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 5 U.S.C. 5901–5902; travel expenses; purchase and hire of passenger motor vehicles; not to exceed [$20,000] *$24,000* for official reception and representation expenses; and purchase, lease, charter, maintenance and operation of mission and administrative aircraft, [$6,912,400,000] *$6,172,900,000*, to remain available until September 30, [2003] *2004*, 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 "Science, aeronautics and technology" 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, 2002; additional authorizing legislation required.)*

[For emergency expenses to respond to the September 11, 2001, terrorist attacks on the United States, for "Human space flight", $76,000,000, to remain available until expended, to be obligated from amounts made available in Public Law 107–38.] *(Emergency Supplemental Act, 2002.)*

Program and Financing (in millions of dollars)

Identification code 80–0111–0–1–252		2001 actual	2002 est.	2003 est.
	Obligations by program activity:			
	Direct program:			
00.01	Space station	2,089	1,734	1,503
00.02	Payload and ELV support	92	95	88
00.03	Investments and support	152	1,250	1,219
00.04	Space shuttle	3,201	3,152	3,211
00.05	Space communications and data systems		458	136
00.07	Safety, mission assurance & engineering		45	48
09.01	Reimbursable program	176	248	150
10.00	Total new obligations	5,710	6,982	6,355
	Budgetary resources available for obligation:			
21.40	Unobligated balance carried forward, start of year	167	171	310
22.00	New budget authority (gross)	5,673	7,121	6,323
22.10	Resources available from recoveries of prior year obligations	41		
23.90	Total budgetary resources available for obligation	5,881	7,292	6,633
23.95	Total new obligations	−5,710	−6,982	−6,355
24.40	Unobligated balance carried forward, end of year	171	310	278
	New budget authority (gross), detail:			
	Discretionary:			
40.00	Appropriation	5,508	6,797	6,173
40.15	Appropriation (emergency)		76	
40.77	Reduction pursuant to P.L. 106–554 (0.22 percent)	−12		
43.00	Appropriation (total discretionary)	5,496	6,873	6,173
	Spending authority from offsetting collections:			
68.00	Offsetting collections (cash)	174	248	150
68.10	Change in uncollected customer payments from Federal sources (unexpired)	3		
68.90	Spending authority from offsetting collections (total discretionary)	177	248	150
70.00	Total new budget authority (gross)	5,673	7,121	6,323
	Change in obligated balances:			
72.40	Obligated balance, start of year	1,813	1,468	1,651
73.10	Total new obligations	5,710	6,982	6,355
73.20	Total outlays (gross)	−6,006	−6,799	−6,496
73.40	Adjustments in expired accounts (net)	−8		
73.45	Recoveries of prior year obligations	−41		
74.00	Change in uncollected customer payments from Federal sources (unexpired)	−3		
74.10	Change in uncollected customer payments from Federal sources (expired)	3		
74.40	Obligated balance, end of year	1,468	1,651	1,510
	Outlays (gross), detail:			
86.90	Outlays from new discretionary authority	4,254	4,949	4,373
86.93	Outlays from discretionary balances	1,752	1,850	2,123
87.00	Total outlays (gross)	6,006	6,799	6,496
	Offsets:			
	Against gross budget authority and outlays:			
	Offsetting collections (cash) from:			
88.00	Federal sources	−147	−207	−117
88.40	Non-Federal sources	−30	−41	−33
88.90	Total, offsetting collections (cash)	−177	−248	−150
	Against gross budget authority only:			
88.95	Change in uncollected customer payments from Federal sources (unexpired)	−3		
88.96	Portion of offsetting collections (cash) credited to expired accounts	3		
	Net budget authority and outlays:			
89.00	Budget authority	5,496	6,873	6,173
90.00	Outlays	5,829	6,551	6,346

Budget Authority and Outlays Excluding Full Funding for Federal Retiree Costs (in millions of dollars)

		2001 actual	2002 est.	2003 est.
	Net budget authority and outlays:			
89.00	Budget authority	5,451	6,830	6,131
90.00	Outlays	5,784	6,508	6,304

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 and operation of the Space Shuttle. This includes 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 2001, the 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. Since 2002, other than direct costs (which includes Research and Program Management and non-programmatic Construction of Facilities) are allocated to either the HSF or the SAT account based on the number of full time equivalent people.

General and special funds—Continued

HUMAN SPACE FLIGHT—Continued

(INCLUDING TRANSFER OF FUNDS)—Continued

Performance Objectives

Space Station.—The International Space Station (ISS) is a complex of research laboratories in low Earth orbit in which American, Russian, Canadian, European, and Japanese astronauts are conducting unique scientific and technological investigations in a microgravity environment. The goal of the Station is to support scientific research and other activities requiring the unique attributes of humans in space and establish a permanent human presence in Earth orbit. The President's 2003 Budget request provides funding for continued development of the vehicle and for operations in support of continued assembly, logistics resupply, crew exchange, research operations and other utilization. With nine assembly missions successfully completed, the budget includes funding to keep subsequent assembly missions on schedule through U.S. Core Complete (Flight 10A), currently planned for calendar year 2004, to support early research commensurate with the build-up of on-orbit utilization capabilities and resources.

In early calendar year 2001, NASA launched the U.S. Laboratory and the first set of research equipment necessary for conducting experiments on the Space Station. Subsequent flights enabled the installation of the Canadian robotic arm, additional research equipment for the U.S. Laboratory, installation of the Russian docking compartment, and transport of the 3rd and 4th crew expeditions. By mid-calendar year 2001, the U.S. Airlock had been installed, allowing spacewalks to be conducted without the Space Shuttle present, and marking completion of Phase 2 of the Space Station assembly. The first utilization flight in December 2001 greatly expanded the number of research payloads on-orbit, and raised the number of research investigations initiated to over 40. Crew training, payload processing, hardware element processing, and mission operations were supported without major ground anomalies, and all but two on-orbit subsystems performed above predicted levels, resulting in a lower than expected maintenance workload. This lower maintenance workload, coupled with the commitment of the expedition crews to dedicate time for conducting research experiments, resulted in research activities that exceeded expectations. NASA will seek to exceed expectations for research productivity by achieving astronaut time dedicated to research in excess of the planned 20 hours per week. During 2002, three of the major truss elements constituting the power block will be deployed to orbit, Expeditions 5 and 6 will be deployed, and a second utilization flight will expand science capabilities even further. In calendar year 2003, activation of the thermal system will be completed, two of the three remaning solar array modules will be deployed, and both the S6 truss and Node 2, the final components of the U.S. Core Complete, should be delivered to NASA for final integration and preflight test and checkout to support planned launches in calendar year 2004.

As required by both the NASA Authorization Act (PL 106–391) and the 2002 VA/HUD Appropriations Act (P.L. 107–73), the ISS research budget is transferred to the Biological and Physical Research Enterprise in 2002. The remaining ISS budget supports completion of the U.S. Core Complete and allows the program to press ahead with the integration of the partners' research modules. A NASA cost estimate, and an independent cost estimate (ICE) of the cost to assemble and operate the U.S. Core Complete will be completed by September 2002. The 2002 appropriation directed a general reduction in the station budget of $75M, which eliminated reserves fenced for guaranteed carryover into 2003. The appropriation also earmarked $40M for X–38 efforts that was originally planned to cover X–38 plus continued work on Node 3 and the advanced environmental control system. NASA plans to fund the Node 3 and environmental control work into the 2nd quarter of 2002, when a decision will be made to continue those efforts or to cancel them.

