

Administrator Daniel S. Goldin's Accomplishments

For nearly ten years, Dan Goldin's vision for the future has shaped NASA's continuing mission of discovery.

- Appointed NASA's ninth Administrator by President George H.W. Bush April 1, 1992
- Served under three United States Presidents and is the longest serving NASA Administrator

During Mr. Goldin's time as NASA Administrator, there were many firsts, including:

- 1992, the first African-American woman flew in space
- 1992, the maiden voyage of the Space Shuttle *Endeavour*, named after the 18th century sailing vessel captained by British explorer
- 1994, the first Russian to fly on an American space shuttle
- 1995, the first American to fly on a Russian space station
- 1999, the first woman to command a space mission
- 2001, the first landing of a spacecraft on the surface of an asteroid

Administrator Goldin has reshaped the Agency in all areas, from human space flight to science and technology research; from business operations to the way NASA reaches out to all people, whether American citizens or international partners. He infused NASA's programs and operations with the "safety, first and foremost" imperative. It has been his vision that has changed how NASA executes science missions. He has pushed NASA into new paradigms, including the "faster, better, cheaper" approach to designing science missions, performance-based contracting, small disadvantaged businesses, and focussing on research and revolutionary new technologies instead of operations. His insistence on reducing the cost of human space flight has enabled the percentage of the NASA budget allocated to the sciences and aerospace technologies to grow dramatically.

Administrator Goldin's new approach to mission design resulted in an extraordinary increase in the number of space missions launched by NASA. The past decade had more than triple the number of flights attempted during the 1980's. Cutting the "design-build-launch" cycle time and building less costly spacecraft using new technologies has enabled NASA to undertake over 170 missions worth some \$23 billion during his tenure. His acceptance of the potential for failure on lower cost missions was critical to this accomplishment. Thus, while the number of mission failures increased in absolute terms, the eleven failures cost the taxpayers only \$0.5 billion.

Administrator Goldin's laser-beam focus on safety resulted in remarkable improvements in safety. There are fewer Space Shuttle inflight anomalies. The Shuttle's systems have been redesigned to reduce greatly the likelihood of another Challenger-like catastrophe. NASA aircraft have made 250 thousand takeoff/landing cycles without loss of life or serious injury, even though many of the aircraft involved were experimental or flying demanding flight profiles. He advocated and brought into being an aggressive program

of research and technology development to improve safety in commercial aviation and general aviation. On NASA's installations, the attention paid to improving safety has reduced the number of workplace injuries to a quarter of what they were before Administrator Goldin's tenure.

HUMAN SPACE FLIGHT

One of the cornerstones of NASA's mission -- human space flight -- has crossed the threshold to permanent occupancy of space, using the remarkable capabilities of the Space Shuttle and its crew to assemble the International Space Station.

When the Clinton Administration threatened to cancel the International Space Station, Mr. Goldin led a redesign that resulted in incorporating the capabilities of the Russian space program. Mr. Goldin argued that the flights of the NASA astronauts to the Russian Mir space station would provide invaluable experience to the U.S.-led development of the ISS. Indeed, the lessons learned from that experience has contributed to the extraordinary technical success of the ISS during the complex and difficult assembly phase.

- The first Space Station element --the Russian-built Control Module Zarya -- was launched from Baikonur, Kazakhstan, on Nov. 20, 1998.
- The heart of U.S. research on ISS began with the deployment of the Destiny Laboratory Module in February 2001. Destiny's launch marked the beginning of world-class research into fundamental physical and biological processes.
- Prime Contractor vehicle development work is now 98 percent complete. More than 380,000 pounds of U.S. hardware has been delivered to the Kennedy Space Center, and more than 100,000 pounds of U.S. hardware has been launched to orbit over the last year, bringing the total on orbit weight to over 200,000 pounds.
- To date, four of five international partners' ISS hardware placed in orbit.
- On Nov. 2, 2001, humans will have been on board ISS continuously for one year.
- The ISS has enhanced the United States' relationship with Russia, its former Cold War adversary.
- ISS construction, which has been successfully demonstrated, is more complex than the Apollo missions to the Moon

More than half of all Space Shuttle flights have occurred during the Administrator's tenure. In that time, the program has completed a diverse range of missions while focusing on improved safety. Highlights include:

- May 7, 1992, STS-49: the first flight of Endeavour marked the debut of many Space Shuttle improvements, including a drag chute to assist with braking during landing, improved nosewheel steering, lighter and more reliable hydraulic power units, and updates to a variety of avionics equipment.
- June 25, 1992, STS-50: Columbia became the first Space Shuttle to fly long-duration missions. This involved modifications to the orbiter, including a regenerative system

to remove carbon dioxide from the air, connections for a pallet of additional hydrogen and oxygen tanks to be mounted in the cargo bay, and extra stowage room in the crew cabin.

