b>				
86.90	Outlays from new discretionary authority .....	3,783	3,799	5,177
86.93	Outlays from discretionary balances .....	1,883	1,785	1,853
87.00	Total outlays (gross) .....	5,666	5,584	7,030
<b>Offsets:</b>				
Against gross budget authority and outlays:				
Offsetting collections (cash) from:				
88.40	Non-Federal sources .....	-31	-30	-35
88.45	Offsetting governmental collections from the public .....	-138	-133	-166
88.90	Total, offsetting collections (cash) .....	-169	-163	-201
Against gross budget authority only:				
88.95	Change in uncollected customer payments from Federal sources .....	5	.....	.....
<b>Net budget authority and outlays:</b>				
89.00	Budget authority .....	5,488	5,451	7,296
90.00	Outlays .....	5,498	5,421	6,829

Note.—Includes \$1,712 million in budget authority in 2002 for activities previously financed from:

	2000	2001
Mission Support (in millions of dollars) .....	1,566	1,715

This appropriation provides funding for Human Space Flight (HSF) activities, and for Safety, mission assurance and engineering activities supporting the Agency. The HSF activities include development and operations of the Space Station, the Space Station research program, and operation of the Space Shuttle. This includes development of contingency capabilities for the Space Station, high priority investments to improve the safety of the Space Shuttle, and required construction projects in direct support of Space Station and Space Shuttle programs. This appropriation also provides for salaries and related expenses; design, repair, rehabilitation, and modification of facilities and construction of new facilities; maintenance, and operation of facilities; and other operations activities supporting human space flight programs; and space operations, safety, mission assurance and engineering activities that support the Agency.

In FY 2000 and FY 2001, the Human Space Flight (HSF) account provided only for the direct funding of human space flight activities; space operations services had been funded within the Science, Aeronautics and Technology (SAT) account; and Safety, mission assurance and engineering had been funded within the Mission Support account. Beginning

**General and special funds—Continued****HUMAN SPACE FLIGHT—Continued**

(INCLUDING TRANSFER OF FUNDS)—Continued

in FY 2002, other than direct costs (which includes Research and Program Management and non-programmatic Construction of Facilities) will be allocated to either the HSF or the SAT account based on the number of full time equivalent people, and there will no longer be a Mission Support account.

**Performance Objectives**

*Space station.*—The International Space Station (ISS) is an international laboratory in low Earth orbit on which American, Russian, Canadian, European, and Japanese astronauts will conduct unique scientific and technological investigations in a microgravity environment. The goal of the Station is to support activities requiring the unique attributes of humans in space and establish a permanent human presence in Earth orbit. The proposed budget provides funding for the continued development of the vehicle and its research components and for current operations, assembly and utilization of the station. With several assembly missions successfully completed, the budget includes funding to keep subsequent assembly missions on schedule through U.S. Core Station Complete, currently planned for late 2003-early 2004, and for early research commensurate with the build-up of on-orbit utilization capabilities and resources.

Between January 2000 and January 2001, the Russian Service Module, the Z1 and SO trusses, the control moment gyros, the first photo-voltaic array and battery sets, initial thermal radiators, communication equipment, and the U.S. Laboratory were assembled on-orbit. A permanent human presence in space was achieved with the launch of Expedition 1. The first phases of multi-element integrated testing (MEIT) were completed. Crew training, payload processing, hardware element processing, and mission operations were supported. During the remainder of 2001, Expedition 2 will be deployed, and Phase 2 of the station assembly will be completed with the launch of the airlock. Preparations will continue for the start of Phase 3 and the first shuttle mission dedicated to research utilization is expected to be launched in mid-2002.

Russian Program Assurance (RPA) is contained within the Space Station budget and provides funding for contingency activities to address ISS program requirements resulting from delays or shortfalls on the part of Russia in meeting its commitments to the ISS program. Key elements of the RPA program have been the Interim Control Module (ICM), developed by the U.S. Naval Research Laboratory (NRL), and the U.S. Propulsion Module. With the successful launch of the Russian Service Module, and escalating costs for Space Station, including RPA components, NASA reassessed its Space Station priorities and the need for planned RPA hardware. In FY 2000, the ICM was placed in "call-up" mode and stored at NRL. Work on the original Propulsion Module design was terminated, and in FY 2001 funds for the Propulsion Module were redirected to cover cost increases in the baseline program. This left logistics contingency funding and funds for potential procurement of safety-related Russian goods and services in the RPA budget. Based on recent operational experience, continuing flight software and hardware integration issues, obsolescence issues, and realization that earlier assembly phase cost estimates were low, NASA concluded that the program baseline could not be executed on schedule within approved funding levels. A reassessment of the ISS Program budget baseline was started in FY 2000 and continued into FY 2001. The initial results, based on conservative estimating assumptions, showed a budget shortfall of up to \$4 billion over 5 fiscal years. To remain within the Agency's budget marks, NASA redirected funds from remaining high-risk, high-cost hardware development, including the Habitation Module and

Crew Return Vehicle (CRV), as well as funds from the RPA budget mentioned above, to ensure that ISS would stay within budget, while assembly continues through U.S. Core Station Complete (deployment of Node 2 on flight 10A). This will allow for the integration of flight hardware being provided by the International Partners. In addition, the ISS Research Program is being realigned to match the on-orbit capability build-up as the program moves toward U.S. Core Complete. NASA will continue to pursue atmospheric testing of the X-38 and is assessing the affordability of completing the space flight test relative to other program priorities. Options for provision of a crew return capability and Habitat capability to support the desired increase in crew size from 3 to 6 will be discussed with the international partners. However, U.S. contributions to such capabilities will be dependent on the availability of funds within the President's five-year budget plan for Human Space Flight, technical risks, and the Administration's confidence in Agency cost estimates.

Over the next several years, the Agency will press ahead with ISS assembly and the integration of the partners' research modules. Research operations on board the ISS have been expanding since they began in FY 2000 and will greatly exceed any previous capabilities for research in space including Skylab, Shuttle, or Mir.

*Payload and Expendable Launch Vehicle (ELV) support.*—During 2001, six pallets will be used in Space Shuttle missions. In FY 2001 and FY 2002, over 20 major and secondary payloads will be supported, including major hardware for ISS assembly. The ELV Mission Support budget provides funds for acquiring requisite launch services to meet all NASA requirements and for technical insight of commercially provided launch services. Advanced mission design/analysis and leading edge integration services are provided for the full range of NASA missions under consideration for launch on ELVs. During FY 2000, six ELV missions were successfully launched. Integration and technical management of 13 missions are planned for launch in FY 2001. In FY 2002 support for eight missions is planned.

*Investments and support.*—The Human Exploration and Development of Space (HEDS) Technology and Commercialization Initiative (HTCI) began in FY 2001. HTCI will continue in FY 2002 to focus on human space exploration and development activities emphasizing highly innovative technologies, advances in science, and enabling synergistic commercial space development efforts.

Project activity will continue in FY 2002 to ensure NASA's rocket propulsion test capabilities are properly managed and maintained in world class condition. The project will significantly enhance our ability to properly manage NASA's rocket testing activities and infrastructure across all four participating NASA centers.

Engineering and technical base (ETB) activity will continue to support the institutional capability in the operation of space flight laboratories, technical facilities, and testbeds; to conduct independent safety, and reliability assessments; and to stimulate science and technical competence in the United States.

Funding for other direct costs associated with Human Space Flight, which were previously funded in the Mission Support account, are now funded as part of investments and support. This includes research and program management costs and non-programmatic construction of facilities costs.

*Space shuttle.*—The Space Shuttle is a partially reusable space vehicle that provides several unique capabilities to the United States space program. These include retrieving payloads from orbit for reuse, servicing and repairing satellites in space, safely transporting humans to and from space, launching ISS components and providing an assembly platform in space, and operating and returning space laboratories. In FY 2000, the Space Shuttle launched four flights success-

fully including the emergency HST Servicing Mission 3A which replaced failing gyros on the HST and the Shuttle Radar Topography Mission (SRTM), a joint DOD/NASA payload to study the earth. The Space Shuttle also visited the ISS two more times, for both assembly and maintenance.

Seven flights are planned during FY 2001, all of which are ISS assembly and servicing missions. The first crew began permanent occupation and presence aboard the ISS in FY 2001. In FY 2002, seven flights are planned including a dedicated microgravity research flight and another HST Servicing Mission (HST-3B) and five ISS assembly and servicing missions.