Consistent with the recommendations in the ISS Management and Cost Evaluation (IMCE) Task Force, and direction from the Administration, NASA will develop a Cost Analysis Requirements Document (CARD) to support cost estimates of the U.S. Core Complete baseline. NASA will also develop an integrated management action plan based on recommendations of the IMCE Task Force, and begin implementation of those actions. NASA will also report to the Administration and to Congress its plans for a non-governmental organization (NGO) for ISS research, and the results of discussions with the International Partners on ways to increase on-orbit resources for station research, in particular innovative methods for increasing crew availability. The ISS Program is pressing ahead with final flight hardware deliveries, and completion of the current prime contract in December 2003. Requirements for follow-on support are being reviewed and estimated, and a plan to competitively award contracts for the station's operations phase will be released this Spring.

Payload and Expendable Launch Vehicle (ELV) Support.—The Payload Carriers and Support budget provides technical expertise, facilities, flight carrier hardware and capabilities necessary to provide end-to-end servicing of multiple payloads to be flown aboard the Space Shuttle. During 2001, six pallets were used in Space Shuttle missions. In 2002 and 2003, over 20 major and secondary payloads will be supported, including major hardware for International Space Station assembly and operations.

The ELV Mission Support budget provides funds for technical and management insight of commercial launch services, including advanced mission design/analysis and leading-edge integration services, which are provided for the full range of NASA missions under consideration for launch on ELVs. During 2001, eight ELV missions were launched. Integration and technical management of 11 launches, including one secondary, are planned in 2002. In 2003, support for ten launches, including one secondary, is planned.

Investments and Support.—NASA's rocket propulsion test project will ensure that unique capabilities are properly managed and maintained in world-class condition. The project will significantly enhance NASA's ability to properly manage 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; conduct independent safety, and reliability assessments; and stimulate science and technical competence in the United States. Funding for other direct costs associated with Human Space Flight, which were funded in the Mission Support account prior to 2002, are also funded within 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 2001, the Space Shuttle launched seven flights, all of which were ISS assembly and servicing missions. Seven flights are planned during 2002 including a dedicated microgravity research flight and another HST Servicing Mission (HST-3B) and five ISS assembly and servicing missions. In

2003, four flights are planned, all of which are ISS assembly and servicing missions. In support of the research objectives of the Space Station, the Space Shuttle will commit a minimum of five powered mid-deck lockers on each mission to deliver necessary research equipment and specimens.

NASA will aggressively pursue Space Shuttle competitive sourcing as an important step in transitioning NASA from infrastructure ownership and operation to purchasing space transportation services where possible. NASA will seek industry comment on its plans early this year, leading to release of a solicitation for competitive sourcing. NASA will prepare a Cost Analysis Requirements Document (CARD) to support NASA and independent cost estimates of Space Shuttle operations and safety investments, similar to estimates being done for the Space Station. These estimates, to be completed by September, 2002, will provide an important baseline from which to assess competitive sourcing options.

The President's 2003 Budget supports key Space Shuttle safety investments as part of NASA's Integrated Space Transportation Plan. NASA will seek to accelerate the implementation of safety investments, to begin achieving safety gains in Shuttle operations as quickly as possible. The President's 2003 Budget also supports investments in the Space Shuttle infrastructure, as necessary to address safety issues and critical repair and revitalization activities.

Space Communications and Data Systems.—The program goal is to support NASA's Enterprises and external customers with Space Communications and Data System (SCDS) services that are responsive to customer needs. Additionally, the program performs infrastructure upgrades and replenishment efforts necessary to maintain the service capabilities that satisfy the approved mission model. The program conducts technology and standards infusion efforts to provide more efficient and effective services. The Space Communications Office at Headquarters manages and directs an integrated Agency-wide Space Communications and Data Systems program.

Beginning in 2002, a decentralized management process has been implemented that involves transferring most management and budget responsibilities previously performed by the Space Operations Management Office to the appropriate Enterprises. Beginning in 2003, the Deep Space Network, Ground Network and Western Aeronautical Test Range will be managed by NASA's Enterprises. The Office of Space Flight will continue to perform overall program integration, including the management of Consolidated Space Operations Contract, which is now in its fourth year of providing data services to both NASA and non-NASA customers.

The TDRS–8 spacecraft, which completed on-orbit checkout in September 2000, is working well and meets all user service telecommunications performance requirements except for a Multiple Access (MA) performance anomaly. Modifications to the TDRS–I and TDRS–J spacecraft flight hardware and test program as a result of the MA investigation have been implemented. TDRS–I launch is now planned for February 2002. The launch of TDRS–J is slated for October 2002.

Safety, Mission Assurance and Engineering.—The Safety and Mission Assurance program invests 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 Engineering program, managed by the Office of the Chief Engineer (OCE), oversees the conduct and improvement of NASA's engineering practice and independently evaluates ongoing programs, proposed concepts, and options for new programs. The OCE establishes policies, standards, guidance, and support for improving NASA engineering practices and technical capabilities, and manages the NASA Electronics Parts and Packaging Program, which supports evaluation and infusion of advanced electronic parts and packaging technology into NASA programs.

Object Classification (in millions of dollars)

Identification code 80–0111–0–1–252		2001 actual	2002 est.	2003 est.
	Direct obligations:			
	Personnel compensation:			
11.1	Full-time permanent		537	569
11.3	Other than full-time permanent		5	5
11.5	Other personnel compensation		17	16
11.8	Special personal services payments		13	13
11.9	Total personnel compensation		572	603
12.1	Civilian personnel benefits	45	166	173
21.0	Travel and transportation of persons		23	23
22.0	Transportation of things	4	4	4
23.1	Rental payments to GSA		7	7
23.2	Rental payments to others	1	1	1
23.3	Communications, utilities, and miscellaneous charges	40	56	39
24.0	Printing and reproduction	2	2	2
25.1	Advisory and assistance services	56	60	55
25.2	Other services	286	307	282
25.3	Other purchases of goods and services from Government accounts	64	69	63
25.4	Operation and maintenance of facilities	1,955	2,163	1,925
25.5	Research and development contracts	2,667	2,860	2,619
25.7	Operation and maintenance of equipment	32	34	32
26.0	Supplies and materials	164	176	162
31.0	Equipment	96	103	95
32.0	Land and structures	66	71	65
41.0	Grants, subsidies, and contributions	56	60	55
99.0	Direct obligations	5,534	6,734	6,205
99.0	Reimbursable obligations	176	248	150
99.9	Total new obligations	5,710	6,982	6,355

