

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Federal Funds

General and special funds:

HUMAN SPACE FLIGHT

For necessary expenses, not otherwise provided for, in the conduct and support of human space flight research and development activities, including research, development, operations, and services; maintenance; construction of facilities including repair, rehabilitation, and modification of real and personal property, and acquisition or condemnation of real property, as authorized by law; space flight, spacecraft control and communications activities including operations, production, and services; and purchase, lease, charter, maintenance and operation of mission and administrative aircraft, **[\$5,506,500,000]** \$5,511,000,000, to remain available until September 30, **[1999: Provided, That of the \$2,351,300,000 made available under this heading for Space Station activities, only \$1,500,000,000 shall be available before March 31, 1998]** 2000.

For necessary expenses of the International Space Station, to become available on October 1 of the fiscal year specified and remain available for that and the following fiscal year, as follows: for fiscal year 2000, \$2,134,000,000; for fiscal year 2001, \$1,933,000,000; for fiscal year 2002, \$1,766,000,000; for fiscal year 2003, \$1,546,000,000; for fiscal year 2004, \$350,000,000. (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1998.)

Program and Financing (in millions of dollars)

Identification code 80-0111-0-1-252	1997 actual	1998 est.	1999 est.
Obligations by program activity:			
Direct program:			
00.01 Space station	2,088	2,273	2,272
00.02 US/Russian cooperation and program assurance	230	137	3
00.03 Payload and utilization operations	267	325	184
00.04 Space shuttle	3,001	2,849	3,052
09.01 Reimbursable program	69	71	200
10.00 Total obligations	5,655	5,655	5,711
Budgetary resources available for obligation:			
21.40 Unobligated balance available, start of year:			
Uninvested	222	226	149
22.00 New budget authority (gross)	5,609	5,578	5,711
22.22 Unobligated balance transferred from other accounts	50		
23.90 Total budgetary resources available for obligation	5,881	5,804	5,860
23.95 New obligations	-5,655	-5,655	-5,711
24.40 Unobligated balance available, end of year:			
Uninvested	226	149	149
New budget authority (gross), detail:			
Current:			
40.00 Appropriation	5,363	5,507	5,511
42.00 Transferred from other accounts	177		
43.00 Appropriation (total)	5,540	5,507	5,511
Permanent:			
Spending authority from offsetting collections:			
68.00 Offsetting collections (cash)	84	71	200
68.10 Change in orders on hand from Federal sources	-15		
68.90 Spending authority from offsetting collections (total)	69	71	200
70.00 Total new budget authority (gross)	5,609	5,578	5,711
Change in unpaid obligations:			
Unpaid obligations, start of year:			
72.40 Obligated balance: Uninvested	1,770	1,700	1,708
72.95 Orders on hand from Federal sources	48	33	33
72.99 Total unpaid obligations, start of year	1,818	1,733	1,741
73.10 New obligations	5,655	5,655	5,711
73.20 Total outlays (gross)	-5,740	-5,647	-5,674
73.40 Adjustments in expired accounts	-1		

Unpaid obligations, end of year:			
74.40 Obligated balance: Uninvested	1,700	1,708	1,745
74.95 Orders on hand from Federal sources	33	33	33
74.99 Total unpaid obligations, end of year	1,733	1,741	1,778
Outlays (gross), detail:			
86.90 Outlays from new current authority	3,808	3,651	3,654
86.93 Outlays from current balances	1,865	1,925	1,820
86.97 Outlays from new permanent authority	33	71	200
86.98 Outlays from permanent balances	34		
87.00 Total outlays (gross)	5,740	5,647	5,674
Offsets:			
Against gross budget authority and outlays:			
Offsetting collections (cash) from:			
88.40 Non-Federal sources	-35	-15	-11
88.45 Offsetting governmental collections	-49	-56	-189
88.90 Total, offsetting collections (cash)	-84	-71	-200
88.95 Change in orders on hand from Federal sources	15		
Net budget authority and outlays:			
89.00 Budget authority	5,540	5,507	5,511
90.00 Outlays	5,656	5,576	5,474

This appropriation provides funding for human space flight activities, including development of the Space Station, the Space Station research program, and operation of the Space Shuttle. This includes support of planned cooperative activities with Russia, upgrades to the performance and safety of the Space Shuttle, and required construction projects in direct support of Space Station and Space Shuttle programs.

Performance Objectives

Space Station.—The Space Station will be 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 micro-gravity 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 multi-year funding through an advanced appropriation for the complete development of the Station with Station assembly beginning in mid-1998 and finishing by the end of 2003. With the first launch to assemble this unique orbital laboratory only a few months away, the budget includes sufficient funding to keep subsequent assembly missions on schedule and provide a long-term solution to the safe return of the full complement of Station crewmembers.

In 1997, node and laboratory module fabrication were completed, the node was delivered to the launch site, and qualification testing of flight hardware components continued. Activities are well underway to support crew training, payload processing, and hardware element processing requirements. In 1998, continued fabrication of flight hardware, qualification testing, and assembly and integration will be the focus of the program. First element launch is scheduled for the summer of 1998. In 1999, plans are to complete phase 2 (the first ten assembly flights) of the Station.

U.S./Russian Cooperation and Program Assurance.—As part of an operating plan approved in May 1997, the U.S./Russian budget line was discontinued, and a new budget line entitled U.S./Russian Cooperation and Program Assurance was established. It includes two activities, U.S./Russian Cooperation and Russian Program Assurance (RPA). U.S./Rus-

General and special funds—Continued

HUMAN SPACE FLIGHT—Continued

sian Cooperation continues the support to the Russian Space Agency, including the cooperative use of Mir. The RPA budget was established to implement contingency plans in response to the slippage of the Russian service module (SM) to the Space Station, from May 1998 to December 1998. The United States and Russia are continuing a program of joint space missions. In 1997, three Shuttle flights to Mir took place, highlighted by the continual presence of American astronauts aboard the Mir conducting scientific research. Flight hardware to conduct experiments has been and will continue to be placed on the Mir. These flights provide valuable opportunities to gain experience in working with our Russian partners, which will be crucial to the success of building and operating the International Space Station (ISS). Two additional flights are planned in FY 1998, completing phase I of this cooperative precursor to Space Station.