**Space operations.**—The primary goal of space operations is to provide highly reliable and cost-effective space operations services in support of NASA's science and aeronautics programs. In addition, support is provided to interagency, international, and commercial space-faring enterprising on a reimbursable basis. The Space Communications program is composed of Operations, Mission and Data Service Upgrades, Tracking and Data Relay Satellite Replenishment, and Technology Projects, as well as spectrum management and data standards coordination. Services are provided to a large number of NASA missions including planetary and interplanetary missions; human space flight missions, near-earth and earth orbiting missions; and sub-orbital and aeronautical flight tests. A Consolidated Space Operations Contract (CSOC) was successfully implemented by the Space Operations Management Office at Johnson Space Center and the Lockheed Martin Space Operations Company. The CSOC provides end-to-end mission and data services to both NASA and non-NASA customers. A total of nine contracts have been consolidated to date, and seven further contracts are to be consolidated in FY 2001 and FY 2002. Management responsibility for all Wide Area Network data distribution services for all human space flight, earth orbiting and deep space missions and NASA administrative communications was outsourced by CSOC in FY 2000. Development of the TDRS Replenishment Spacecraft is ongoing, with the first satellite launched in FY 2000.

**Safety, mission assurance and engineering.**—The goal of this program is to invest in the safety and success of NASA missions by assuring that sound and robust policies, processes, and tools for safety, reliability, quality assurance, and engineering disciplines are in place and applied throughout NASA. The program also examines long-term technology requirements for NASA's strategic objectives.

The FY 2003 budget estimate for this account is \$6.9 billion.

Object Classification (in millions of dollars)			
Identification code 80-0111-0-1-252	2000 actual	2001 est.	2002 est.
<b>Direct obligations:</b>			
<b>Personnel compensation:</b>			
11.1			613
11.3			8
11.5			19
11.8			6
11.9			646
12.1			138
13.0			467
21.0			24
22.0	3	4	4
23.1			5
23.2	2	2	2
23.3			
	31	55	59
24.0	2	2	2
25.1	74	5	5
25.2	190	131	142
25.3			
	109	124	134
25.4	235	1,378	1,489
25.5	4,585	3,199	3,454

25.7	Operation and maintenance of equipment .....	41	43	46
26.0	Supplies and materials .....	199	147	159
31.0	Equipment .....	92	94	102
32.0	Land and structures .....	77	145	157
41.0	Grants, subsidies, and contributions .....	51	43	46
99.0	Subtotal, direct obligations .....	5,691	5,372	7,081
99.0	Reimbursable obligations .....	164	163	201
99.9	Total new obligations .....	5,855	5,535	7,282

**Personnel Summary**

Identification code 80-0111-0-1-252	2000 actual	2001 est.	2002 est.
<b>Direct:</b>			
1001	Total compensable workyears: Full-time equivalent employment .....		7,922
<b>Reimbursable:</b>			
2001	Total compensable workyears: Full-time equivalent employment .....		48

**SCIENCE, AERONAUTICS AND TECHNOLOGY**

*(INCLUDING TRANSFER OF FUNDS)*

For necessary expenses, not otherwise provided for, in the conduct and support of science, aeronautics and technology research and development activities, including research, development, operations, support and services; maintenance; construction of facilities including repair, rehabilitation, revitalization, and modification of facilities, construction of new facilities and additions to existing facilities, facility planning and design *environmental compliance and restoration*, and acquisition or condemnation of real property, as authorized by law; space flight, spacecraft control and communications activities including operations, production, and services; *program management; personnel and related costs, including uniforms or allowances therefor, as authorized by 5 U.S.C. 5901-5902; travel expenses; purchase and hire of passenger motor vehicles; not to exceed \$20,000 for official reception and representation expenses; and purchase, lease, charter, maintenance and operation of mission and administrative aircraft, [\$6,190,700,000] \$7,191,700,000, to remain available until September 30, [2002] 2003, of which amounts as determined by the Administrator for salaries and benefits; training, travel and awards; facility and related costs; information technology services; science, engineering, fabricating and testing services; and other administrative services may be transferred to the Human Space Flight account in accordance with section 312(b) of the National Aeronautics and Space Act of 1958, as amended by Public Law 106-377. (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 2001, as enacted by section 1(a)(1) of P.L. 106-377.)*

**Program and Financing (in millions of dollars)**

Identification code 80-0110-0-1-999	2000 actual	2001 est.	2002 est.	
<b>Obligations by program activity:</b>				
<b>Direct program:</b>				
00.01	Space science .....	2,198	2,361	2,778
00.02	Biological and physical research .....	280	333	376
00.03	Earth science .....	1,439	1,474	1,502
00.04	Aerospace technology .....	1,125	1,369	2,353
00.05	Space operations .....		500	26
00.06	Academic programs .....	137	146	143
00.07	Mission communication services .....	410	5	
09.01	Reimbursable program .....	432	600	680
10.00	Total new obligations .....	6,021	6,788	7,858
<b>Budgetary resources available for obligation:</b>				
21.40	Unobligated balance carried forward, start of year .....	281	306	295
22.00	New budget authority (gross) .....	6,014	6,777	7,872
22.10	Resources available from recoveries of prior year obligations .....	31		
23.90	Total budgetary resources available for obligation .....	6,326	7,083	8,167
23.95	Total new obligations .....	-6,021	-6,788	-7,858
23.98	Unobligated balance expiring or withdrawn .....	-1		
24.40	Unobligated balance carried forward, end of year .....	306	295	309

**General and special funds—Continued****SCIENCE, AERONAUTICS AND TECHNOLOGY—Continued**

(INCLUDING TRANSFER OF FUNDS)—Continued

**Program and Financing (in millions of dollars)—Continued**

Identification code 80-0110-0-1-999	2000 actual	2001 est.	2002 est.
<b>New budget authority (gross), detail:</b>			
Discretionary:			
40.00 Appropriation .....	5,608	6,191	7,192
40.76 Reduction pursuant to P.L. 106-113 .....	-26		
40.77 Reduction pursuant to P.L. 106-554 (0.22 percent) .....		-14	
43.00 Appropriation (total discretionary) .....	5,582	6,177	7,192
Spending authority from offsetting collections:			
68.00 Offsetting collections (cash) .....	540	600	680
68.10 Change in uncollected customer payments from Federal sources .....	-108		
68.90 Spending authority from offsetting collections (total discretionary) .....	432	600	680
70.00 Total new budget authority (gross) .....	6,014	6,777	7,872
<b>Change in unpaid obligations:</b>			
Unpaid obligations, start of year:			
72.40 Unpaid obligations, start of year .....	3,194	3,155	3,598
72.95 Uncollected customer payments from Federal sources, start of year .....	-217	-109	-109
72.99 Obligated balance, start of year .....	2,977	3,046	3,489
73.10 Total new obligations .....	6,021	6,788	7,858
73.20 Total outlays (gross) .....	-6,017	-6,345	-7,528
73.40 Adjustments in expired accounts (net) .....	-12		
73.45 Recoveries of prior year obligations .....	-31		
74.00 Change in uncollected customer payments from Federal sources .....	108		
Unpaid obligations, end of year:			
74.40 Unpaid obligations, end of year .....	3,155	3,598	3,928
74.95 Uncollected customer payments from Federal sources, end of year .....	-109	-109	-109
74.99 Obligated balance, end of year .....	3,046	3,489	3,819
<b>Outlays (gross), detail:</b>			
86.90 Outlays from new discretionary authority .....	3,028	3,386	4,398
86.93 Outlays from discretionary balances .....	2,989	2,960	3,131
87.00 Total outlays (gross) .....	6,017	6,345	7,528
<b>Offsets:</b>			
Against gross budget authority and outlays:			
Offsetting collections (cash) from:			
88.40 Non-Federal sources .....	-87	-60	-61
88.45 Offsetting governmental collections from the public .....	-453	-540	-619
88.90 Total, offsetting collections (cash) .....	-540	-600	-680
Against gross budget authority only:			
88.95 Change in uncollected customer payments from Federal sources .....	108		
<b>Net budget authority and outlays:</b>			
89.00 Budget authority .....	5,582	6,177	7,192
90.00 Outlays .....	5,478	5,745	6,848

Note.—Includes \$1,029 million in budget authority in 2002 for activities previously financed from:

	2000	2001
Mission support (in millions of dollars) .....	856	887

This appropriation provides for the science, aeronautics and technology (SAT) supporting the Agency. The SAT activities include space science, biological and physical research, earth science, aerospace technology, and academic programs. This appropriation also provides for salaries and related expenses; design, repair, rehabilitation, and modification of facilities and construction of new facilities; maintenance and operation of facilities; and other operations activities supporting science, aeronautics, and technology programs.