- June 27, 1995, STS-71: The first docking of a Space Shuttle (Atlantis) with the Russian Space Station Mir. This mission debuted many changes to the orbiters in anticipation of ISS assembly. This included relocation of the Shuttle's airlock from inside the cabin to the cargo bay, reductions in weight, and development of the super lightweight external tank, as well as other performance improvements. This increased cargo capacity for the Space Shuttle by 16,000 pounds.
- July 13, 1995, STS-70: Space Shuttle Discovery debuted the first of three Space Shuttle Main Engine redesigns, called the Block I engine, which strengthened the oxygen turbopump and engine powerhead.
- January 22, 1998, STS-89: Space Shuttle Endeavor first flew the second upgrade to the main engine, the Block IIA. This upgrade featured a larger throat to the main combustion chamber.
- Dec. 4, 1998, STS-88: Launch of first U.S.-built element of the ISS -- the connecting module Unity.
- July 23, 1999, STS-93: Space Shuttle Columbia launches the heaviest payload ever carried by a Space Shuttle, the Chandra X-ray Telescope, weighing in at 50,162 pounds along with its two-stage, solid-fuel Inertial Upper Stage booster and associated cargo bay equipment.
- May 19, 2000, STS-101: First flight of the "glass cockpit," setting the stage for a new "smart cockpit" that will ultimately reduce the pilot's workload during critical periods.
- July 12, 2001, STS-104: First flight of Block II Space Shuttle Main Engine, which provides a safer ride to orbit via a new high pressure fuel turbopump.

SCIENCE

Solar System

The Administrator has led a renaissance of NASA's scientific research, ranging from the microscopic structures of our bodies to huge clusters of galaxies. He emphasized the need for NASA to focus on astrobiology to answer the primary question of whether life exists other than on Earth. The number of missions conducted and in planning is greater than ever before.

- Mars has been visited by American spacecraft three times since 1992, including the first interplanetary rover, sending back to Earth unprecedented images detailed data.

- Mars Odyssey, launched in April 2001 will arrive at Mars on October 24, 2001. While in orbit it will conduct mineral research and serve as a communications relay for future Mars missions.
- In a 1996 announcement that caused all humankind to take pause, a nine-member team of NASA and Stanford University scientists presented compelling, though not conclusive, evidence that fossil-like remains of Martian microorganisms were embedded in a small meteor. The potato-sized meteor, dating back 3.6 billion years, had been found in Antarctica in 1984. The team called for additional research so that other scientists could either to confirm or refute these findings. Administrator Goldin invited governments from around the globe to participate in the continuing investigation of the meteorite.
- In 1996 NASA's Galileo probe revealed that one of Jupiter's moons Europa, may harbor "warm ice" or even liquid water. Many scientists and science fiction writers have speculated that Europa—in addition to Mars and Saturn's moon Titan—is one of the three planetary bodies in this Solar System that might possess, or may have possessed, an environment where primitive life can exist. Images captured during Galileo's closest flyby of Europa showed features of the Jovian moon, giving new credibility to theories of hidden, subsurface oceans and the possibility of life on nearby Europa
- Looking further into space, the Cassini mission was launched in 1997 on a seven-year voyage bound for Saturn
- Scientists using the joint European Space Agency/NASA Solar and Heliospheric Observatory (SOHO) spacecraft 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 11-year sunspot cycle and associated increases in solar activity that can disrupt the Earth's power and communications systems
- In 1998 Lunar Prospector was launched on a one-year polar mission to explore the Moon, specifically to determine if water ice is buried inside the lunar crust. In March it detected water ice at both poles.
- The NEAR Shoemaker Earth Asteroid Rendezvous mission became the first spacecraft to orbit an asteroid in 2000. Its close encounter brought the spacecraft within 3 miles (5 kilometers) of the space rock and returned stunning images and other data on the object, which is also known as asteroid 433 Eros. In 2001, NEAR landed on Eros.
- Giant fountains of fast-moving, multi-million degree gas in the outermost atmosphere of the Sun revealed an important clue in 2000 to a long standing mystery—the heating source that makes the corona 300 times hotter than the Sun's visible surface. NASA's Transition Region and Coronal Explorer captured dramatic images of the immense coils of hot, electrified gas, known as coronal loops.