The RPA provides contingency planning funds to address ISS program requirements resulting from delays on the part of Russia in meeting its commitments to the ISS program. The first step in the contingency plan is to protect against a potential further delay in the SM. The ISS program is purchasing, from the U.S. Naval Research Laboratory (NRL), an interim control module (ICM) to provide attitude control and reboost functions for continuation of the ISS assembly sequence in case the Russian SM is launched later than December 1998. The NRL's ICM will be prepared for a February 1999 launch and will be attached to the back of the Russian built functional cargo block (FGB). If the SM is launched in December 1998, the ICM will be reconfigured to be attached to the SM. The ICM would then be able to dock to the back of the SM in 1999 to back up any shortfall of Russian Progress fuel resupply vehicles.

Payload and Utilization Operations.—These funds will support the mission planning and hardware preparation activities required to support the payload and experiment infrastructure, including the Spacelab. In 1997–1998, 3 module missions (MSL–1 reflight and Neurolab) will be flown, along with 2 pallet missions. The Spacelab program is scheduled to be terminated in 1998, following the Neurolab mission. In FY 1999, one (Spacelab) science mission will be supported, in addition to seven assembly flights for the ISS.

Activities funded by the Payload Processing budget support the technical expertise and facilities necessary to perform payload buildup, test and checkout, integration, servicing, transportation and installation into the launch vehicle. In FY 1998, over 20 major and secondary payloads will be supported; in FY 1999, a similar number will be supported, including major hardware for ISS assembly. Advanced Projects pursues advanced technology developments for future human space flight requirements. Under this program, the X–38 experimental vehicle is being designed to demonstrate the technology and processes required to produce a crew return vehicle for the ISS. Beginning in FY 1999, funding for Advanced Projects other than X–38 and X–38 transition costs, will be terminated. The Engineering and Technical Base provides basic engineering and technical capabilities to support the NASA mission assigned to the programs carried out by the Human Space Flight Centers. These funds support a core environment dedicated to multiprogram laboratories, test facilities and associated systems, including a skill base to respond to research, testing and simulations.

Space Shuttle.—The Space Shuttle is a partially reusable space vehicle that provides several unique capabilities to the United States space program. These include launching spacecraft and retrieving payloads from orbit for reuse, servicing and repairing satellites in space, safely transporting humans to and from space, and operating and returning space labora-

tories. In FY 1998, six missions are planned, including the final two flights to the Russian Mir Space Station, and the initial assembly flight for the ISS. Activities supporting consolidation of Shuttle contracts into one Space Flight Operations contract were completed in FY 1996. This will result in significant reductions in the cost of operating the Space Shuttle through FY 2000 and beyond, with no impact on safety, performance or schedule.

In 1999, eight shuttle flights are planned, seven of which are in support of ISS assembly. Upgrades to the shuttle to increase its reliability and maintainability will be continued. Major Shuttle upgrades, including the Super Light Weight Tank and the Alternate Turbo Pump, will be completed with initial flights planned to occur in 1998.

Object Classification (in millions of dollars)

Identification code 80–0111–0–1–252	1997 actual	1998 est.	1999 est.
Direct obligations:			
22.0 Transportation of things	3	3	3
23.3 Communications, utilities, and miscellaneous charges	63	63	62
24.0 Printing and reproduction	4	4	4
25.1 Advisory and assistance services	1,197	1,197	1,181
25.2 Other services	308	308	304
25.3 Purchases of goods and services from Government accounts	128	128	126
25.4 Operation and maintenance of facilities	91	91	90
25.5 Research and development contracts	3,480	3,478	3,433
26.0 Supplies and materials	92	92	91
31.0 Equipment	85	85	84
32.0 Land and structures	131	131	129
41.0 Grants, subsidies, and contributions	4	4	4
99.0 Subtotal, direct obligations	5,586	5,584	5,511
99.0 Reimbursable obligations	69	71	200
99.9 Total obligations	5,655	5,655	5,711

SCIENCE, AERONAUTICS AND TECHNOLOGY

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, and services; maintenance; construction of facilities including repair, rehabilitation, and modification of real and personal property, and acquisition or condemnation of real property, as authorized by law; space flight, spacecraft control and communications activities including operations, production, and services; and purchase, lease, charter, maintenance and operation of mission and administrative aircraft, **[\$5,690,000,000] \$5,457,400,000**, to remain available until September 30, **[1999] 2000**. (*Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1998.*)

Program and Financing (in millions of dollars)

Identification code 80–0110–0–1–999	1997 actual	1998 est.	1999 est.
Obligations by program activity:			
Direct program:			
00.01 Space science	2,039	2,093	2,057
00.02 Life and microgravity science	396	249	240
00.06 Earth science	1,403	1,597	1,374
00.07 Mission communication services	428	387	381
00.08 Academic programs	134	155	102
00.09 Aeronautics and space transportation technology	1,409	1,424	1,314
09.01 Reimbursable program	440	643	653
10.00 Total obligations	6,249	6,548	6,121
Budgetary resources available for obligation:			
21.40 Unobligated balance available, start of year:			
Uninvested	1,186	508	283
22.00 New budget authority (gross)	6,030	6,323	6,110
22.21 Unobligated balance transferred to other accounts	–94		
22.30 Unobligated balance expiring	–365		
23.90 Total budgetary resources available for obligation	6,757	6,831	6,393
23.95 New obligations	–6,249	–6,548	–6,121