In FY 2000 and FY 2001, the SAT account provided only for the *direct* funding of science, aeronautics and technology activities, and included funding for space operations services

which are now funded within the human space flight account. Beginning in FY 2002, other direct costs (which include Research and Program Management and non-programmatic Construction of Facilities) will be allocated to either the HSF or the SAT account based on the number of full time equivalent personnel, and there will no longer be a Mission Support account.

**Performance Objectives**

**Space science.**—The Space Science program seeks to answer fundamental questions concerning: the galaxy and the universe; the connection between the Sun, Earth and heliosphere; the origin and evolution of planetary systems; and the origin and distribution of life in the universe. The Space Science program is comprised of a base program of research and development activities, including research and flight mission activities, and major space-based facilities.

In 2000, the Space Science program produced many notable scientific accomplishments. Scientists using data from NASA's Mars Global Surveyor spacecraft camera found features that suggest there may be current sources of liquid water at or near the surface of the red planet. The water supply may be about 100 to 400 meters (300 to 1,300 feet) below the surface, and limited to specific regions across the planet. Additional MGS images revealed layers of sedimentary rock that paint a portrait of an ancient Mars that long ago may have featured numerous lakes and shallow seas. These regions of sedimentary layers on Mars are spread out and scattered around the planet.

Solar and Heliospheric Observatory (SOHO) scientists have, for the first time, imaged solar storm regions on the side of the Sun facing away from the Earth. A week's advance warning of potential bad weather in space is now possible thanks to these SOHO measurements. Detailed images from the Transition Region and Coronal Explorer (TRACE) mission of giant fountains of fast-moving, multimillion-degree gas in the outermost atmosphere of the Sun have revealed an important clue to a long-standing mystery—the location of the heating mechanism that makes the corona 300 times hotter than the Sun's visible surface. Scientists are interested in the corona, which appears as a halo of light seen by the unaided eye during a total solar eclipse, because eruptive events in this region can disrupt high-technology systems on Earth. Astronomers also hope to use the solar corona studies to better understand other stars.

The balloon-borne BOOMERANG sub-millimeter telescope mapped the faint light left over from the Big Bang, revealing the earliest structure in the Universe that later became the vast, soap bubble-shaped clusters of galaxies that astronomers observe today. BOOMERANG confirmed that the Universe is flat (Euclidean) and that the expansion of the universe is accelerating.

The Shoemaker Near Earth Asteroid Rendezvous (NEAR) mission became the first spacecraft to orbit an asteroid on February 14, 2000. The mission has returned stunning images and other data of the asteroid Eros, resulting in numerous discoveries throughout the year. Most recently, NEAR made history again by becoming the first spacecraft ever to touch down on the surface of a small solar system body.

Scientists used the Chandra X-ray Observatory to examine a mid-mass black hole in the galaxy M82. This black hole may represent the missing link between smaller stellar black holes and the supermassive black holes found at the centers of galaxies. A Hubble Space Telescope census finds that the mass of a supermassive black hole is directly related to the size of a the bulge of stars at the center of its host galaxy. This suggests that the evolution of galaxies and their host black holes is intimately linked.

The Cassini spacecraft, on its way to meet Saturn in 2004, flew by Jupiter in December and performed joint science operations with Galileo.

The Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) was successfully launched in March 2000, and has provided the first large-scale pictures of the Earth's magnetic field.

The NASA budget request for FY 2002 funds a robust program of Mars exploration for the next decade. Following the loss of the Mars Climate Orbiter and the Mars Polar Lander in 1999, an in-depth review of our Mars exploration program found significant flaws in program formulation and execution, and made recommendations for the future exploration of Mars. Consistent with those recommendations, we are pressing forward with the development of a set of future Mars missions to establish a sustained presence at Mars. By means of orbiters, landers, rovers and sample return missions, NASA's revamped campaign to explore Mars is poised to unravel the secrets of the red planet's past environments, the history of its rocks, the many roles of water and, possibly, evidence of past or present life. The Mars Global Surveyor entered Mars orbit in September 1997, and is still performing flawlessly. The 2001 Mars Odyssey will be launched in April 2001, and we have started development of the twin Mars Environmental Rovers for launch in 2003. Additional Mars Exploration Program funding provided in the President's FY 2002 Budget will enable: a robust 2005 Mars Reconnaissance Orbiter; a competitively selected 2007 Mars Scout mission; an accelerated 2009 Mars Mobile Laboratory mission; U.S. participation in foreign missions to Mars; and technologies for the next decade of robotic Mars missions.

Development activities continue on the Relativity (Gravity Probe-B) mission, which is now scheduled for launch in 2002, and the Space Infrared Telescope Facility (SIRTF), with launch planned for July 2002. Launch of the Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics (TIMED) mission is expected to occur this summer (2001). Development activities on the Stratospheric Observatory for Infrared Astronomy (SOFIA) continue. Funding for the Hubble Space Telescope (HST) continues to support operations and preparations for the last planned Hubble servicing missions, servicing mission 3B in early FY 2002 and servicing mission 4 in FY 2004, when new science instruments will be installed.

In the Explorer program, development activities continue for the Microwave Anisotropy Probe (MAP), which will be launched in summer 2001; the Full-sky Astrometric Mapping Explorer (FAME), scheduled for launch in 2004, and Swift, a multi-wavelength observatory for gamma-ray burst astronomy, to be launched in 2003. Three Small (SMEX) missions continued development in FY 1999: the High Energy Spectroscopic Imager (HESSI) is to launch in spring 2001; the Galaxy Evolution Explorer (GALEX) will launch in early FY 2002; and the Two Wide-Angle Neutral Atom Spectrometers (TWINS) will be launched in 2002 and 2004.

In the Discovery program, the fourth mission, Stardust, was launched on schedule in February 1999, and is operating normally during its cruise to comet Wild-2, with the encounter scheduled for 2004. Two Discovery missions selected in 1997 are proceeding: the Comet Nucleus Tour (CONTOUR) began development in CY 2000 and will be launched in 2002; the Genesis solar wind sample return mission has nearly finished development and will be launched in summer 2001. Two new missions were selected for implementation during 1999: The MErcury Surface, Space ENvironment, GEOchemistry and Ranging (MESSENGER) mission to orbit Mercury; and the Deep Impact mission to fly by and fire an impactor into a comet. Both MESSENGER and Deep Impact are planned for launch in 2004.

The New Millennium program is providing flight demonstrations of critical new technologies which will reduce the

mass and cost of future science and spacecraft subsystems, while maintaining or improving mission capabilities. In 1999, NASA selected the Nanosat Constellation Trailblazer as the Space Technology-5 New Millennium mission. This mission will feature three very small satellites (each about the size of a large birthday cake), that will fly in formation and test eight technologies in the harsh space environment near the boundary of Earth's protective magnetic field. The Flight Validation program has been restructured to enhance openness and competition as well as to increase the number of opportunities for technologies to be flight-validated. An Announcement of Opportunity for Space Technology-6 technologies was recently released, and in January 2001, eight teams from industry, universities and NASA centers were selected to develop new technology concepts, such as advanced solar power and optical communications, for future NASA missions. The teams will study flight test options during a six-month phase for defining the technology concepts. NASA then plans to select up to five of the concepts for Space Technology-6 (ST-6), the next New Millennium Program project, which will flight-test the new technology concepts in 2003 and 2004.

The President's FY 2002 Budget also provides funding for a new Planetary Propulsion program. This program will competitively develop advanced propulsion systems that will reduce the flight time for future robotic missions to the planets and other science targets in the solar system.