Astronomy

Administrator Goldin oversaw the extraordinary success of the Great Observatories.

- The Hubble Space Telescope was successfully repaired in December 1993, and serviced twice since, increasing its capability each time, its discoveries rewriting the textbooks.
- In 1999, Space Shuttle *Columbia's* STS-93 mission, commanded by Col. Eileen Collins (USAF), the first woman to command a space mission, successfully carried to orbit the Chandra X-Ray Observatory, the third of NASA's "Great Observatories," joining the Hubble Space Telescope and the Compton Gamma Ray Observatory.
- A cosmic gamma ray burst detected in 1998 released a hundred times more energy than previously theorized, making it the most powerful explosion since the creation of the universe in the Big Bang.
- Astronomers racing the clock managed to take the first-ever-optical images of one of the most powerful explosions in the Universe—a gamma ray burst—just as it was occurring on Jan. 23, 1999. Such bursts occur with no warning and typically last just for a few seconds.

Earth

By refocussing NASA's Earth science research, he has helped see our home planet in new ways.

- NASA has successfully launched a dozen new Earth observing satellites, tripling the world's capabilities for Earth Science research data. Mr. Goldin led the successful resolution of the technical problems plaguing the geosynchronous weather satellites, leading to a restoration of the system of spacecraft that provide coverage of the U.S.
- Administrator Goldin reshaped the approach to designing and developing the spacecraft for the Earth Observing System. Instead of building a few, extraordinarily costly, very large and complex spacecraft, NASA is using a system of moderately sized and small spacecraft with advanced technologies developments that will provide sound scientific knowledge about our home planet's environment.
- In the past decade, research with the National Oceanic and Atmospheric Administration (NOAA) has led to an understanding of the mechanics behind the formation of El Niño and La Niña events.
- Using data from the Tropical Rainfall Measuring Mission (TRMM), SeaWiFS, TOPEX/POSEIDON, and other spacecraft, the unfolding of these weather phenomena is now featured on TV news programs.
- In 1999 the flagship of NASA's Earth Observing System, *Terra*, was launched. It is part of an international program to monitor climate and environmental change on Earth over the next 15 years. Part of a series of EOS satellites, *Terra* will enable new research into the ways that Earth's lands, oceans, air, ice, and life function as a total environmental system.
- A NASA spectrometer detected an Antarctic ozone "hole" (what scientists call an "ozone depletion area") that is three times larger than the entire land mass of the United States, nearly 11 million square miles—the largest such area ever observed. Although production of ozone-destroying gases has been curtailed under international agreements, concentrations of the gases in the stratosphere are only now reaching their peak. Researchers believe it may be many decades before the ozone hole is no longer an annual occurrence.

- Looking at Earth as a whole system has been enabled by a series of NASA programs through which we have made the first precise radar map of Antarctica, measured the output of the Sun through two solar cycles, provided the first views of the Earth's biosphere, measured rainfall over the global tropics, among other accomplishments.

Biological and Physical Research

Mr. Goldin recognized the central importance of interdisciplinary research and the growing importance of biology, and fostered the creation of the Biological and Physical Research Enterprise to enhance rigorous interdisciplinary research closely linking fundamental biological and physical science. Administrator Goldin oversaw the development of an outstanding and unique peer-reviewed, open, and competitive research program in the biological and physical sciences. His leadership and vision helped to demonstrate the valuable contributions that laboratory research on orbit can make in disciplines ranging from fundamental physics to molecular biotechnology. Exploiting limited research opportunities on the Space Shuttle and the Russian Mir Space Station, NASA-sponsored researchers have investigated fundamental and applied scientific issues using the microgravity environment as a research tool, while defining and learning to control the negative physiological consequences of human space flight.