24.40	Unobligated balance available, end of year:			
	Uninvested	508	283	272
New budget authority (gross), detail:				
Current:				
40.00	Appropriation	5,767	5,690	5,457
40.79	Line item veto cancellation		-10	
41.00	Transferred to other accounts	-177		
43.00	Appropriation (total)	5,590	5,680	5,457
50.00	Reappropriation		365	
50.35	Reappropriation rescinded		-365	
53.00	Reappropriation (total)			
Permanent:				
Spending authority from offsetting collections:				
68.00	Offsetting collections (cash)	451	643	653
68.10	Change in orders on hand from Federal sources	-11		
68.90	Spending authority from offsetting collections (total)	440	643	653
70.00	Total new budget authority (gross)	6,030	6,323	6,110
Change in unpaid obligations:				
Unpaid obligations, start of year:				
72.40	Obligated balance: Uninvested	3,316	3,222	3,537
72.95	Orders on hand from Federal sources	316	305	305
72.99	Total unpaid obligations, start of year	3,632	3,527	3,842
73.10	New obligations	6,249	6,548	6,121
73.20	Total outlays (gross)	-6,340	-6,233	-6,308
73.40	Adjustments in expired accounts	-15		
Unpaid obligations, end of year:				
74.40	Obligated balance: Uninvested	3,222	3,537	3,350
74.95	Orders on hand from Federal sources	305	305	305
74.99	Total unpaid obligations, end of year	3,527	3,842	3,655
Outlays (gross), detail:				
86.90	Outlays from new current authority	2,535	2,408	2,314
86.93	Outlays from current balances	3,380	3,182	3,341
86.97	Outlays from new permanent authority	111	643	653
86.98	Outlays from permanent balances	316		
87.00	Total outlays (gross)	6,340	6,233	6,308
Offsets:				
Against gross budget authority and outlays:				
Offsetting collections (cash) from:				
88.40	Non-Federal sources	-22	-47	-29
88.45	Offsetting governmental collections	-429	-596	-624
88.90	Total, offsetting collections (cash)	-451	-643	-653
88.95	Change in orders on hand from Federal sources	11		
Net budget authority and outlays:				
89.00	Budget authority	5,590	5,680	5,457
90.00	Outlays	5,889	5,590	5,655

This appropriation provides for the research and development activities of the National Aeronautics and Space Administration. Funds are included for the construction, maintenance, and operation of programmatic facilities.

Funding for Space Science, Earth Science, Aeronautics and Space Transportation Technology is proposed as part of the Research Fund for America. This proposal highlights the Administration's priority to providing needed and sustained investments in important Federal research programs on a deficit neutral basis. A discussion of the Research Fund for America, and two other funds for the environment and transportation, can be found in Section II of the *Budget* volume.

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 flight missions which provide major space-based facilities. In 1997, highlights included the July 4 landing of the Pathfinder spacecraft on Mars, the first Mars landing since the Viking missions in 1976 and the first ever to use air bags to cushion impact on the surface. Shortly after Pathfinder's landing, the Sojourner rover began its own exploration of nearby rocks and other features. The images from both craft were posted to the Internet, where more than 500 million "hits" were recorded by the end of July. The international Cassini mission left Earth bound for Saturn on October 15, 1997. With the European Space Agency's Huygens probe and a high-gain antenna provided by the Italian Space Agency, Cassini will arrive at Saturn July 1, 2004. Also, astronauts flawlessly performed major maintenance and upgrades to the orbiting Hubble Space Telescope, replacing older hardware with two dramatically improved instruments that are helping astronomers probe the universe in greater detail than ever before. This year, Hubble uncovered over 1,000 bright, young star clusters bursting to life in a brief, intense, brilliant "fireworks show" at the heart of a nearby pair of colliding galaxies. The Hubble image of the galactic collision was printed on the front pages of newspapers around the world as well as on the cover of Newsweek magazine. Images captured during Galileo's closest flyby of Europa on February 20 showed features of the Jovian moon, lending credence to the possibility of hidden, subsurface oceans. The findings generated new questions about the possibility of life on Europa. Scientists using the joint European Space Agency/NASA Solar and Heliospheric Observatory (SOHO) spacecraft have discovered "jet streams" or "rivers" of hot, electrically charged plasma flowing beneath the surface of the sun. These new findings will help scientists understand the famous 11-year sunspot cycle and associated increases in solar activity that can disrupt the Earth's power and communications systems.

To capitalize on these enormous successes during the past year, the NASA budget request for FY 1999 once again highlights Space Science. Space Science continues to focus on the Origins program and fundamental questions regarding the creation of the universe and planetary systems and the possibility of life beyond Earth. In addition to planning for the deployment of powerful telescopes to detect Earth-like planets elsewhere in our galaxy, planning has begun for a Europa mission to launch in 2003 to directly observe potential subsurface oceans on Europa, and the Mars Surveyor Program is augmented to enhance the Mars 2001 lander. NASA will also initiate a series of Solar-Terrestrial Probes to track solar phenomena and their impact on the Earth, and initiate mission development for a gamma-ray telescope to understand the final stages of stars' lives and to seek out the most extreme environments in the universe.

Development activities will continue in 1998-1999 on the Advance X-ray Astrophysics Facility (AXAF) in support of a launch in early FY 1999. Development activities continue on the Relativity (Gravity Probe-B) mission, which remains on schedule for launch in 2000. The Space Infrared Telescope Facility (SIRTF) initiates development in April 1998, with launch planned for December 2001. Development activities on the Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics (TIMED) mission began in 1997, with launch planned in 2000. Development activities on the Stratospheric Observatory for Infrared Astronomy (SOFIA) continue to receive support. The Second Hubble Space Telescope (HST) servicing mission in February 1997 provided two new science instruments and other servicing, and the upgraded telescope is providing new insights into our universe by investigating objects in the near-infrared portion of the electromagnetic spectrum. Funding for HST continues to support operations, as well as preparation for the third servicing mission in 1999. Galileo's highly successful tour of Jupiter and its moons has

General and special funds—Continued

SCIENCE, AERONAUTICS AND TECHNOLOGY—Continued

been extended through 1999, with a focus on the moons Europa and Io.