*Biological and Physical Research.*—In FY 2001, the Office of Biological and Physical Research (OBPR) was created as an independent research organization and a fifth strategic enterprise, by the restructuring of the Office of Life and Microgravity Sciences and Applications (OLMSA). The Enterprise uses the unique environment of space to understand the effect of gravity on biological systems and to conduct research in the areas of fluid physics, combustion science, fundamental physics, materials science and biotechnology.

In FY 2000, Space Shuttle Mission STS-101 flew two commercial research payloads which grew large biological crystals in space and investigated the effects of microgravity on the efficiency of genetically transforming plant seeds. Also during FY 2000, the Protein Crystal Growth-Enhanced Gaseous Nitrogen Dewar (PCG-EGN), was used aboard ISS to crystallize proteins for later analysis.

In FY 2001, the first rack of the Human Research Facility (HRF) will be deployed to the International Space Station, and OBPR will begin initial operations of this facility. Construction continues on the Booster Applications Facility at Brookhaven National Laboratory. In FY 2001, research in bioastronautics increased to accelerate development of countermeasures that will improve the health and safety of astronauts aboard the International Space Station (ISS). Devices and countermeasures developed through this initiative may also have many health benefits on Earth. The first four commercial research payloads, investigating antibiotic production, protein crystal growth, agricultural research, and materials research, will be flown on the International Space Station in FY 2001.

During FY 2002, OBPR will continue to demonstrate key technology capabilities for human support, such as advanced techniques for water processing, solid waste processing, air revitalization, biomass production, food processing, and thermal control. In addition, the office will continue work in fundamental biology and bioastronautics to increase knowledge and address critical questions in crew health and safety by conducting investigations on the Space Shuttle and ISS. These will include investigations of the effect of microgravity on skeletal myofibers, avian development in space, the effects of microgravity on bone as a function of age, changes in gene expression in bacteria in space, and the effects of gravity on plant photosynthesis and respiration. New research projects will be selected in the areas of biotechnology, fluid

**General and special funds—Continued**

## SCIENCE, AERONAUTICS AND TECHNOLOGY—Continued

(INCLUDING TRANSFER OF FUNDS)—Continued

physics, and materials science, and commercial payloads will be flown on both the Shuttle and aboard ISS.

*Earth Science.*—The mission of NASA's Earth Science Enterprise (ESE) is to develop a scientific understanding of the Earth system and its response to natural and human-induced changes to enable improved prediction of climate, weather and natural hazards for present and future generations. ESE seeks to answer a question of fundamental importance to science and society: *How is the Earth system changing, and what are the consequences for life on Earth?* To do so ESE is developing the interdisciplinary research field of Earth System Science, which recognizes that the Earth's land surface, oceans, atmosphere, ice sheets, and life itself all interact in a highly dynamic system. Earth system science is an area of research with immense benefit to the Nation, leading to new knowledge and tools that may improve weather forecasting, agriculture, urban and regional planning, environmental quality, and natural disaster management. ESE has established three goals to pursue in order to fulfill its mission: (1) Science—observe, understand, and model the Earth system to learn how it is changing, and the consequences for life on Earth; (2) Applications—expand and accelerate the realization of economic and societal benefits from Earth science, information, and technology; (3) Technology—develop and adopt advanced technologies to enable mission success and serve national priorities.

In ESE Science, 2000 was another year of substantial accomplishment toward understanding the Earth system. In an 11-day Space Shuttle mission, a new interferometric synthetic aperture radar technique collected data sufficient to produce the first detailed topographic map of the entire land surface of the Earth between 60°N and 56°S. Landsat 7 completed a global survey of land cover, and the Terra satellite observed the global land and ocean biosphere as it underwent seasonal changes, and showed that snow cover over North America was substantially below normal following the warmest winter on record. The QuikSCAT satellite observed a Connecticut-size iceberg break off of the Antarctic polar ice sheet, and the US and Canada mapped Antarctica for the second time with space-based radar in order to compare with the first and determine rates of change. Using data from the US/Japan Tropical Rainfall Measuring Mission, researchers determined that air pollution affects rainfall rates downwind of its sources. Also in 2000, ESE formulated a new Research Strategy for 2000–2010 to guide research over the next decade, identifying 23 societally important research questions in the Earth system paradigm of variability, forcing, response, consequence and prediction. This Research Strategy will guide ESE's science activities and investments over the next decade.

In ESE Applications, ESE has entered into a variety of partnerships that will demonstrate the goods and services made possible by ESE's research. ESE provides QuikSCAT data in real time to NOAA to improve marine weather forecasting, and has used these data to show that severe storms forming over the oceans can be predicted two days in advance. ESE is working with FEMA to use remote sensing tools to update their flood plain maps throughout the US. In a partnership called AG 2020 with USDA and four growers associations representing 100,000 farmers, ESE is demonstrating how to increase crop productivity, reduce risks to crop health, and manage environmental impacts. With the National Institutes of Health, we are exploring the use of satellite data to predict spread of infectious diseases such as malaria that are highly influenced by weather and climate. Throughout the summer, three ESE satellites tracked devastating wildfires in the western US, providing data to the US Forest

Service and regional authorities. ESE held three regional workshops across the US to plan the next generation of applications demonstration projects with State and local governments in infrastructure planning and related topics.

In ESE Technology, the Enterprise launched its first New Millennium Program satellite to demonstrate a variety of new technologies for Earth Science. These include a new instrument to produce a Landsat-type sensor one-fourth the size of the current Landsat 7 instrument, and the first hyperspectral imager in space, which views the land surface in hundreds of spectral channels rather than the conventional 5 to 7. Sponsored technology research with universities, industry and other government laboratories moved 20 different remote sensing instrument concepts one step closer to reality on an established scale of technology maturity. These will substantially reduce the cost and enhance the capability of new satellites over the next decade or more.

ESE is in the midst of deployment of the Earth Observing System (EOS), a set of spacecraft and associated interdisciplinary science investigations to initiate a long-term data set of key parameters required for the study of global climate change. The first four EOS satellites are already in orbit, including the flagship Terra mission launched in 1999. The remaining EOS satellites will be launched through 2003, including Aqua (2001) to study the water cycle and atmospheric circulation, and Aura (2003) to probe the chemistry of the upper and lower atmosphere. Complementing EOS is a series of small, focused Earth System Science Pathfinder missions to explore Earth system processes never before examined globally from space. Data from the EOS satellites already in orbit are being acquired, processed, and distributed by the EOS Data and Information System (EOSDIS), which is currently handling more than 1 terabyte of data per day. EOSDIS handled 1.5 million user queries for over 8 million products in 2000. EOSDIS continues to evolve as new satellites are launched, and as new partners are added to produce data products with innovative applications.

As it deploys EOS, ESE is also planning for the future. For example, a Landsat Data Continuity Mission is being formulated in partnership with USGS, and will be implemented as a commercial data purchase, if possible. ESE is also planning for the transition of several of its key research observations to the Nation's weather satellite system. The DoD, NOAA and NASA have established an Integrated Program Office (IPO) to create a converged civilian and military weather satellite system called the National Polar-orbiting Operational Environmental Satellite System (NPOESS) to replace the present generation of separate systems. NASA and the IPO are jointly funding the NPOESS Preparatory Project (NPP) that will simultaneously continue key measurements begun by EOS and demonstrate instruments for NPOESS. The NPP will save money for both organizations by combining essential atmospheric and Earth surface observations on a single platform, and by seeking to meet both climate science and operational weather requirements with the same advanced instruments.

ESE data products and research are a major contribution to the US Global Change Research Program, an interagency collaboration overseen by the Committee on Natural Resources of the National Science and Technology Council. Because Earth science is inherently global in scope, ESE is engaged in a variety of international partnerships with individual nation's space agencies, and with international consortia such as the World Meteorological Organization. ESE seeks and receives scientific advice on a broad range of topics from the various boards and committees of the National Research Council. These partnerships, together with those above, ensure that NASA's Earth Science Enterprise conducts research at the frontiers of Earth science on questions of practical importance to the Nation.