Personnel Summary

Identification code 80–0111–0–1–252		2001 actual	2002 est.	2003 est.
	Direct:			
1001	Total compensable workyears: Full-time equivalent employment		7,143	6,912
	Reimbursable:			
2001	Total compensable workyears: Full-time equivalent employment		30	30

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] *$24,000* for official reception and representation expenses; and purchase, lease, charter, maintenance and operation of mission and administrative aircraft, [$7,857,100,000] *$8,918,500,000* to remain available until September 30, [2003] *2004*, 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 "Human space flight" in accordance with section 312(b) of the National Aeronautics and Space Act of 1958, as amended by Public Law 106–377[, except that no funds may be transferred to the program budget element for the Space Station]. *(Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 2002; additional authorizing legislation required.)*

General and special funds—Continued

SCIENCE, AERONAUTICS AND TECHNOLOGY—Continued

(INCLUDING TRANSFER OF FUNDS)—Continued

[For emergency expenses to respond to the September 11, 2001, terrorist attacks on the United States, for "Science, aeronautics and technology", $32,500,000, to remain available until expended, to be obligated from amounts made available in Public Law 107–38.] *(Emergency Supplemental Act, 2002.)*

Program and Financing (in millions of dollars)

Identification code 80–0110–0–1–999		2001 actual	2002 est.	2003 est.
	Obligations by program activity:			
	Direct program:			
00.01	Space science	2,326	2,888	3,402
00.02	Biological and physical research	291	846	849
00.03	Earth science	1,445	1,690	1,640
00.04	Aerospace technology	1,382	2,529	2,838
00.05	Space operations	503	18	.....
00.06	Academic programs	132	207	161
00.07	Mission communication services	9	.....	.....
09.01	Reimbursable program	517	598	632
10.00	Total new obligations	6,605	8,776	9,522
	Budgetary resources available for obligation:			
21.40	Unobligated balance carried forward, start of year	306	448	385
22.00	New budget authority (gross)	6,752	8,712	9,550
22.10	Resources available from recoveries of prior year obligations	20	.....	.....
23.90	Total budgetary resources available for obligation	7,078	9,160	9,935
23.95	Total new obligations	−6,605	−8,776	−9,522
23.98	Unobligated balance expiring or withdrawn	−25	.....	.....
24.40	Unobligated balance carried forward, end of year	448	385	414
	New budget authority (gross), detail:			
	Discretionary:			
40.00	Appropriation	6,249	8,082	8,918
40.15	Appropriation (emergency)	.....	32	.....
40.77	Reduction pursuant to P.L. 106–554 (0.22 percent)	−14	.....	.....
43.00	Appropriation (total discretionary)	6,235	8,114	8,918
68.00	Spending authority from offsetting collections: Offsetting collections (cash)	517	598	632
70.00	Total new budget authority (gross)	6,752	8,712	9,550
	Change in obligated balances:			
72.40	Obligated balance, start of year	3,046	3,360	4,179
73.10	Total new obligations	6,605	8,776	9,522
73.20	Total outlays (gross)	−6,283	−7,957	−9,063
73.40	Adjustments in expired accounts (net)	−5	.....	.....
73.45	Recoveries of prior year obligations	−20	.....	.....
74.10	Change in uncollected customer payments from Federal sources (expired)	17	.....	.....
74.40	Obligated balance, end of year	3,360	4,179	4,638
	Outlays (gross), detail:			
86.90	Outlays from new discretionary authority	3,307	4,826	5,279
86.93	Outlays from discretionary balances	2,976	3,131	3,784
87.00	Total outlays (gross)	6,283	7,957	9,063
	Offsets:			
	Against gross budget authority and outlays:			
	Offsetting collections (cash) from:			
88.00	Federal sources	−493	−550	−590
88.40	Non-Federal sources	−38	−48	−42
88.90	Total, offsetting collections (cash)	−531	−598	−632
	Against gross budget authority only:			
88.96	Portion of offsetting collections (cash) credited to expired accounts	14	.....	.....
	Net budget authority and outlays:			
89.00	Budget authority	6,235	8,114	8,918
90.00	Outlays	5,752	7,359	8,431

Budget Authority and Outlays Excluding Full Funding for Federal Retiree Costs (in millions of dollars)

		2001 actual	2002 est.	2003 est.
	Net budget authority and outlays:			
89.00	Budget authority	6,177	8,047	8,844
90.00	Outlays	5,694	7,292	8,357

This appropriation provides for the Science, Aeronautics and Technology (SAT) supporting the Agency. The SAT activities include space science, biological and physical research including research for the International Space Station, 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 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 (HSF) account. Since 2002, other direct costs (which include Research and Program Management and non-programmatic Construction of Facilities) are allocated to either the HSF or the SAT account based on the number of full time equivalent personnel.

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 many research and development activities, including flight missions, major space-based facilities, technology and mission development programs, and research and data analysis.

In 2001, the Space Science program produced many notable scientific results: The Hubble Space Telescope discovered a supernova blast that occurred very early in the life of the Universe, bolstering the case for the existence of a mysterious form of "dark energy" pervading the Universe. The concept of dark energy, which pushes galaxies away from each other at an ever-increasing speed, was first proposed, then discarded, by Albert Einstein early in the last century. The Hubble discovery also reinforces the startling idea that the expansion of the universe only recently began speeding up.

The Chandra X-ray Observatory enhanced our understanding of black holes on many fronts. Chandra took the deepest X-ray images ever and found the early Universe teeming with black holes, probed the theoretical edge of a black hole known as the event horizon, and captured the first X-ray flare ever seen from the supermassive black hole at the center of our own Milky Way galaxy.

Detailed scientific analysis of high-resolution images obtained by the BOOMERANG (Balloon Observations of Millimetric Extragalactic Radiation and Geophysics) mission provided the most precise measurements to date of several of the key characteristics cosmologists use to describe the Universe. These images were the first to bring the cosmic microwave background (the radiation remaining from the "big bang" that created the Universe) into sharp focus.

In addition to these discoveries that have enhanced our understanding of the origin, evolution, and structure of the Universe, many discoveries in 2001 related to the rapidly growing field of extrasolar planet (planets outside our Solar System) detection. NASA and National Science Foundation-funded astronomers discovered eight new extrasolar planets, bringing the total number of extrasolar planet detections to about eighty. Observations from the Submillimeter Wave As-

tronomy Satellite (SWAS) provided the first evidence that extrasolar planetary systems contain water, a molecule that is an essential ingredient for known forms of life. Also in this field, astronomers using the Hubble Space Telescope have made the first detection and chemical analysis of the atmosphere of a planet outside our Solar System.

Within our Solar System, NASA spacecraft made many stunning achievements in 2001. In a risky flyby, the Deep Space-1 spacecraft successfully navigated past comet Borrelly, giving researchers the best look ever inside a comet's glowing core of icy dust and gas. Deep Space-1 passed just 2,200 kilometers (1,400 miles) from the rocky, icy nucleus of the 10 kilometer-long (more than 6 mile-long) comet. The NEAR (Near Earth Asteroid Rendezvous) Shoemaker spacecraft achieved the first soft landing on an asteroid. The landing was the culmination of a year-long orbital mission at the asteroid Eros during which the mission returned enormous quantities of scientific data and images.