In Explorer missions, the Advanced Composition Explorer (ACE) was launched in August 1997 and development activities continue on the Far Ultraviolet Spectroscopy Explorer (FUSE) for a launch in 1998. Development is also underway for the Microwave Anisotropy Probe (MAP) and Imager for Magnetosphere-to-Aurora Global Exploration (IMAGE) Medium-Class Explorer (MIDEX) missions. Three new Small (SMEX) missions were selected in 1997: the High Energy Spectroscopic Imager (HESSI) is to launch in 2000; the Galaxy Evolution Explorer (GALEX) will launch in 2001; the Two Wide-Angle Neutral-Atom Spectrometers (TWINS) has been selected as a mission of opportunity, to be launched in 2001 or 2003 aboard a currently undesignated U.S. Government mission. These missions emphasize reduced mission costs and accelerated launch schedules.

The Mars Global Surveyor entered Mars orbit in September 1997, and funds are requested for the development of future Mars missions in 1998 and beyond. The third Discovery-class mission, Lunar Prospector, launched in January 1998, the fourth, the Stardust mission, is to be launched in 1999. Two new Discovery missions were selected in 1997: the Comet Nucleus Tour (CONTOUR) to be launched in 2002; and Genesis, a solar wind sample return mission, to be launched in 2001. The New Millennium program is underway to provide flight demonstrations of critical new technologies which will greatly reduce the mass and cost of future science instruments and spacecraft subsystems, while maintaining or improving mission capabilities. Development activities continue on the Deep Space-1 and Deep Space-2 missions, scheduled for launch in July 1998 and January 1999, respectively.

The Space Science program is responsible for Agency-wide core technology development. Space Science is also undertaking an aggressive technology development effort to enable new missions to the outer planets, and to search for Earth-like planets around nearby stars. New technologies are also being pursued to enhance our capability to explore Mars robotically, and perhaps to confirm the past or current presence of life on that planet.

Life and Microgravity Science.—This program uses the microgravity environment of space to conduct basic and applied research to understand the effect of gravity on living systems and to conduct research in the areas of fluid physics, materials science and biotechnology. In addition to conducting basic and applied research, this program provides the opportunity to refine the definition, design, and development of experiment hardware planned for use on the ISS. In FY 1998 five Shuttle missions involving Life and Microgravity Science are planned, including the USMP-4 mission and Neurolab, the final Spacelab series flight. The final two NASA/Mir missions are planned for 1998. The NASA/NIH Neurolab mission will continue the agency's efforts to expand its collaborative activities with the National Institutes of Health and other Federal agencies to maximize the return on science investments. In FY 1999, as assembly of the ISS continues, the program will fly one science mission (STS-95) on a Spacelab carrier with ISS precursor science experiments. The U.S. Laboratory will be launched for ISS mid-year, which will allow Life and Microgravity hardware and experiments to be established aboard the ISS and will begin a new era of research.

Earth Science.—The purpose of NASA's Earth Science (ES) enterprise is to understand the total Earth system and the effects of natural and human-induced changes on the global environment. ES is pioneering the new interdisciplinary field of research called Earth system science, which recognizes that the Earth's land surface, oceans, atmosphere, ice sheets and

biota are both dynamic and highly interactive. Earth system science is an area of research with the potential for immense benefit to the nation, yielding new knowledge and tools for weather forecasting, agriculture, urban and land use planning, and other areas of economic and environmental importance. In concert with other agencies and the global research community, ES is providing the scientific foundation needed for the complex policy choices that lie ahead on the road to sustainable development. ES has established three broad goals to fulfill its purpose: (1) expand scientific knowledge of the Earth system using NASA's unique capabilities from the vantage points of space, aircraft and *in situ* platforms; (2) disseminate information about the Earth system; and, (3) enable productive use of ES science and technology in the public and private sectors.

The Earth Observing System (EOS), the centerpiece of Earth Science, is a program of multiple spacecraft missions (the AM, PM, Chemistry series, Landsat 7, and others) and interdisciplinary science investigations aimed at providing a 15-year data set of key parameters needed to understand global climate change. The first EOS satellite launches will be in 1998. Preceding EOS are a number of individual satellite and Shuttle-based missions which are helping to reveal basic processes. The Upper Atmosphere Research Satellite, launched in 1991, collects data on atmospheric chemistry. The Total Ozone Mapping Spectrometer instrument, launched in 1978 and 1991, measures ozone distribution and depletion. Two total ozone mapping spectrometer instruments were launched in 1996, one on the Japanese Advanced Earth Observing System (ADEOS) mission and the other on a dedicated U.S. Earth probe. France and the U.S. collaborated on the Ocean Topography Experiment (TOPEX/Poseidon), launched in 1992, to study ocean topography and circulation. The NASA scatterometer, also launched on the Japanese ADEOS in 1996, provided 10 months of ocean winds data. The failure of Japan's ADEOS satellite meant the loss of the NASA scatterometer (as well as one of the two TOMS). NASA will launch QUIKSCAT in November 1998 to minimize the loss of ocean winds data. In 1997 the Tropical Rainfall Measuring Mission (TRMM) began measuring tropical precipitation. Complementing EOS will be a series of small, rapid development Earth System Science Pathfinders (ESSP). Data from ES will be captured from the satellites, processed into useful data products, and broadly distributed by the EOS Data and Information System (EOSDIS). In FY 1997, NASA initiated a data purchase program designed to acquire data sets from private sources that are necessary to accomplish the broad research goals of Earth system science. The ES science program is essential to the discovery of new concepts and to the design of future missions. The ES research is coordinated through the U.S. Global Change Research Program (USGCRP), the Committee on the Environment and Natural Resources (CENR) Subcommittee on Global Change Research, and the various boards and committees at the National Academy of Sciences.