*Aerospace Technology.*—The mission of this Enterprise is to pioneer the identification, development, verification, transfer, application, and commercialization of high-payoff aerospace technologies. Through its research and technology accomplishments, Aerospace Technology promotes economic growth and national security by supporting a safe, efficient national aviation system and affordable, reliable space transportation. In addition, the Aerospace Technology Program supports the development of crosscutting technology to serve the needs of all NASA Enterprises. To meet this challenge, the Enterprise has established three main technology goals and one goal for commercialization. Within the three technology goals a set of objectives has been defined to address current and future National needs. The technologies associated with these objectives are pre-competitive, long-term, high-risk research endeavors with high payoff in terms of market growth, safety, low acquisition cost, consumer affordability and a cleaner environment. The first goal, *Revolutionize Aviation*, addresses the fundamental, systemic issues in the aviation system to ensure continued growth and development appropriate to the needs of the national and global economies. These systemic issues—safety, capacity, environmental compatibility, and mobility—cut across markets including large subsonic civil transports, air cargo, commuter and general aviation. NASA coordinates its investments and technology objectives in this area with the Federal Aviation Administration and the Department of Defense through the *National Research and Development Plan for Aviation Security, Efficiency, and Environmental Compatibility*. The second goal, *Advance Space Transportation*, will create a safe, affordable highway through the air and into space by improving safety, reliability, and operability, while significantly reducing the cost of space transportation systems. With the creation of the Integrated Space Transportation Plan (ISTP), NASA defined a single, integrated investment strategy for all its diverse space transportation efforts. The third goal, *Pioneer Technology Innovation*, is unique in that it focuses on broad, crosscutting innovations critical to a number of NASA missions and to the aerospace industry in general. Pursuing technology fields that are in their infancy today, developing the knowledge bases necessary to design radically new aerospace systems, and developing tools for efficient, high-confidence design and development, will enable a revolution in aerospace. The fourth goal, *Commercialize Technology*, is to extend the commercial application of NASA technology for economic benefit and improved quality of life. By partnering with both aerospace and non-aerospace industry as well as academia, the full range of NASA's assets—technological expertise, new technologies, and research facilities—are made available to help the Nation.

As planned in the FY 2001 budget request, the Administration's 2002 request includes an increase in funding for the 2nd Generation Reusable Launch Vehicle (RLV) Program, although this request is lower than last year's projections primarily due to reallocation of Crew Return Vehicle placeholder funding to the International Space Station. Low-cost space transportation remains the key enabler for a more aggressive civil space program. NASA's Integrated Space Transportation Planning activities have identified a strategy based upon competition, safety, industry leadership and affordable requirements. Funding supports aggressive technical risk reduction and advanced development for multiple reusable launch vehicle concepts. Identification and preliminary development of NASA-unique systems and near-term pursuit of technologies required for alternative access for key Space Station needs are also both critical elements of the Integrated Space Transportation Plan (ISTP). All of these efforts combined will move NASA closer to a full and open RLV competition in the middle of this decade to meet NASA's human space flight needs by the end of the decade. In FY 2001, NASA will make the

first risk reduction activity awards to industry under the 2nd Generation RLV Program. These risk reduction activities will continue through FY 2002 and feed future steps toward the launch services competition at mid-decade. The President's FY 2002 Budget prescribes several key management reforms in areas like vehicle requirements and program integration that will help ensure the success of this important undertaking.

The Administration's request includes a significant investment in computing and information technology developments and also increases the investment in biotechnology and nanotechnology—the revolutionary technologies of the 21st Century. To ensure the highest quality research and strong ties to NASA's mission, these investments will be guided by technology development agreements signed by customers in other NASA Enterprises and subject to external, independent reviews. A significant portion of these investments will be externally competed. The Administration's request supports the implementation of six University-based Research, Education, and Training Institutes (RETIs). This will strengthen NASA's ties to the academic community through long-term sustained investment in areas of science and technology critical to NASA's future. To ensure the highest quality research and training and infusion of new ideas, these RETIs will be subject to independent, external reviews and recompetition at regular intervals, including mandatory sunsets after ten years. The Administration's request also supports a 21st Century aerospace vehicle technology program. This research will develop and verify critical technologies that provide leapfrog capabilities for aerospace vehicles that will be able to change their shape in flight like birds to optimize performance or perform complex maneuvers in complete safety, and be capable of self repair when damaged.

The President's request for NASA maintains investments in technology development activities that will address the challenges (safety, environmental impact, capacity, and noise reduction) that face the Nation's air system. As part of NASA's response to the national goal of reducing aircraft accidents by a factor of 5 by the end of FY 2007, NASA began a focused Aviation Safety Program (AvSP) in FY 2000 that builds on the extensive safety related activities of the Base Research and Technology (R&T) Programs. The base technologies provided the foundation for focused safety development efforts in the future, as well as some near-term achievements. For example, in FY 2000, AvSP produced an icing training program for general aviation and commuter pilots, completed a flight evaluation of an initial national capability for digital data link and graphical display of weather information, and demonstrated a concept for the integration of air traffic control runway incursion information onto aircraft flight deck displays. In FY 2001, the AvSP will complete a laboratory demonstration of a fuel system modification to reduce flammability, define the architecture for an integrated onboard health management system, and down-select synthetic vision concepts suitable for retrofit in commercial, business, and general aviation aircraft. The Base R&T Programs will continue to develop the technologies that will contribute to the FY 2007 goal. For example, in FY 2002, NASA will complete an interim progress assessment utilizing the technology products of the Aviation Safety program as well as related Aerospace Base R&T efforts to demonstrate potential to meet the National Goal.

NASA also continued its efforts to reduce the environmental impact associated with aviation systems. The Ultra Efficient Engine Technology (UEET) program is a focused program that began in FY 2000. UEET is planned and designed to develop high-payoff, high-risk technologies to enable the next breakthroughs in propulsion systems and to spawn a new generation of high-performance, operationally efficient and economical, reliable and environmentally compatible U.S. air-

**General and special funds—Continued**

SCIENCE, AERONAUTICS AND TECHNOLOGY—Continued  
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craft. In FY 2002, UEET will, in sector combustor tests, demonstrate initial 70% low NOx reduction, relative to 1996 International Civil Aviation Organization (ICAO) standards for Landing/Takeoff conditions in subsonic engines. Similarly, progress is being achieved in noise abatement efforts. In 2000, NASA validated the technologies required to reduce community noise impact by up to 10 dB relative to 1992 technology. In FY 2001 and FY 2002, NASA will: select engine system and airframe system technologies necessary to achieve a 3-dB aircraft system noise reduction beyond the 1997 baseline, establish the influence of wind and temperature gradients on community noise impact, and release the beta version of an improved advanced noise prediction code. Also in FY 2002, source diagnostics tests will be completed, giving engine component designers insight into the fundamental physics of the mechanisms that generate broadband fan noise. The data generated by these tests will be used to improve the computational algorithms used in computer codes to predict engine noise. The design of an advanced concept for reduced jet noise will be initiated for testing at laboratory scale later in the Quiet Aircraft Technology program.

In FY 2000, NASA's Aviation System Capacity program demonstrated technologies in a realistic Terminal Area environment, achieving a 12–15% increase in single-runway throughput and proving the ability to space aircraft closer than 3,400 feet on parallel runways while meeting all Federal Aviation Administration (FAA) safety criteria. In FY 2001, NASA will demonstrate transition airspace decision support tools for: (1) Air Traffic Control (ATC)/airline operations center and ATC/cockpit information exchange, and (2) conflict resolution. In FY 2002 NASA will demonstrate an interoperable suite of at least two decision support tools for arrival, surface and departure operations and begin an activity entitled AvSTAR which will undertake a Virtual Airspace Modeling project to produce a high-fidelity computer model of the Nation's aviation system. This model will help the FAA and NASA develop new operational concepts and better understand the benefits of new technologies for reducing aviation system congestion and delays while improving aviation safety.

Building on its world-record-setting performances, the Environmental Research Aircraft and Sensor Technology (ERAST) project modified the Centurion solar-powered remotely piloted aircraft (RPA) to a wingspan configuration of greater than 245 feet, renamed the aircraft Helios, and continued flight testing in FY 2000. This configuration will be more suitable for extreme endurance as well as short flights to the 100,000 ft. altitude. In FY 2001, the Flight Research program will demonstrate a solar-powered RPA at 100,000 ft and complete development of a heavyweight energy storage system under the ERAST project. Both achievements will demonstrate technologies that will provide atmospheric satellites for commercial use, disaster relief efforts such as communication relays and real time sensing, and will increase the Nation's capability to make scientific sampling high in the atmosphere. In FY 2002 flight validation of an experimental, consumable fuel, RPA design will enable an enhanced prototype vehicle that meets the prescribed set of Earth Science RPA platform requirements.