A pair of spacecraft, the Mars Global Surveyor and the Hubble Space Telescope, provided astronomers with a ringside seat to the biggest global dust storm seen on Mars in several decades. The Martian dust storm, larger by far than any seen on Earth, raised a cloud of dust that engulfed the entire planet for several months. The sun-warmed dust raised Martian atmospheric temperatures by 80 degrees Fahrenheit while the shaded Martian surface chilled precipitously. Also in calendar year 2001, the Mars Odyssey 2001 spacecraft successfully achieved orbit around Mars following a six-month, 286-million mile journey. Following aerobraking operations, this spacecraft will be placed in its science-mapping orbit in early calendar year 2002 and will characterize composition of the Martian surface at unprecedented levels of detail.

In the field of Sun-Earth Connections, where we seek to develop a scientific understanding of the physical interactions in the Sun-Earth system, there were several important scientific accomplishments in calendar year 2001. The Solar and Heliospheric Observatory (SOHO) observed the largest sunspot in ten years, with a surface area equivalent to thirteen Earths. This area proved to be a prolific source of stormy solar activity, hurling clouds of electrified gas (known as Coronal Mass Ejections, or CMEs) towards Earth. Other studies conducted by the SOHO spacecraft have provided the first clear picture of what lies beneath sunspots, peering inside the Sun to see swirling flows of electrified gas that create the self-reinforcing cycle that holds a sunspot together.

The calendar year was capped by the successful launch of the TIMED (Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics) mission on December 7, 2001. This is the first mission in the Solar Terrestrial Probes program. It will study a region of the Earth's atmosphere that has never been the subject of a comprehensive, long-term scientific investigation.

The NASA budget request for 2003 features two very significant changes from the previous baseline program: a reformulated planetary program and the inclusion of a nuclear power and propulsion program. In the field of planetary exploration, the 2003 Budget takes a fundamentally different approach from previous years. Given cost growth and schedule delays, all funding for the Pluto-Kuiper Belt mission and the Europa Orbiter mission has been eliminated in 2003 and subsequent years. These missions will be replaced by a revamped planetary program that will incorporate the following principles: clear science priorities that support key goals in understanding the potential existence of life beyond Earth and the origins of life; open competition and rigorous reviews of cost, schedule, and risk to minimize future overruns and delays per the highly successful Discovery Program; and an architectural approach that balances science return in this decade with investments in high-leverage technologies that will enable faster and more frequent missions with greater science return in the next decade. It is envisioned that the new planetary program will be structured and managed along the lines of the highly successful Discovery program. A key element of this new program will be the development and incorporation of nuclear power and propulsion technologies. Building upon ongoing NASA investments in advanced electric propulsion and instrument and electronics miniaturization, investments in nuclear power and nuclear-electric propulsion technologies that will enable much faster and more frequent planetary investigations with greater science capabilities. These investments will allow NASA to undertake fundamentally new approaches to planetary exploration. In the next decade, nuclear-electric propulsion technology will enable affordable planetary missions that: can reach targets in half the time it would take using today's propulsion systems; are not limited by today's power and mass constraints; and can conduct long-term observations of multiple targets.

Nuclear power technology will also be incorporated into the Mars Exploration Program, specifically in the Mars Smart Lander/Mobile Laboratory mission. This mission will now be launched in calendar year 2009 to allow the incorporation of nuclear power, instead of calendar year 2007 as previously planned. By using nuclear power, the time during which the Mars Mobile Laboratory can conduct science operations will be extended from several months to several years. The nearer-term missions in the Mars Exploration Program remain essentially unchanged. In May and June of 2003, two highly capable surface rovers will be launched to Mars, with landings on the surface expected in April and May of 2004. The Mars Reconnaissance Orbiter (MRO) will be launched in calendar year 2005; this powerful scientific orbiter will focus on analyzing the surface at unprecedented levels of detail to follow tantalizing hints of water detected in images from the Mars Global Surveyor spacecraft. MRO will measure thousands of Martian landscapes at 20- to 30-centimeter (8- to 12-inch) resolution. It will be followed by a competitively selected Mars Scout mission in calendar year 2007 and the Smart Lander/Mobile Laboratory in calendar year 2009. This robust program of orbiters, landers, and rovers 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.

This Budget supports the completion of development of many significant missions, including Gravity Probe-B (GP–B), the Space Infrared Telescope Facility (SIRTF), and the Stratospheric Observatory For Infrared Astronomy (SOFIA). GP–B, which will verify a key aspect of Einstein's theory of general relativity, will be launched in October 2002. SIRTF, the fourth and final of the Great Observatories, is scheduled for launch in 2003. SOFIA development activities will continue, with the aircraft door and the telescope to be installed and tested in 2003. Development activities supporting the Solar Terrestrial Relations Observatory (STEREO), the Gammaray Large Area Space Telescope (GLAST), the final Hubble Space Telescope servicing mission, as well as several key missions in the payloads program such as Solar-B and Herschel, will also continue in 2003.

In the Explorer program, the Microwave Anisotropy Probe successfully launched on June 30, 2001, and development of Swift, a multi-wavelength observatory for gammaray burst astronomy, remains on schedule for a September, 2003 launch. Another MIDEX mission, the Full-sky Astrometric Mapping Explorer (FAME), did not pass confirmation review due to cost increases and was not approved for full-scale development. Selection of the MIDEX–5 and MIDEX–6 missions will occur in 2002, and an Announcement of Opportunity for MIDEX–7 and MIDEX–8 will be released in 2003. In the Small-class (SMEX) mission series, three NASA missions and two non-NASA Missions of Opportunity are sup-

General and special funds—Continued

SCIENCE, AERONAUTICS AND TECHNOLOGY—Continued

(INCLUDING TRANSFER OF FUNDS)—Continued

ported. The NASA missions include the Galaxy Evolution Explorer (GALEX), Two Wide-Angle Neutral Atom Spectrometers (TWINS), and the High Energy Solar Spectroscopic Imager (HESSI). The Missions of Opportunity are the Coupled Ion Neutral Dynamics Investigation (CINDI; a cooperative mission with the Air Force), and ASTRO E–2, an X-ray astronomy mission (in cooperation with Japan). ASTRO E–2 is a rebuild of ASTRO E, which was lost due to a failure of the Japanese launch vehicle in February, 2000.

In the Discovery program, the Genesis mission was launched on August 8, 2001; it has begun collecting samples of charged particles from the solar wind, and it will return these samples to Earth for analysis in calendar year 2004. Development activities continue on three other Discovery missions. The Comet Nucleus Tour (CONTOUR) will be launched in July 2002, and it will encounter two comets: comet Encke in calendar year 2003, and comet Schwassman Wachman-3 in calendar year 2006. 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 comet Temple-1, are both scheduled to launch in early calendar year 2004.