Aeronautics and Space Transportation Technology.—The goal of this Enterprise is to pioneer long-term high risk, high payoff technologies that are effectively transferred to industry and government. This Enterprise has developed dramatic technology goals which are grouped into three areas: global civil aviation, revolutionary technology leaps, and access to space. These technology goals reflect the national priorities for aeronautics and space.

Within Aeronautics, the High-Speed Research program continued to develop technologies to establish the viability of an economical and environmentally sound High Speed Civil Transport. This vehicle—if built by U.S. industry—could promote U.S. leadership in long-range commercial air travel markets of the next century. Development of this vehicle could offer returns of \$200 billion in sales and 140,000 high-quality

jobs for the United States. In FY 1997, a two-dimensional bifurcated inlet concept and a center-stick flight controller concept were selected for further research and evaluation. In FY 1999, funding is included to extend High-Speed Research to mitigate risk in two critical areas—propulsion and airframe materials and structures. In FY 1997, the Advanced Subsonic Technology program completed the set of National Airspace System operational scenarios in support of aviation capacity research. In FY 1998, the Aging Aircraft element will be completed with the field demonstrations on non-destructive evaluation prototypes that can locate cracks, corrosion and disbands in aircraft fuselages. Funding is included to continue development of high payoff technologies that enable a safe, highly productive global air transportation system with reduced environmental impact.

The High Performance Computing and Communications program demonstrated significant reductions in cost and time in performing three-dimensional aerodynamic simulations that reduced the development time for an extremely fuel-efficient, high pressure compressor by 50%. In FY 1998, this program's NASA Research & Education Network (NREN) begins activities supporting development of the Next Generation Internet (NGI) to increase quality, security and certainty of Internet transmissions on a network capable of 1,000 times the capacity of the 1996 baseline. This initiative will involve several Federal agencies, including the Departments of Defense, Energy and Commerce, the National Science Foundation, and NASA. In FY 1997, research activities within the research and technology base developed innovative concepts, explored new areas of theory and created the computational models of the aeronautical principles that lead to more efficient design and operation of advanced aerospace systems. In FY 1998, the safety research will be initiated in support of the Administration's Aviation Safety initiative and in FY 1999, the research and technology base will continue to develop advanced concepts and technologies that will allow safe, economical and environmentally compatible air transportation systems.

The Space Transportation Technology program is developing new technologies aimed at revitalizing access to space. The technologies targeted will reduce launch costs dramatically over the next decade, and increase the safety and reliability of current and future generation launch systems. In 1997, the Reusable Launch Vehicle (RLV) program continued to pursue technology development, design and business planning activities in support of next-generation reusable systems, on the X-33 and X-34 flight demonstrators. The X-33 and X-34 have completed their critical design reviews and initiated fabrication of flight hardware. Funding for the RLV program in 1998 and 1999 is included to continue X-33 and X-34 technology development, hardware fabrication and test, in preparation for the flight of the technology demonstrators, both of which will fly in 1999. The Advanced Space Transportation Program (ASTP) is developing key technologies to dramatically reduce space transportation costs across the mission spectrum. ASTP will focus on technological advances with the potential of reducing launch costs beyond RLV goals, as well as on developing technology required to support NASA strategic needs that are not currently addressed by RLV. Industry-led Future Space Launch trade studies in 1999 and 2000 will support an end-of-the-decade decision called for in the National Space Transportation Policy on the development of an operational launch system to reduce NASA's launch costs. \$760 million in placeholder funds are set aside in the outyears to pursue existing, planned or new vehicles in response to this decision.

The Commercial Technology Program's focus in FY 1997 has been to invest 10–15 percent of the NASA R&D budget in commercial partnerships with industry. 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 strengthen the international competitiveness of key industry sectors. In FY 1997 and 1998, the program will emphasize increasing commercial partnerships with industry and continue to refine and expand a technology and partnership database.

Mission Communication Services.—The primary goal of this operational program is to provide highly reliable, cost-effective telecommunications services in support of NASA's science and aeronautics programs. Other U.S. agencies, international space-faring agencies, and U.S. commercial enterprises are supported on a reimbursable basis. Ground network, space network, and mission systems are provided under this program in support of planetary, deep space, Earth-orbiting, aeronautics, and suborbital systems.

Academic Programs.—The goal of this program is to promote excellence in America's education system through enhancing and expanding scientific and technological competence. NASA's education programs span from the elementary through graduate levels, and are directed at students and faculty. The goal of the Minority University Research Program is to expand opportunities for talented students from underrepresented groups who are pursuing degrees in science and engineering, and to strengthen the research capabilities of minority universities and colleges. 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.

Object Classification (in millions of dollars)

Identification code 80-0110-0-1-999	1997 actual	1998 est.	1999 est.
Direct obligations:			
22.0 Transportation of things	4	4	4
23.1 Rental payments to GSA	1	1	1
23.2 Rental payments to others			1
23.3 Communications, utilities, and miscellaneous charges	81	82	76
24.0 Printing and reproduction	5	5	5
25.1 Advisory and assistance services	669	680	630
25.2 Other services	807	820	760
25.3 Purchases of goods and services from Government accounts	259	263	244
25.4 Operation and maintenance of facilities	67	68	63
25.5 Research and development contracts	3,000	3,050	2,824
25.7 Operation and maintenance of equipment	133	135	125
26.0 Supplies and materials	61	62	57
31.0 Equipment	199	202	187
32.0 Land and structures	37	38	35
41.0 Grants, subsidies, and contributions	486	495	457
99.0 Subtotal, direct obligations	5,809	5,905	5,468
99.0 Reimbursable obligations	440	643	653
99.9 Total obligations	6,249	6,548	6,121

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; space communications activities including operations, production and services; maintenance; construction of facilities including repair, rehabilitation, and modification of facilities, minor 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 \$35,000 for official reception and representation expenses; and purchase (not to exceed 33 for replacement only) and hire of passenger motor vehicles;

General and special funds—Continued

MISSION SUPPORT—Continued

[\$2,433,200,000] \$2,476,600,000, to remain available until September 30, [1999] 2000. (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1998.)