The Commercial Technology Program's focus in FY 2000 was continued investment of 10–20 percent of the NASA R&D budget in commercial partnerships with industry and a more efficiently administered program. Based on experience to date, these commercial partnerships are expected to increase the return on the Government's R&D investment, allowing NASA to do more with limited funds, and strengthening the inter-

national competitiveness of key industry sectors. In FY 2001 and 2002, the program will continue to emphasize innovative commercial partnerships with industry and continue to refine and enhance a technology and partnership database. In addition, the Small Business Innovative Research programs will pursue increased use and expanded commercial application of the developed technology.

*Academic programs.*—The goal of Academic Programs is educational excellence: NASA involves the educational community in our endeavors to inspire America's students, create learning opportunities, and enlighten inquisitive minds. NASA's Education Program brings students and educators at all levels into its missions and its research as participants and partners, providing opportunities for a diverse group of educators and students to experience first hand involvement with NASA personnel, facilities, and research and development activities. Academic Programs includes the Minority University Research Program, with a goal to expand NASA's research base by strengthening the research capabilities of minority universities and colleges; to contribute to the scientific and technological workforce; and to promote educational excellence. The range of activities conducted under this program will continue to capture the interest of all students in science and technology, develop talented students at the undergraduate and graduate levels, provide research opportunities for students and faculty members at NASA centers, and strengthen and enhance the research capabilities of the Nation's colleges and universities.

The 2003 budget estimate for this account is \$8.1 billion.

**Object Classification** (in millions of dollars)

Identification code 80-0110-0-1-999	2000 actual	2001 est.	2002 est.
<b>Direct obligations:</b>			
<b>Personnel compensation:</b>			
11.1 Full-time permanent .....			814
11.3 Other than full-time permanent .....			10
11.5 Other personnel compensation .....			25
11.8 Special personal services payments .....			7
11.9 Total personnel compensation .....			856
12.1 Civilian personnel benefits .....			185
13.0 Benefits for former personnel .....			619
21.0 Travel and transportation of persons .....			31
22.0 Transportation of things .....	4	5	5
23.1 Rental payments to GSA .....			8
23.3 Communications, utilities, and miscellaneous charges .....	54	58	51
24.0 Printing and reproduction .....	6	5	5
25.1 Advisory and assistance services .....	118	116	93
25.2 Other services .....	627	824	731
25.3 Purchases of goods and services from Government accounts .....	250	238	211
25.4 Operation and maintenance of facilities .....	395	282	250
25.5 Research and development contracts .....	2,910	3,343	2,962
25.6 Medical care .....			2
25.7 Operation and maintenance of equipment .....	47	88	78
26.0 Supplies and materials .....	146	224	199
31.0 Equipment .....	122	108	96
32.0 Land and structures .....	65	26	23
41.0 Grants, subsidies, and contributions .....	845	871	773
99.0 Subtotal, direct obligations .....	5,589	6,188	7,178
99.0 Reimbursable obligations .....	432	600	680
99.9 Total new obligations .....	6,021	6,788	7,858

**Personnel Summary**

Identification code 80-0110-0-1-999	2000 actual	2001 est.	2002 est.
<b>Direct:</b>			
1001 Total compensable workyears: Full-time equivalent employment .....			10,772
<b>Reimbursable:</b>			
2001 Total compensable workyears: Full-time equivalent employment .....			50



**[MISSION SUPPORT]**

[For necessary expenses, not otherwise provided for, in carrying out mission support for human space flight programs and science, aeronautical, and technology programs, including research operations and support; maintenance; construction of facilities including revitalization and modification of facilities, construction of new facilities and additions to existing facilities, facility planning and design, environmental compliance and restoration, and acquisition or condemnation of real property, as authorized by law; program management; personnel and related costs, including uniforms or allowances therefor, as authorized by 5 U.S.C. 5901–5902; travel expenses; purchase, lease, charter, maintenance, and operation of mission and administrative aircraft; not to exceed \$40,000 for official reception and representation expenses; and purchase (not to exceed 33 for replacement only) and hire of passenger motor vehicles, \$2,608,700,000 to remain available until September 30, 2002.] (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 2001, as enacted by section 1(a)(1) of P.L. 106–377.)

**Program and Financing** (in millions of dollars)

Identification code 80–0112–0–1–999	2000 actual	2001 est.	2002 est.
<b>Obligations by program activity:</b>			
Direct program:			
00.01 Safety, mission assurance, engineering, and advanced concepts .....	43	47	5
00.02 Research and program management .....	2,200	2,292	43
00.03 Construction of facilities .....	170	233	56
00.04 Space communication services .....	88	5	.....
01.00 Total direct program .....	2,501	2,577	104
09.01 Reimbursable program .....	114	76	.....
10.00 Total new obligations .....	2,615	2,653	104
<b>Budgetary resources available for obligation:</b>			
21.40 Unobligated balance carried forward, start of year .....	86	136	162
22.00 New budget authority (gross) .....	2,625	2,679	.....
22.10 Resources available from recoveries of prior year obligations .....	40	.....	.....
23.90 Total budgetary resources available for obligation .....	2,751	2,815	162
23.95 Total new obligations .....	–2,615	–2,653	–104
24.40 Unobligated balance carried forward, end of year .....	136	162	58
<b>New budget authority (gross), detail:</b>			
Discretionary:			
40.00 Appropriation .....	2,514	2,609	.....
40.35 Appropriation rescinded .....	–3	.....	.....
40.77 Reduction pursuant to P.L. 106–554 (0.22 percent) .....	.....	–6	.....
43.00 Appropriation (total discretionary) .....	2,511	2,603	.....
Spending authority from offsetting collections:			
68.00 Offsetting collections (cash) .....	137	76	.....
68.10 Change in uncollected customer payments from Federal sources .....	–23	.....	.....
68.90 Spending authority from offsetting collections (total discretionary) .....	114	76	.....
70.00 Total new budget authority (gross) .....	2,625	2,679	.....
<b>Change in unpaid obligations:</b>			
Unpaid obligations, start of year:			
72.40 Unpaid obligations, start of year .....	645	659	664
72.95 Uncollected customer payments from Federal sources, start of year .....	–59	–36	–36
72.99 Obligated balance, start of year .....	586	623	628
73.10 Total new obligations .....	2,615	2,653	104
73.20 Total outlays (gross) .....	–2,553	–2,648	–538
73.40 Adjustments in expired accounts (net) .....	–9	.....	.....
73.45 Recoveries of prior year obligations .....	–40	.....	.....
74.00 Change in uncollected customer payments from Federal sources .....	23	.....	.....
Unpaid obligations, end of year:			
74.40 Unpaid obligations, end of year .....	659	664	230
74.95 Uncollected customer payments from Federal sources, end of year .....	–36	–36	–36
74.99 Obligated balance, end of year .....	623	628	194

<b>Outlays (gross), detail:</b>			
86.90 Outlays from new discretionary authority .....	1,988	2,156	.....
86.93 Outlays from discretionary balances .....	565	492	538
87.00 Total outlays (gross) .....	2,553	2,648	538
<b>Offsets:</b>			
Against gross budget authority and outlays:			
Offsetting collections (cash) from:			
88.40 Non-Federal sources .....	–18	–15	.....
88.45 Offsetting governmental collections from the public .....	–119	–61	.....
88.90 Total, offsetting collections (cash) .....	–137	–76	.....
Against gross budget authority only:			
88.95 Change in uncollected customer payments from Federal sources .....	23	.....	.....
<b>Net budget authority and outlays:</b>			
89.00 Budget authority .....	2,511	2,603	.....
90.00 Outlays .....	2,416	2,572	538

Note.—Excludes \$2,741 million in budget authority in 2002 for activities transferred to Human Space Flight and Science, Aeronautics and Technology. Estimated comparable amounts for 2000 (\$2,422 million) and 2001 (\$2,602 million) are included above.

In FY 2000 and FY 2001, this appropriation provides funding for mission support and includes: safety, mission assurance, engineering and advanced concepts activities supporting agency programs; salaries and related expenses in support of research in NASA field installations; design, repair, rehabilitation and modification of institutional facilities and construction of new institutional facilities; and other operations activities supporting conduct of agency programs.