The New Millennium program is providing flight demonstrations of critical new technologies that will reduce the mass and cost of future science and spacecraft subsystems, while maintaining or improving mission capabilities. In calendar year 2003, the Nanosat Constellation Trailblazer (Space Technology-5, or ST–5) will undergo spacecraft and instrument integration and test in preparation for launch in calendar year 2004. Also in calendar year 2003, the Critical Design Review for ST–6 will be conducted, as will the Confirmation Review for ST–7, and the initial confirmation for ST–8.

The President's 2003 Budget also provides funding for focused technology programs in each of the four major Space Science themes: the Astronomical Search for Origins, Structure and Evolution of the Universe, Solar System Exploration, and Sun-Earth Connections, which includes both the Living With A Star Program and the Solar Terrestrial Probes Program. These funds provide for early technology development in support of strategic missions such as the Next Generation Space Telescope and the Space Interferometry Mission. The goal is to retire technology risk early in a mission's lifecycle, before proceeding to full-scale development. Funds are also provided to continue on-going operations of approximately thirty spacecraft, and to conduct robust research and analysis, data analysis, and suborbital research campaigns.

Biological and Physical Research.—The Biological and Physical Research Enterprise (BPRE) seeks to exploit the rich opportunities of space flight for fundamental research in the biological and physical sciences, as well as in commercial development of space, and conducts research to enable efficient and effective systems for protecting and sustaining humans in space. BPRE seeks to achieve advances in biological and physical sciences by understanding nature's forces in space, and achieve an understanding of the human experience in space.

In late 2001, BPRE was created as NASA's fifth strategic enterprise. BPRE closed its first fiscal year with a significant record of accomplishment. It expanded its interagency research collaborations, establishing a new memorandum of understanding with the United States Department of Agriculture, conducting a joint research solicitation with the National Cancer Institute, and continuing work under 18 other agreements with the National Institutes of Health. A BPRE investigator received the Nobel Prize in physics for ground-based research that he plans to extend and expand on the International Space Station. Outfitting the International Space Station (ISS) for research began with the delivery of the Human Research Facility in March 2001. Two research equipment racks were delivered to the ISS in mid-April and an additional two at the beginning of Expedition 3 in August. BPRE initiated a program of research on the ISS to take advantage of available resources during the construction phase. The ISS Expedition 1 and 2 teams were able to exceed expectations for meeting research objectives of the planned experiments, with only one unsuccessful experiment due to technical reasons.

In 2002, BPRE will continue to increase knowledge and demonstrate key technology capabilities for humans in space, address critical questions in crew health and safety, and materials science and commercial research payloads will be flown on both the Space Shuttle and aboard ISS. The Space Station research program is on track to deliver another five equipment racks on orbit by the end of calendar year 2002. BPRE also will complete definition studies leading to award of a contract to manage ISS utilization to a Non-Governmental Organization (NGO). Working with the scientific community, its advisory committees, and the Administration, BPRE will complete the development of research priorities across its portfolio of research endeavors to provide a basis for critical resource allocation decisions. In the area of public outreach and education, BPRE plans to develop electronic and printed educational materials that focus on biological and physical research.

In 2003, BPRE will implement its research priorities and develop ISS flight facilities to achieve a prioritized and productive research program. BPRE will also work with Life Science Museum Network members to explore opportunities for the development of projects, special events, or workshops focused on the life sciences and biology-related research themes to attract and engage public audiences. In addition, BPRE will make available to wide audiences an online database of Commercial Space Center activities, including publications listings, patents, and other information useful to the general public.

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, 2001 was another year of substantial accomplishment toward understanding the Earth system. Goddard Space Flight Center (GSFC) produced the first global record of the Earth's biosphere, showing the uptake and release of carbon by land and oceans continuously over three years. NASA-sponsored research showed that the growing sea-

son over parts of the Northern hemisphere has lengthened over the past two decades, with an accompanying increase in lushness of vegetation. NASA and the EarthSAT Corporation released the first consistent 30-m resolution land cover map for the U.S., and are nearing completion of the global map. These data are from calendar year 1990 and provide a basis for comparison of future change; plans are being developed to repeat the process for calendar year 2001 and beyond. Results from a major NASA/NSF-led international research campaign indicate that aerosols from dust and pollution may be reducing evaporation and thus slowing the global water cycle. Results from comparing the 2000 and 1997 Antarctic Mapping Missions have led to new estimates of change in the Antarctic ice sheet; ice in the Lambert glacier flows from the interior to the "mouth" where it reaches a rate of 1 kilometer per year. In the Northern hemisphere, NASA researchers identified patterns of change in sea ice extent over a twenty-year period; overall, Arctic sea ice extent has decreased since calendar year 1978. Continued monitoring of global ocean topography showed that the Pacific Decadal Oscillation governs climate impacts of the Pacific in non-El Nino/La Nina years, and allowed the prediction of last winter's chill across the northern U.S. and relative warmth across the South. ESE also made major advances in computing for climate modeling, using a partnership among two NASA Centers and Silicon Graphics, Inc. to simulate 900 days of Earth's climate in one day, up from the prior capability of 70 days per day; performance on end-to-end climate simulation improved ten-fold. This greatly enhances climate modelers' ability to perform the multiple runs of many years of climate simulations needed to generate useful projections of climate change.

In ESE Applications, ESE has entered into a variety of partnerships that will apply the goods and services made possible by ESE's research. ESE provides QuikSCAT data in real time to the National Oceanic and Atmospheric Administration (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 the Federal Emergency Management Agency (FEMA) to use remote sensing tools to update their flood plain maps throughout the U.S. In a partnership called Agriculture 2020 with the U.S. Department of Agriculture (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 U.S., providing data to the U.S. Forest Service (USFS) and regional authorities. As a result, USFS is investing in direct broadcast receiving stations to rapidly acquire data from NASA's Terra satellite.

In ESE Technology, the Enterprise's first New Millennium Program satellite to demonstrate a variety of new technologies for Earth Science successfully completed all its demonstration tasks (save one high-risk propulsion task scheduled for near the end of mission life). 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 five to seven channels. Sponsored technology research with universities, industry and other government laboratories moved 35% of ESE's new remote sensing instrument concepts one step closer to reality on an established scale of technology maturity. These advances will substantially reduce the cost and enhance the capability of new satellites over the next decade or more. ESE also began formation flying of four land imaging satellites, demonstrating that several smaller satellites can be operated in tandem to dramatically increase spatial and temporal coverage.