Program and Financing (in millions of dollars)

Identification code 80-0112-0-1-999	1997 actual	1998 est.	1999 est.
Obligations by program activity:			
Direct program:			
00.01 Safety, reliability and quality assurance	41	37	36
00.02 Space communication services	287	210	179
00.03 Research and program management	2,059	2,093	2,095
00.04 Construction of facilities	166	153	150
01.00 Total direct program	2,553	2,493	2,460
09.01 Reimbursable program	133	122	132
10.00 Total obligations	2,686	2,615	2,592
Budgetary resources available for obligation:			
21.40 Unobligated balance available, start of year:			
Uninvested	151	160	100
22.00 New budget authority (gross)	2,695	2,555	2,609
23.90 Total budgetary resources available for obligation	2,846	2,715	2,709
23.95 New obligations	-2,686	-2,615	-2,592
24.40 Unobligated balance available, end of year:			
Uninvested	160	100	117
New budget authority (gross), detail:			
Current:			
40.00 Appropriation	2,562	2,433	2,477
Permanent:			
Spending authority from offsetting collections:			
68.00 Offsetting collections (cash)	106	122	132
68.10 Change in orders on hand from Federal sources	27		
68.90 Spending authority from offsetting collections (total)	133	122	132
70.00 Total new budget authority (gross)	2,695	2,555	2,609
Change in unpaid obligations:			
Unpaid obligations, start of year:			
72.40 Obligated balance: Uninvested	460	526	704
72.95 Orders on hand from Federal sources	79	106	106
72.99 Total unpaid obligations, start of year	539	632	810
73.10 New obligations	2,686	2,615	2,592
73.20 Total outlays (gross)	-2,583	-2,437	-2,432
73.40 Adjustments in expired accounts	-11		
Unpaid obligations, end of year:			
74.40 Obligated balance: Uninvested	526	704	862
74.95 Orders on hand from Federal sources	106	106	106
74.99 Total unpaid obligations, end of year	632	810	968
Outlays (gross), detail:			
86.90 Outlays from new current authority	1,989	1,931	1,966
86.93 Outlays from current balances	479	383	336
86.97 Outlays from new permanent authority	76	122	132
86.98 Outlays from permanent balances	39		
87.00 Total outlays (gross)	2,583	2,437	2,432
Offsets:			
Against gross budget authority and outlays:			
Offsetting collections (cash) from:			
88.40 Non-Federal sources	-6	-31	-13
88.45 Offsetting governmental collections	-100	-91	-119
88.90 Total, offsetting collections (cash)	-106	-122	-132
88.95 Change in orders on hand from Federal sources	-27		
Net budget authority and outlays:			
89.00 Budget authority	2,562	2,433	2,477
90.00 Outlays	2,478	2,315	2,300

This appropriation provides funding for mission support and includes: safety, reliability and quality assurance activities

supporting agency programs; space communication services for NASA 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.

Performance Objectives

Safety, Reliability and Quality Assurance.—The goal of this program is to assure the safety and quality of NASA missions through the development, implementation and oversight of Agency-wide safety, engineering, reliability, maintainability, and quality assurance policies and procedures.

Space Communication Services.—Activities included in this program provide for the tracking, telemetry, command, data acquisition, communications and data processing required by NASA flight projects. In 1997–1999, the networks and support systems that accomplish these tasks will continue operation. Completion of the upgrade of the Tracking and Data Relay Satellite (TDRS) White Sands Complex and early development of the TDRS Replenishment Spacecraft occurred and will continue in 1997 and 1998. Development of a remote ground terminal at Guam which will extend network capability by providing for coverage of the zone of exclusion will be completed in FY 1998. Development of the replenishment Tracking and Data Relay satellites is ongoing. The first satellite will be launched in late FY 1999. The NASA Integrated Services Network consolidated all NASA wide area network systems in FY 1997.

Research and Program Management.—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.—This activity provides for: facility construction activities to preserve NASA's core infrastructure; environmental compliance and restoration activities, design of facilities projects, and advanced planning related to future facilities needs. In 1997–1999, activities in support of discrete projects to repair and modernize the basic infrastructure and institutional facilities at NASA centers will be conducted, as well as activities in support of environmental compliance and restoration requirements.

Object Classification (in millions of dollars)

Identification code 80-0112-0-1-999	1997 actual	1998 est.	1999 est.
Direct obligations:			
Personnel compensation:			
11.1 Full-time permanent	1,214	1,216	1,218
11.3 Other than full-time permanent	22	23	22
11.5 Other personnel compensation	24	24	23
11.8 Special personal services payments	8	8	9
11.9 Total personnel compensation	1,268	1,271	1,272
12.1 Civilian personnel benefits	252	253	253
13.0 Benefits for former personnel	31	31	15
21.0 Travel and transportation of persons	45	46	47
22.0 Transportation of things	6	3	3
23.1 Rental payments to GSA	17	16	16
23.2 Rental payments to others	1	1	1
23.3 Communications, utilities, and miscellaneous charges	71	66	65
24.0 Printing and reproduction	8	7	7
25.1 Advisory and assistance services	41	38	37
25.2 Other services	328	307	300
25.3 Purchases of goods and services from Government accounts	26	24	24
25.4 Operation and maintenance of facilities	63	59	58
25.5 Research and development contracts	116	108	106
25.6 Medical care	3	3	3
25.7 Operation and maintenance of equipment	64	60	58
26.0 Supplies and materials	23	22	21
31.0 Equipment	35	33	32
32.0 Land and structures	152	142	139
41.0 Grants, subsidies, and contributions	3	3	3