Beginning in FY 2002, NASA is implementing a two-appropriation budget (excluding the Inspector General account). The two-appropriation budget (Human Space Flight (HSF) and Science, Aeronautics and Technology (SAT)) is NASA's first step at transitioning to a full cost budget. While full cost will ultimately integrate institutional and programmatic funds into a single budget, that integration is done in a step-wise manner, by providing for a mission support budget line under each Enterprise and eliminating the present mission support appropriation. This initial step will begin to recognize, budget, and track direct full time equivalent (FTE) personnel associated at the Enterprise level and then use this FTE data to distribute other-than-direct (OTD) institutional costs (Research and Program Management and non-programmatic Construction of Facilities) using the relative percentages of direct FTE's by Enterprise.

This means the distribution of the OTD resources takes advantage of a basic assumption, to be used prior to the existence of cost and service pools, that FTE's are a reasonable relative indicator at the Enterprise level of required facility and institutional capabilities. Taking this step will help program/project personnel and decision makers begin to understand the potential magnitude of institutional funds that are associated with each Enterprise in preparation for the day when full cost budgeting will distribute these funds most appropriately to the project level via the appropriate cost/service pools.

The Mission Support budget shown below is shown for display purposes only. Beginning in FY 2002, there will no longer be a Mission Support account. Institutional costs will be budgeted within HSF and SAT (as discussed above) and Safety, mission assurance and engineering will be budgeted within the HSF account.

NASA plans to control personnel levels through full time permanent (FTP) civil servant positions while continuing to track full time equivalent positions, as done in the past. This will allow NASA more flexibility in the use of non-permanent positions for short-term technical needs as well as co-op and intern programs.

General and special funds—Continued

[MISSION SUPPORT]—Continued

Performance Objectives

*Research and program management.*—In FY 2000 and FY 2001, this activity provides for the salaries, travel support, other personnel expenses of the entire NASA civil service workforce, and includes vital support to the physical plant at the Centers and at NASA Headquarters.

*Construction of facilities.*—In FY 2000 and FY 2001, this activity provides for facility construction activities to preserve NASA's infrastructure and enable NASA's missions; environmental compliance and restoration activities, design of facilities projects, and advanced planning and critical functional leadership activities related to future facilities needs. Activities in support of construction projects to repair, revitalize and modernize the basic infrastructure and institutional facilities at NASA centers will continue with the major focus on eliminating safety-related concerns. Increasing attention is being given to activities in support of environmental compliance and restoration requirements.

Object Classification (in millions of dollars)

Identification code 80-0112-0-1-999	2000 actual	2001 est.	2002 est.
<b>Direct obligations:</b>			
<b>Personnel compensation:</b>			
11.1 Full-time permanent .....	1,268	1,370	.....
11.3 Other than full-time permanent .....	21	25	.....
11.5 Other personnel compensation .....	26	32	.....
11.8 Special personal services payments .....	10	9	.....
11.9 Total personnel compensation .....	1,325	1,436	.....
12.1 Civilian personnel benefits .....	289	313	.....
13.0 Benefits for former personnel .....	7	.....	.....
21.0 Travel and transportation of persons .....	50	53	.....
22.0 Transportation of things .....	6	4	.....
23.1 Rental payments to GSA .....	17	13	.....
23.3 Communications, utilities, and miscellaneous charges .....	19	28	4
24.0 Printing and reproduction .....	7	5	1
25.1 Advisory and assistance services .....	10	5	1
25.2 Other services .....	242	191	26
25.3 Purchases of goods and services from Government accounts .....	27	22	3
25.4 Operation and maintenance of facilities .....	105	119	16
25.5 Research and development contracts .....	70	110	15
25.6 Medical care .....	7	5	1
25.7 Operation and maintenance of equipment .....	100	77	10
26.0 Supplies and materials .....	47	31	4
31.0 Equipment .....	25	39	5
32.0 Land and structures .....	143	123	17
41.0 Grants, subsidies, and contributions .....	6	3	1
99.0 Subtotal, direct obligations .....	2,502	2,577	104
99.0 Reimbursable obligations .....	113	76	.....
99.9 Total new obligations .....	2,615	2,653	104

Personnel Summary

Identification code 80-0112-0-1-999	2000 actual	2001 est.	2002 est.
<b>Direct:</b>			
1001 Total compensable workyears: Full-time equivalent employment .....	18,094	18,643	.....
<b>Reimbursable:</b>			
2001 Total compensable workyears: Full-time equivalent employment .....	89	98	.....

RESEARCH AND DEVELOPMENT

Program and Financing (in millions of dollars)

Identification code 80-0108-0-1-999	2000 actual	2001 est.	2002 est.
<b>Change in unpaid obligations:</b>			
Unpaid obligations, start of year:			
72.40 Unpaid obligations, start of year .....	29	.....	.....
72.99 Obligated balance, start of year .....	29	.....	.....
73.20 Total outlays (gross) .....	-18	.....	.....
73.40 Adjustments in expired accounts (net) .....	-11	.....	.....
Unpaid obligations, end of year:			
74.40 Unpaid obligations, end of year .....	.....	.....	.....
74.99 Obligated balance, end of year .....	.....	.....	.....
<b>Outlays (gross), detail:</b>			
86.93 Outlays from discretionary balances .....	18	.....	.....
<b>Net budget authority and outlays:</b>			
89.00 Budget authority .....	.....	.....	.....
90.00 Outlays .....	18	.....	.....

Since FY 1995 NASA's research and development activities have been performed in Human space flight; Science, aeronautics and technology; and Mission support. This account shows spending from balances prior to the account restructuring.

SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS

Program and Financing (in millions of dollars)

Identification code 80-0105-0-1-252	2000 actual	2001 est.	2002 est.
<b>Change in unpaid obligations:</b>			
Unpaid obligations, start of year:			
72.40 Unpaid obligations, start of year .....	14	1	.....
72.99 Obligated balance, start of year .....	14	1	.....
73.20 Total outlays (gross) .....	-1	-1	.....
73.40 Adjustments in expired accounts (net) .....	-13	.....	.....
Unpaid obligations, end of year:			
74.40 Unpaid obligations, end of year .....	1	.....	.....
74.99 Obligated balance, end of year .....	1	.....	.....
<b>Outlays (gross), detail:</b>			
86.93 Outlays from discretionary balances .....	1	1	.....
<b>Net budget authority and outlays:</b>			
89.00 Budget authority .....	.....	.....	.....
90.00 Outlays .....	1	1	.....

Since FY 1995 NASA's Space flight, control and data communications activities have been performed in Human space flight; Science, aeronautics and technology; and Mission support. This account shows spending from balances prior to the account restructuring.

CONSTRUCTION OF FACILITIES

Program and Financing (in millions of dollars)

Identification code 80-0107-0-1-999	2000 actual	2001 est.	2002 est.
<b>Obligations by program activity:</b>			
10.00 Total new obligations .....	7	.....	.....
<b>Budgetary resources available for obligation:</b>			
21.40 Unobligated balance carried forward, start of year .....	13	7	7
23.95 Total new obligations .....	-7	.....	.....
24.40 Unobligated balance carried forward, end of year .....	7	7	7
<b>Change in unpaid obligations:</b>			
Unpaid obligations, start of year:			
72.40 Unpaid obligations, start of year .....	18	12	.....

72.99	Obligated balance, start of year .....	18	12	.....
73.10	Total new obligations .....	7	.....	.....
73.20	Total outlays (gross) .....	-12	-12	-7
Unpaid obligations, end of year:				
74.40	Unpaid obligations, end of year .....	12	.....	-7
74.99	Obligated balance, end of year .....	12	.....	-7

**Outlays (gross), detail:**

86.93	Outlays from discretionary balances .....	12	12	7
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**Net budget authority and outlays:**

89.00	Budget authority .....	.....	.....	.....
90.00	Outlays .....	12	12	7

Since FY 1995 NASA's Construction of facilities activities have been performed in Human space flight; Science, aeronautics and technology; and Mission support. This account shows spending from balances prior to the account restructuring.

**Object Classification** (in millions of dollars)

Identification code 80-0107-0-1-999	2000 actual	2001 est.	2002 est.
25.2 Other services .....	1	.....	.....
25.3 Purchases of goods and services from Government accounts .....	2	.....	.....
32.0 Land and structures .....	4	.....	.....
99.9 Total new obligations .....	7	.....	.....