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 six EOS satellites are already in orbit, including Jason-1 and SAGE III, launched in December 2001. The remaining EOS satellites will be launched through calendar year 2004, including Aqua (calendar year 2002) to study the water cycle and atmospheric circulation, and Aura (calendar year 2004) 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 12.3 million user queries for over 15 million products in calendar year 2001. 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. ESE and U.S. Geological Survey (USGS) released a request for proposal for Landsat Data Continuity Mission to succeed Landsat 7; it is being implemented as a commercial data purchase. ESE is also planning for the transition of several of its key research observations to the Nation's weather satellite system. The Department of Defense (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 NASA and NOAA 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 U.S. Global Change Research Program, an interagency collaboration overseen by the Committee on Natural Resources of the National Science and Technology Council. NASA ESE will also contribute to the new Climate Change Initiative, a multiagency effort with strong focus on outcomes. 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 Aerospace Technology (AST) Enterprise mission is to pioneer the identification, development, verification, transfer, application, and commercialization of high-payoff aerospace technologies and the development of broad, crosscutting revolutionary innovations critical to a number of NASA missions. The Enterprise plays a key role in: 1) maintaining a safe and efficient national aviation system, 2) enabling affordable, reliable space transportation systems, and 3) developing basic technologies for a broad range of space applications. Research and development pro-

General and special funds—Continued

SCIENCE, AERONAUTICS AND TECHNOLOGY—Continued

(INCLUDING TRANSFER OF FUNDS)—Continued

grams conducted by the Enterprise contribute to NASA's science and exploration missions, national security, economic growth, and the long-term competitiveness of American aerospace companies. The Enterprise directly supports national policy in both aeronautics and space as directed in the President's Goals for a National Partnership in Aeronautics and Research Technology, the National Space Policy, and the National Space Transportation Policy.

A modern air and space transportation system is fundamental to our national economy, quality of life, and security of the United States. For 75 years, a strong base for aerospace technology research and development has provided enormous contributions to this system, contributions that have fostered the economic growth of our Nation and provided unprecedented mobility for U. S. citizens. Although major technical advances have made our Nation's air and space transportation system the largest and best of its kind, the future holds critical challenges to its continued growth and performance. Because the U. S. air and space transportation system serves both the public good and critical national security needs, ensuring the continued health and preeminence of that system is a key issue for the future of the Nation.

Although NASA technology benefits the aerospace industry directly, the creative application of NASA's advanced technology to disparate design and development challenges has made numerous contributions to other areas such as the environment, surface transportation, and medicine.

In order to develop the aerospace systems of the future, revolutionary approaches to system design and technology development will be necessary. Pursuing technology fields that are in their infancy today, developing the knowledge bases necessary to design radically new aerospace systems, and performing efficient, high-confidence design and development of revolutionary vehicles are challenges that face us in innovation. These challenges are intensified by the demand for safety in our highly complex aerospace systems.

The President's 2003 Budget provides the resources necessary to maintain the progress required to achieve a 21st Century aviation system that is safe, environmentally friendly, efficient and meets the growing demands for increased and predictable performance. The President's 2003 Budget also supports technology development for space transportation systems that are safer and significantly less costly than today's systems. The structure of the Aerospace Technology budget has been changed so that the budget lines are directly linked to the Enterprise Strategic Goals. The first goal, Revolutionize Aviation, addresses 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 (FAA) and the Department of Defense through the National Research and Development Plan for Aviation Security, Efficiency, and Environmental Compatibility. In 2003, the President's Budget provides for the demonstration of several advanced technologies that when implemented will result in a significant reduction in aviation accidents. Specific flight evaluations will include an integrated Synthetic Vision System and Runway Incursion Prevention System intended for use on commercial and business aircraft, a next-generation cockpit weather information digital datalink and turbulence awareness system, and a smart icing management system which will automatically activate and manage an aircraft's ice protection systems. In addition, ground-based demonstrations of an advanced vehicle health management system, an engine disk crack detection monitoring system and recovery methods for flight critical systems will be accomplished. The Administration's request also provides for continued development of the technologies necessary to reduce the environmental impact of today's aircraft. The sector testing of a jet engine combustor that could reduce nitrous oxide emissions by 70 percent will be complete. Selection of contractors to proceed with full annular testing for large and regional jet engines will also be complete. Additionally, the Administration's request includes funding for the development of a broad suite of advanced technologies that will provide the basis for future emission reductions including carbon dioxide. The request also includes the continuation of the noise reduction technology that in calendar year 2007 will reduce the perceived aircraft noise pollution by a factor of two from the calendar year 1997 baseline set by the International Civil Aviation Organization (ICAO). The budget request also continues to transfer to the Federal Aviation Administration technologies required to safely increase the use of the National Airspace System (NAS). In order to define future technology investments in this area, the Virtual Airspace Modeling and Simulation project will provide state-of-the-art models of the airspace system which have the capability to model the dynamic effects of interactive agents in the NAS. These models will provide the capability to assess the economic impact of new technologies on the operational performance of the NAS and thus guide future technology development. The budget request continues the Small Aircraft Transportation System (SATS) demonstration program. In 2003, SATS will select candidate technologies for experimental flight evaluation based on their impact on mobility—either through reduced system cost, improved doorstep-to-destination time, increased trip reliability, and/or improved safety—and complete initial lower landing minimum and higher volume flight experiments. Building on its altitude world-record-setting performances, the Environmental Research Aircraft and Sensor Technology (ERAST) project will demonstrate a solar power unpiloted air vehicle with the ability to fly 14 hours above 50,000 feet. The accomplishment of this goal could have significant impact on the application of these systems in disaster relief, communications, environmental sensing, and defense.

The second goal, Advance Space Transportation, will create a safe, affordable highway through the air and into space by improving safety, reliability, and operability, and 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 space transportation efforts, including Space Shuttle safety investments, the Space Launch Initiative (SLI), and 3rd Generation Space Transportation Technology. By investing in a sustained progression of research and technology development, NASA will enable future generations of reusable launch vehicles and in-space transportation systems that will surmount the Earth-to-orbit challenge and allow less costly, more frequent, and more reliable access to neighboring planets and the stars beyond. As planned in the 2002 Budget, the President's 2003 Budget request includes an increase in funding for the Space Launch Initiative (SLI), which supports the 2nd Generation Reusable Launch Vehicle (RLV) Program. In 2001, NASA awarded 23 contracts under the 2nd Generation RLV Program for study and risk reduction activities across many technical areas, including: airframes, vehicle subsystems, operations, integrated vehicle health management, flight mechanics, NASA-unique systems, and propulsion. In 2003, the Main Engine Prototype Critical Design Review and the Systems Requirements Review will be complete and the Architecture Systems Requirements Document will be baselined. Upon completion of these activities, NASA will

downselect to a minimum of two space transportation architectures for continued development based on their ability to meet safety and affordability goals. This selection will determine what architectures and critical technology developments will be continued through 2006. The successful completion of 2nd Generation RLV Program risk reduction and technology development will enable a mid-decade competition to transition all of NASA's launch needs, including human space flight, to safer, lower cost, commercially competitive, privately operated vehicles at the turn of the decade. In 3rd Generation Space Transportation Technology, the Department of Defense and NASA have collaborated on an integrated science and technology plan for hypersonics research, the National Hypersonic Science and Technology Plan (NHP), which defines a national effort to address numerous challenges. The plan addresses airbreathing propulsion or, in some cases, combined rocket/airbreathing (RBCC) or turbine/airbreathing propulsion (TBCC) cycles. While pure rockets have already achieved hypersonic speeds, airbreathing technologies could offer significant benefits over rocket propulsion in performance and cost. In 2003, NASA will complete the independent evaluation of three competing, revolutionary hypersonic propulsion technology systems demonstrations, including an RBCC engine, a TBCC engine and a scramjet engine.