99.0	Subtotal, direct obligations	2,553	2,493	2,460
99.0	Reimbursable obligations	133	122	132
99.9	Total obligations	2,686	2,615	2,592

Personnel Summary

Identification code 80-0112-0-1-999	1997 actual	1998 est.	1999 est.	
Direct:				
1001	Total compensable workyears: Full-time equivalent employment	19,793	19,274	18,434
Reimbursable:				
2001	Total compensable workyears: Full-time equivalent employment	90	90	85

RESEARCH AND DEVELOPMENT

Program and Financing (in millions of dollars)

Identification code 80-0108-0-1-999	1997 actual	1998 est.	1999 est.	
Budgetary resources available for obligation:				
21.40	Unobligated balance available, start of year: Uninvested	1		
22.30	Unobligated balance expiring	-1		
23.90	Total budgetary resources available for obligation			
New budget authority (gross), detail:				
Spending authority from offsetting collections:				
68.00	Offsetting collections (cash)	26	34	
68.10	Change in orders on hand from Federal sources	-26	-34	
68.90	Spending authority from offsetting collections (total)			
Change in unpaid obligations:				
Unpaid obligations, start of year:				
72.40	Obligated balance: Uninvested	230	104	
72.95	Orders on hand from Federal sources	60	34	
72.99	Total unpaid obligations, start of year	290	138	
73.20	Total outlays (gross)	-127	-138	
73.40	Adjustments in expired accounts	-25		
Unpaid obligations, end of year:				
74.40	Obligated balance: Uninvested	104		
74.95	Orders on hand from Federal sources	34		
74.99	Total unpaid obligations, end of year	138		
Outlays (gross), detail:				
86.93	Outlays from current balances	127	138	
Offsets:				
Against gross budget authority and outlays:				
88.45	Offsetting collections (cash) from: Offsetting governmental collections	-26	-34	
88.95	Change in orders on hand from Federal sources	26	34	
Net budget authority and outlays:				
89.00	Budget authority			
90.00	Outlays	101	104	

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	1997 actual	1998 est.	1999 est.	
Budgetary resources available for obligation:				
21.40	Unobligated balance available, start of year: Uninvested	4		
22.30	Unobligated balance expiring	-4		

23.90	Total budgetary resources available for obligation			
New budget authority (gross), detail:				
Spending authority from offsetting collections:				
68.00	Offsetting collections (cash)	3	2	
68.10	Change in orders on hand from Federal sources	-3	-2	
68.90	Spending authority from offsetting collections (total)			
Change in unpaid obligations:				
Unpaid obligations, start of year:				
72.40	Obligated balance: Uninvested	171	56	
72.95	Orders on hand from Federal sources	5	2	
72.99	Total unpaid obligations, start of year	176	58	
73.20	Total outlays (gross)	-95	-58	
73.40	Adjustments in expired accounts	-23		
Unpaid obligations, end of year:				
74.40	Obligated balance: Uninvested	56		
74.95	Orders on hand from Federal sources	2		
74.99	Total unpaid obligations, end of year	58		
Outlays (gross), detail:				
86.93	Outlays from current balances	95	58	
Offsets:				
Against gross budget authority and outlays:				
88.40	Offsetting collections (cash) from: Non-Federal sources	-3	-2	
88.95	Change in orders on hand from Federal sources	3	2	
Net budget authority and outlays:				
89.00	Budget authority			
90.00	Outlays	92	56	

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	1997 actual	1998 est.	1999 est.	
Obligations by program activity:				
00.01	Supporting activity	9	26	
00.02	Space transportation	8	8	
00.03	Mission to Planet Earth	1		
00.04	Aeronautical research and technology	28	20	
10.00	Total obligations	46	54	
Budgetary resources available for obligation:				
Unobligated balance available, start of year:				
21.40	Uninvested	98	54	
21.41	U.S. Securities: Par value	2	2	
21.99	Total unobligated balance, start of year	100	56	
23.90	Total budgetary resources available for obligation	100	56	
23.95	New obligations	-46	-54	
Unobligated balance available, end of year:				
24.40	Uninvested	54		
24.41	U.S. Securities: Par value	2		
24.99	Total unobligated balance, end of year	56		
Change in unpaid obligations:				
Unpaid obligations, start of year: Obligated balance:				
72.40	Uninvested	147	68	52
73.10	New obligations	46	54	
73.20	Total outlays (gross)	-122	-70	-52
73.40	Adjustments in expired accounts	-1		
Unpaid obligations, end of year: Obligated balance:				
74.40	Uninvested	68	52	
Outlays (gross), detail:				
86.93	Outlays from current balances	122	70	52

General and special funds—Continued

CONSTRUCTION OF FACILITIES—Continued

Program and Financing (in millions of dollars)—Continued

Identification code 80-0107-0-1-999	1997 actual	1998 est.	1999 est.
Net budget authority and outlays:			
89.00 Budget authority			
90.00 Outlays	122	70	52

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	1997 actual	1998 est.	1999 est.
25.2 Other services	5	5	
25.4 Operation and maintenance of facilities	1	1	
32.0 Land and structures	40	48	
99.9 Total obligations	46	54	

RESEARCH AND PROGRAM MANAGEMENT

Program and Financing (in millions of dollars)

Identification code 80-0103-0-1-999	1997 actual	1998 est.	1999 est.
Change in unpaid obligations:			
72.40 Unpaid obligations, start of year: Obligated balance:			
Uninvested	10	1	
73.20 Total outlays (gross)	-2		
73.40 Adjustments in expired accounts	-7	-1	
74.40 Unpaid obligations, end of year: Obligated balance:			
Uninvested	1		
Outlays (gross), detail:			
86.93 Outlays from current balances	2		
Net budget authority and outlays:			
89.00 Budget authority			
90.00 Outlays	2		

Since FY 1995 NASA's Research and Program Management activities have been performed in 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, **[\$18,300,000]** \$20,000,000. (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1998.)