OFFICE OF INSPECTOR GENERAL

For necessary expenses of the Office of Inspector General in carrying out the Inspector General Act of 1978, as amended, **[\$23,000,000] \$23,700,000.** (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 2001, as enacted by section 1(a)(1) of P.L. 106-377.)

**Program and Financing** (in millions of dollars)

Identification code 80-0109-0-1-252	2000 actual	2001 est.	2002 est.
<b>Obligations by program activity:</b>			
10.00 Total new obligations .....	20	23	24
<b>Budgetary resources available for obligation:</b>			
22.00 New budget authority (gross) .....	20	23	24
23.95 Total new obligations .....	-20	-23	-24
<b>New budget authority (gross), detail:</b>			
Discretionary:			
40.00 Appropriation .....	20	23	24
<b>Change in unpaid obligations:</b>			
Unpaid obligations, start of year:			
72.40 Unpaid obligations, start of year .....	3	2	3
72.99 Obligated balance, start of year .....	3	2	3
73.10 Total new obligations .....	20	23	24
73.20 Total outlays (gross) .....	-20	-22	-24
Unpaid obligations, end of year:			
74.40 Unpaid obligations, end of year .....	2	3	2
74.99 Obligated balance, end of year .....	2	3	2
<b>Outlays (gross), detail:</b>			
86.90 Outlays from new discretionary authority .....	18	20	21
86.93 Outlays from discretionary balances .....	2	1	3
87.00 Total outlays (gross) .....	20	22	24
<b>Net budget authority and outlays:</b>			
89.00 Budget authority .....	20	23	24
90.00 Outlays .....	20	22	24

The mission of the Office of Inspector General is to conduct audits and investigations of agency activities. The Inspector General keeps the Administrator informed of problems and deficiencies in agency programs and operations.

The 2003 budget estimate for this account is \$25 million.

**Object Classification** (in millions of dollars)

Identification code 80-0109-0-1-252	2000 actual	2001 est.	2002 est.
11.1 Personnel compensation: Full-time permanent .....	16	18	18
12.1 Civilian personnel benefits .....	3	4	4
21.0 Travel and transportation of persons .....	1	1	2
99.9 Total new obligations .....	20	23	24

**Personnel Summary**

Identification code 80-0109-0-1-252	2000 actual	2001 est.	2002 est.
1001 Total compensable workyears: Full-time equivalent employment .....	192	213	213

Trust Funds

SCIENCE, SPACE, AND TECHNOLOGY EDUCATION TRUST FUND

**Unavailable Collections** (in millions of dollars)

Identification code 80-8978-0-7-503	2000 actual	2001 est.	2002 est.
01.99 Balance, start of year .....	15	15	15
Receipts:			
02.40 Earnings on investments; Science, Space and Technology Education, Trust Fu .....	1	1	1
04.00 Total: Balances and collections .....	16	16	16
Appropriations:			
05.00 Science, space, and technology education trust fund .....	-1	-1	-1
07.99 Balance, end of year .....	15	15	15

**Program and Financing** (in millions of dollars)

Identification code 80-8978-0-7-503	2000 actual	2001 est.	2002 est.
<b>Obligations by program activity:</b>			
10.00 Total new obligations (object class 41.0) .....	1	1	1
<b>Budgetary resources available for obligation:</b>			
22.00 New budget authority (gross) .....	1	1	1
23.95 Total new obligations .....	-1	-1	-1
<b>New budget authority (gross), detail:</b>			
Mandatory:			
60.27 Appropriation (trust fund, indefinite) .....	1	1	1
<b>Change in unpaid obligations:</b>			
73.10 Total new obligations .....	1	1	1
73.20 Total outlays (gross) .....	-1	-1	-1
<b>Outlays (gross), detail:</b>			
86.97 Outlays from new mandatory authority .....	1	1	1
<b>Net budget authority and outlays:</b>			
89.00 Budget authority .....	1	1	1
90.00 Outlays .....	1	1	1
<b>Memorandum (non-add) entries:</b>			
92.01 Total investments, start of year: Federal securities: Par value .....	13	13	13
92.02 Total investments, end of year: Federal securities: Par value .....	13	13	13

NATIONAL SPACE GRANT PROGRAM

**Unavailable Collections** (in millions of dollars)

Identification code 80-8977-0-7-252	2000 actual	2001 est.	2002 est.
01.99 Balance, start of year .....	.....	.....	.....
Receipts:			
02.00 Gifts and donations .....	.....	3	.....
Appropriations:			
05.00 National space grant program gift fund .....	.....	-3	.....

**General and special funds—Continued**

**NATIONAL SPACE GRANT PROGRAM—Continued**

**Unavailable Collections (in millions of dollars)—Continued**

Identification code 80-8977-0-7-252	2000 actual	2001 est.	2002 est.
07.99 Balance, end of year .....			

**Program and Financing (in millions of dollars)**

Identification code 80-8977-0-7-252	2000 actual	2001 est.	2002 est.
<b>Obligations by program activity:</b>			
10.00 Total new obligations (object class 41.0) .....		3	
<b>Budgetary resources available for obligation:</b>			
22.00 New budget authority (gross) .....		3	
23.95 Total new obligations .....		-3	
<b>New budget authority (gross), detail:</b>			
Mandatory:			
60.27 Appropriation (trust fund, indefinite) .....		3	
<b>Change in unpaid obligations:</b>			
73.10 Total new obligations .....		3	
73.20 Total outlays (gross) .....		-3	
<b>Outlays (gross), detail:</b>			
86.97 Outlays from new mandatory authority .....		3	
<b>Net budget authority and outlays:</b>			
89.00 Budget authority .....		3	
90.00 Outlays .....		3	

**ADMINISTRATIVE PROVISIONS**

Notwithstanding the limitation on the availability of funds appropriated for “Human space flight”, or “Science, aeronautics and technology”[, or “Mission support”] by this appropriations Act, when any activity has been initiated by the incurrence of obligations for construction of facilities as authorized by law, such amount available for such activity shall remain available until expended. This provision does not apply to the amounts appropriated [in “Mission support” pursuant to the authorization] for *institutional* minor revitalization and construction of facilities, and *institutional* facility planning and design.

Notwithstanding the limitation on the availability of funds appropriated for “Human space flight”, or “Science, aeronautics and technology”[, or “Mission support”] by this appropriations Act, the amounts appropriated for construction of facilities shall remain available until September 30, [2003] 2004.

[Notwithstanding the limitation on the availability of funds appropriated for “Mission support” and “Office of Inspector General”, amounts made available by this Act for personnel and related costs and travel expenses of the National Aeronautics and Space Administration shall remain available until September 30, 2001 and may be used to enter into contracts for training, investigations, costs associated with personnel relocation, and for other services, to be provided during the next fiscal year.] Funds for announced prizes otherwise authorized shall remain available, without fiscal year limitation, until the prize is claimed or the offer is withdrawn.

[Unless otherwise provided for in this Act or in the joint explanatory statement of the committee of conference accompanying this Act, no part of the funds appropriated for “Human space flight” may be used for the development of the International Space Station in excess of the amounts set forth in the budget estimates submitted as part of the budget request for fiscal year 2001.]

[No funds in this or any other Appropriations Act may be used to finalize an agreement prior to December 1, 2001 between NASA and a nongovernment organization to conduct research utilization and commercialization management activities of the International Space Station.] (*Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 2001, as enacted by section 1(a)(1) of P.L. 106-377.*)

**[TITLE XIII—NATIONAL AERONAUTICS AND SPACE ADMINISTRATION]**

**[ADMINISTRATIVE PROVISION]**

[SEC. 1301. Of the proceeds in any fiscal year from the sale of timber on Federal property at the John C. Stennis Space Center, or on additional real property within the restricted easement area adjacent to the Center, any funds that are in excess of the amount necessary for the expenses of commonly accepted forest management practices on such properties may be retained and used by the National Aeronautics and Space Administration for the acquisition from willing sellers of up to a total of 500 acres of real property to establish education and visitor programs and facilities that promote and preserve the regional and national history of the area, including the contributions of Stennis Space Center, and, as necessary, for wetlands mitigation.] (*Division B, Miscellaneous Appropriations Act, 2001, as enacted by section 1(a)(4) of P.L. 106-554.*)