The third goal, Pioneer Technology Innovation, 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 Administration's request includes a significant investment in computing and information technology developments and also increases investment in biotechnology and nanotechnology—the revolutionary technologies of the 21st Century. To ensure the highest quality research and strong ties to NASA's missions—Space Science, Earth Science, Biological and Physical Research, Human Space Flight, and Aerospace Technology—these investments will be guided by technology development agreements signed by customers in other NASA Enterprises.

Beginning in 2002, NASA will have the National Academy of Sciences undertake reviews of one of these three program areas—Revolutionize Aviation, Advance Space Transportation, and Pioneer Technology Innovation—every three years. These reviews will provide independent assessments of the quality of NASA's technology research and program planning, whether the research can be performed by universities or corporations outside NASA, and how well NASA's technology research integrates with customer needs. In each of these program areas, NASA will also seek to reduce institutional costs at it field centers so more funds can be invested in technology research through openly competed NASA research announcements and through university and industry partnerships.

The fourth goal, Commercialize Technology, extends 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.

Academic Programs.—Academic Programs has two components: (1) Education Program and (2) Minority University Program. Since the creation of NASA, the agency has made a substantial commitment to education. NASA's contribution to education has been and is based on the Agency's inspiring mission, specialized workforce, close working relationship with the research and education community, and unique world-class facilities. Based on these attributes, NASA has created a comprehensive education program containing a portfolio of activities directed toward education at all levels. The guidance for the Education Program stated in the NASA Strategic Plan: "Educational Excellence: We involve 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 students and educators to experience first hand involvement with NASA personnel, facilities, and research and development activities.

The Minority University Research Program has a goal to: expand NASA's research base by strengthening the research capabilities of minority universities and colleges; contribute to the scientific and technological workforce; and 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.

Together, these two components of the Academic Programs budget provide guidance for the Agency's interaction with both the formal and informal education community.

Object Classification (in millions of dollars)

Identification code 80–0110–0–1–999		2001 actual	2002 est.	2003 est.
	Direct obligations:			
	Personnel compensation:			
11.1	Full-time permanent		895	949
11.3	Other than full-time permanent		17	17
11.5	Other personnel compensation		20	26
11.8	Special personal services payments		2	2
11.9	Total personnel compensation		934	994
12.1	Civilian personnel benefits	58	273	293
21.0	Travel and transportation of persons		32	36
22.0	Transportation of things	4	5	5
23.1	Rental payments to GSA	1	11	11
23.3	Communications, utilities, and miscellaneous charges	74	102	93
24.0	Printing and reproduction	4	5	5
25.1	Advisory and assistance services	104	104	104
25.2	Other services	591	677	742
25.3	Other purchases of goods and services from Government accounts	256	293	321
25.4	Operation and maintenance of facilities	414	489	520
25.5	Research and development contracts	3,217	3,689	4,049
25.6	Medical care	1		
25.7	Operation and maintenance of equipment	81	93	102
26.0	Supplies and materials	120	137	151
31.0	Equipment	116	133	146
32.0	Land and structures	83	95	104
41.0	Grants, subsidies, and contributions	964	1,106	1,214
99.0	Direct obligations	6,088	8,178	8,890
99.0	Reimbursable obligations	517	598	632
99.9	Total new obligations	6,605	8,776	9,522

Personnel Summary

Identification code 80–0110–0–1–999		2001 actual	2002 est.	2003 est.
	Direct:			
1001	Total compensable workyears: Full-time equivalent employment		11,552	11,832
	Reimbursable:			
2001	Total compensable workyears: Full-time equivalent employment		67	63

General and special funds—Continued

MISSION SUPPORT

Program and Financing (in millions of dollars)

Identification code 80–0112–0–1–999		2001 actual	2002 est.	2003 est.
	Obligations by program activity:			
	Direct program:			
00.01	Safety, mission assurance, engineering, and advanced concepts	47	3	
00.02	Research and program management	2,316	50	
00.03	Construction of facilities	236	51	42
00.04	Space communication services	7		
01.00	Total direct program	2,606	104	42
09.01	Reimbursable program	59		
10.00	Total new obligations	2,665	104	42
	Budgetary resources available for obligation:			
21.40	Unobligated balance carried forward, start of year	136	146	42
22.00	New budget authority (gross)	2,661		
22.10	Resources available from recoveries of prior year obligations	16		
23.90	Total budgetary resources available for obligation	2,813	146	42
23.95	Total new obligations	−2,665	−104	−42
23.98	Unobligated balance expiring or withdrawn	−2		
24.40	Unobligated balance carried forward, end of year	146	42	
	New budget authority (gross), detail:			
	Discretionary:			
40.00	Appropriation	2,609		
40.77	Reduction pursuant to P.L. 106–554 (0.22 percent)	−6		
41.00	Transferred to other accounts	−1		
43.00	Appropriation (total discretionary)	2,602		
	Spending authority from offsetting collections:			
68.00	Offsetting collections (cash)	58		
68.10	Change in uncollected customer payments from Federal sources (unexpired)	1		
68.90	Spending authority from offsetting collections (total discretionary)	59		
70.00	Total new budget authority (gross)	2,661		
	Change in obligated balances:			
72.40	Obligated balance, start of year	623	623	188
73.10	Total new obligations	2,665	104	42
73.20	Total outlays (gross)	−2,646	−539	−81
73.40	Adjustments in expired accounts (net)	−7		
73.45	Recoveries of prior year obligations	−16		
74.00	Change in uncollected customer payments from Federal sources (unexpired)	−1		
74.10	Change in uncollected customer payments from Federal sources (expired)	6		
74.40	Obligated balance, end of year	623	188	149
	Outlays (gross), detail:			
86.90	Outlays from new discretionary authority	2,023		
86.93	Outlays from discretionary balances	625	539	81
87.00	Total outlays (gross)	2,646	539	81
	Offsets:			
	Against gross budget authority and outlays:			
	Offsetting collections (cash) from:			
88.00	Federal sources	−57		
88.40	Non-Federal sources	−5		
88.90	Total, offsetting collections (cash)	−62		
	Against gross budget authority only:			
88.95	Change in uncollected customer payments from Federal sources (unexpired)	−1		
88.96	Portion of offsetting collections (cash) credited to expired accounts	4		
	Net budget authority and outlays:			
89.00	Budget authority	2,602		
90.00	Outlays	2,584	539	81

In 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.

Since 2002, NASA has implemented 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 stepwise 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 eqivalent (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.

Beginning in 2002, there is no longer 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.