Program and Financing (in millions of dollars)

Identification code 80-0109-0-1-252	1997 actual	1998 est.	1999 est.
Obligations by program activity:			
10.00 Total obligations	17	18	20
Budgetary resources available for obligation:			
Unobligated balance available, start of year:			
U.S. Securities:			
21.41 Par value	16	16	17
21.42 Unrealized discounts			1
21.99 Total unobligated balance, start of year	16	16	18
22.00 New budget authority (gross)	2	1	1
23.90 Total budgetary resources available for obligation	18	17	19
23.95 New obligations	-1		
Unobligated balance available, end of year:			
U.S. Securities:			
24.41 Par value	16	17	17
24.42 Unrealized discounts		1	1
24.99 Total unobligated balance, end of year	16	18	18
New budget authority (gross), detail:			
60.27 Appropriation (trust fund, indefinite)	2	1	1

73.10 New obligations	17	18	20
73.20 Total outlays (gross)	-17	-18	-20
73.40 Adjustments in expired accounts	-1		
74.40 Unpaid obligations, end of year: Obligated balance:			
Uninvested	2	2	2

Outlays (gross), detail:

86.90 Outlays from new current authority	15	16	17
86.93 Outlays from current balances	2	2	2
87.00 Total outlays (gross)	17	18	20

Net budget authority and outlays:

89.00 Budget authority	17	18	20
90.00 Outlays	17	18	20

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	1997 actual	1998 est.	1999 est.
11.1 Personnel compensation: Full-time permanent	12	14	16
12.1 Civilian personnel benefits	3	3	3
21.0 Travel and transportation of persons	1	1	1
25.2 Other services	1		
99.9 Total obligations	17	18	20

Personnel Summary

Identification code 80-0109-0-1-252	1997 actual	1998 est.	1999 est.
1001 Total compensable workyears: Full-time equivalent employment	187	198	210

Trust Funds

SCIENCE, SPACE, AND TECHNOLOGY EDUCATION TRUST FUND

Unavailable Collections (in millions of dollars)

Identification code 80-8978-0-7-503	1997 actual	1998 est.	1999 est.
Balance, start of year:			
01.99 Balance, start of year			
Receipts:			
02.01 Earnings on investments: Science, Space and Technology Education, Trust Fund	1	1	1
Appropriation:			
05.01 Science, space, and technology education trust fund	-2	-1	-1
07.99 Total balance, end of year			

Program and Financing (in millions of dollars)

Identification code 80-8978-0-7-503	1997 actual	1998 est.	1999 est.
Obligations by program activity:			
10.00 Total obligations (object class 41.0)	1		
Budgetary resources available for obligation:			
Unobligated balance available, start of year:			
U.S. Securities:			
21.41 Par value	16	16	17
21.42 Unrealized discounts			1
21.99 Total unobligated balance, start of year	16	16	18
22.00 New budget authority (gross)	2	1	1
23.90 Total budgetary resources available for obligation	18	17	19
23.95 New obligations	-1		
Unobligated balance available, end of year:			
U.S. Securities:			
24.41 Par value	16	17	17
24.42 Unrealized discounts		1	1
24.99 Total unobligated balance, end of year	16	18	18
New budget authority (gross), detail:			
60.27 Appropriation (trust fund, indefinite)	2	1	1

Change in unpaid obligations:				
73.10	New obligations	1		
73.20	Total outlays (gross)	-2	-1	-1
<hr/>				
Outlays (gross), detail:				
86.97	Outlays from new permanent authority	2	1	1
<hr/>				
Net budget authority and outlays:				
89.00	Budget authority	2	1	1
90.00	Outlays	2	1	1

ADMINISTRATIVE PROVISIONS

Notwithstanding the limitation on the availability of funds appropriated for "Human space flight", "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 repair, rehabilitation and modification of facilities, minor construction of new facilities and additions to existing facilities, and facility planning and design.

Notwithstanding the limitation on the availability of funds appropriated for "Human space flight", "Science, aeronautics and technology", or "Mission support" by this appropriations Act, the amounts appropriated for construction of facilities shall remain available until September 30, [2000] 2001.

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, [1998] 1999 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.

[Of the funds provided to the National Aeronautics and Space Administration in this Act, the Administrator shall by November 1, 1998, make available no less than \$400,000 for a study by the National Research Council, with an interim report to be completed by June 1, 1998, that evaluates, in terms of the potential impact on the Space Station's assembly schedule, budget, and capabilities, the engineering challenges posed by extravehicular activity (EVA) requirements, United States and non-United States space launch requirements, the potential need to upgrade or replace equipment and components after assembly complete, and the requirement to decommission and disassemble the facility.]

NASA shall develop a revised appropriation structure for submission in the Fiscal Year 2000 budget request consisting of two basic appropriations (the Human Space Flight Appropriation and the Science, Aeronautics and Technology Appropriation) with a separate (third) appropriation for the Office of the Inspector General. The appropriations shall each include the planned full costs (direct and indirect costs) of NASA's related activities and allow NASA to shift civil service salaries, benefits and support between and/or among appropriations or accounts, as required, for the safe, timely, and successful accomplishment of NASA missions. (Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1998.)