Performance Objectives

Research and program management.—In 2001, this activity provided 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 2001, this activity provided 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		2001 actual	2002 est.	2003 est.
	Direct obligations:			
	Personnel compensation:			
11.1	Full-time permanent	1,340		
11.3	Other than full-time permanent	26		

11.5	Other personnel compensation	32		
11.8	Special personal services payments	12		
11.9	Total personnel compensation	1,410		
12.1	Civilian personnel benefits	314		
13.0	Benefits for former personnel	2		
21.0	Travel and transportation of persons	52		
22.0	Transportation of things	6		
23.1	Rental payments to GSA	18		
23.3	Communications, utilities, and miscellaneous charges	28	4	
24.0	Printing and reproduction	6	1	
25.1	Advisory and assistance services	20	1	
25.2	Other services	236	26	
25.3	Other purchases of goods and services from Government accounts	39	3	
25.4	Operation and maintenance of facilities	123	16	
25.5	Research and development contracts	74	15	
25.6	Medical care	7	1	
25.7	Operation and maintenance of equipment	38	10	
26.0	Supplies and materials	18	4	
31.0	Equipment	6	5	
32.0	Land and structures	201	17	42
41.0	Grants, subsidies, and contributions	7	1	
42.0	Insurance claims and indemnities	1		
99.0	Direct obligations	2,606	104	42
99.0	Reimbursable obligations	59		
99.9	Total new obligations	2,665	104	42

Personnel Summary

Identification code 80–0112–0–1–999	2001 actual	2002 est.	2003 est.
Direct:			
1001 Total compensable workyears: Full-time equivalent employment	18,412		
Reimbursable:			
2001 Total compensable workyears: Full-time equivalent employment	98		

Space Flight, Control and Data Communications

Program and Financing (in millions of dollars)

Identification code 80–0105–0–1–252	2001 actual	2002 est.	2003 est.
Change in obligated balances:			
72.40 Obligated balance, start of year	1		
73.20 Total outlays (gross)	−1		
Outlays (gross), detail:			
86.93 Outlays from discretionary balances	1		
Net budget authority and outlays:			
89.00 Budget authority			
90.00 Outlays	1		

Since 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	2001 actual	2002 est.	2003 est.
Obligations by program activity:			
10.00 Total new obligations (object class 32.0)	2		
Budgetary resources available for obligation:			
21.40 Unobligated balance carried forward, start of year	7	5	7
23.95 Total new obligations	−2		
24.40 Unobligated balance carried forward, end of year	5	7	7
Change in obligated balances:			
72.40 Obligated balance, start of year	12	6	
73.10 Total new obligations	2		
73.20 Total outlays (gross)	−7	−6	
73.40 Adjustments in expired accounts (net)	−1		
74.40 Obligated balance, end of year	6		
Outlays (gross), detail:			
86.93 Outlays from discretionary balances	7	6	
Net budget authority and outlays:			
89.00 Budget authority			
90.00 Outlays	7	6	

Since 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.

Office of Inspector General

For necessary expenses of the Office of Inspector General in carrying out the Inspector General Act of 1978, as amended, [$23,700,000] *$25,600,000. (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 2002; additional authorizing legislation required.)*

Program and Financing (in millions of dollars)

Identification code 80–0109–0–1–252	2001 actual	2002 est.	2003 est.
Obligations by program activity:			
10.00 Total new obligations (object class 12.1)	24	25	26
Budgetary resources available for obligation:			
22.00 New budget authority (gross)	24	25	26
23.95 Total new obligations	−24	−25	−26
New budget authority (gross), detail:			
Discretionary:			
40.00 Appropriation	24	25	26
Change in obligated balances:			
72.40 Obligated balance, start of year	2	3	3
73.10 Total new obligations	24	25	26
73.20 Total outlays (gross)	−23	−25	−26
74.40 Obligated balance, end of year	3	3	3
Outlays (gross), detail:			
86.90 Outlays from new discretionary authority	21	22	23
86.93 Outlays from discretionary balances	2	3	3
87.00 Total outlays (gross)	23	25	26
Net budget authority and outlays:			
89.00 Budget authority	24	25	26
90.00 Outlays	23	25	26

Budget Authority and Outlays Excluding Full Funding for Federal Retiree Costs (in millions of dollars)

	2001 actual	2002 est.	2003 est.
Net budget authority and outlays:			
89.00 Budget authority	23	24	25
90.00 Outlays	22	24	25

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.

Object Classification (in millions of dollars)

Identification code 80–0109–0–1–252	2001 actual	2002 est.	2003 est.
11.1 Personnel compensation: Full-time permanent	16	17	18
12.1 Civilian personnel benefits	6	6	6
21.0 Travel and transportation of persons	1	1	1
26.0 Supplies and materials	1	1	1
99.9 Total new obligations	24	25	26

General and special funds—Continued

OFFICE OF INSPECTOR GENERAL—Continued

Personnel Summary

Identification code 80–0109–0–1–252	2001 actual	2002 est.	2003 est.
1001 Total compensable workyears: Full-time equivalent employment	201	213	213

Trust Funds

SCIENCE, SPACE, AND TECHNOLOGY EDUCATION TRUST FUND

Unavailable Collections (in millions of dollars)

Identification code 80–8978–0–7–503	2001 actual	2002 est.	2003 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	2001 actual	2002 est.	2003 est.
Obligations by program activity:			
10.00 Total new obligations (object class 41.0)	1	1	1
Budgetary resources available for obligation:			
22.00 New budget authority (gross)	1	1	1
23.95 Total new obligations	−1	−1	−1
New budget authority (gross), detail:			
Mandatory:			
60.26 Appropriation (trust fund)	1	1	1
Change in obligated balances:			
73.10 Total new obligations	1	1	1
73.20 Total outlays (gross)	−1	−1	−1
Outlays (gross), detail:			
86.97 Outlays from new mandatory authority	1	1	1
Net budget authority and outlays:			
89.00 Budget authority	1	1	1
90.00 Outlays	1	1	1
Memorandum (non-add) entries:			
92.01 Total investments, start of year: Federal securities: Par value	15	15	15
92.02 Total investments, end of year: Federal securities: Par value	15	15	15

NATIONAL SPACE GRANT PROGRAM

Unavailable Collections (in millions of dollars)

Identification code 80–8977–0–7–252	2001 actual	2002 est.	2003 est.
01.99 Balance, start of year			
Receipts:			
02.00 Gifts and donations	3		
Appropriations:			
05.00 National space grant program gift fund	−3		
07.99 Balance, end of year			

Program and Financing (in millions of dollars)

Identification code 80–8977–0–7–252	2001 actual	2002 est.	2003 est.
Obligations by program activity:			
10.00 Total new obligations (object class 41.0)		3	
Budgetary resources available for obligation:			
21.40 Unobligated balance carried forward, start of year		3	
22.00 New budget authority (gross)	3		
23.90 Total budgetary resources available for obligation	3	3	
23.95 Total new obligations		−3	
24.40 Unobligated balance carried forward, end of year	3		
New budget authority (gross), detail:			
Mandatory:			
60.26 Appropriation (trust fund)	3		
Change in obligated balances:			
73.10 Total new obligations		3	
73.20 Total outlays (gross)		−3	
Outlays (gross), detail:			
86.98 Outlays from mandatory balances		3	
Net budget authority and outlays:			
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" 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 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" by this appropriations Act, the amounts appropriated for construction of facilities shall remain available until September 30, [2004] *2005*.

Notwithstanding the limitation on the availability of funds appropriated for "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, [2002] *2003* 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.

[No funds in this Act or any other appropriations Act may be used to finalize an agreement prior to December 1, 2002 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, 2002.)*