Under Mr. Goldin's leadership, this research program has expanded relations with the broader scientific community and grown to include over 900 world class investigators ready to take full advantage of the unprecedented research opportunities on the International Space Station. The Biological and Physical Research Enterprise now includes 11 Nobel laureates as researchers and advisors; including a recipient of the Nobel Prize in Physics for 2001. As part of a broader program of outreach to the scientific community, Mr. Goldin established the National Space Biomedical Research Institute and executed a broad memorandum of understanding with the National Institutes of Health (NIH). The NIH agreement became the cornerstone in the development of numerous cooperative relationships, which now include 18 active agreements. Mr. Goldin signed the most recent of these agreements with the National Cancer Institute, which establishes collaboration on new approaches to detect, monitor, and treat this disease. This cutting-edge effort uses biological models to develop medical sensors that will be smaller, more sensitive, and more specific than technology used today.

Mr. Goldin has overseen the development of a productive Space Shuttle-based research program in the biological and physical sciences, as well as the initial transition of this research to the International Space Station. Beginning with early Spacelab missions, NASA investigators increased their range of research culminating with the highly successful Neurolab mission in 1998, which explored the nervous system in space. STS-95, the final dedicated research mission of Mr. Goldin's tenure, returned Senator John Glenn to space to conduct research on the parallels between the changes associated with space flight and those associated with aging.

- Bose Einstein Condensate (a novel state of matter predicted by Einstein) used to produce first atom laser

- First demonstration that Life can reproduce in space and sustain itself over multiple generations
- Demonstration that space flight causes bone loss of 1% per month in weight-bearing bones; physical exercise shown partially effective in controlling loss
- Critical medical risks of space flight identified and initial countermeasure tested
- NASA developed bioreactor technology supported the first cell culture experiments in space and led to substantial scientific progress on the ground, including the first culture of human lymphoid tissue to enable laboratory study of HIV, and successful culture of heart tissue that actually "beat" in the laboratory.
- Demonstration that microgravity significantly changes gene expression in cultured cells and whole animals
- First space-based low-temperature physics experiment with superfluid Helium within one nano-Kelvin of the Lambda point, improving on earth-bound models by an order of magnitude
- Identification of mechanisms that regulate plant response to gravity
- Over \$250 million industry contribution to commercial research in space
- StelSys, (a joint venture of FVI and In Vitro Technologies) signed an agreement with NASA to explore commercial applications of bioreactor technology research related to biological systems and the development of an "artificial liver."
- Fostered the creation of a ground-breaking research program in colloidal physics

TECHNOLOGY

Administrator Goldin has emphasized the importance of making revolutionary advances in aerospace technologies. He has refocused NASA civil service's engineers and technologists away from supporting routine operations to doing cutting edge research and technology. When industry wanted NASA to support at-the-margin improvements in aircraft and launch vehicles, Administrator Goldin bluntly told them NASA's role was not in subsidizing what industry could do best in a market-driven environment. He has not shirked the responsibility for making the tough decisions on behalf of the American taxpayer when technology advances haven't panned out. When industry argued that they could be successful in developing new experimental launch vehicles if the government would undertake only a supportive, secondary role, Administrator Goldin determined that these experiments in developing significantly advanced technology demonstrators was worthwhile, even though it was a major departure for NASA. The experiments worked in several instances, such as remotely piloted vehicles, and failed in others, such as the X-33. The lessons learned will enable more successful ventures in the future.

- Since 1993, under his leadership, NASA's role in aeronautical research has changed substantially.
 - NASA undertook a combined industry-government program to resolve the technical challenges required to produce a commercially-viable supersonic airliner. The program was successful in developing a number of technologies, such as artificial vision, that can contribute to increased aircraft safety. NASA

terminated the program when it became clear there was a lack of industry willingness to proceed with its development.

- Administrator Goldin has altered previous spending plans to undertake a bold attempt to develop revolutionary new technologies and operating concepts that would make tomorrow's aircraft much safer and relieve the congestion problems faced by the nation's air traffic control system. His leadership led to initiation of an integrated program with the Federal Aviation Agency and the Department of Defense.
- NASA has developed a full-scale air traffic control tower simulator that will provide—under realistic airport conditions—a facility that will test way to combat potential air and runway traffic problems at airports.
- NASA and industry partners have developed new technology to allow planes to detect clear-air turbulence and land safely in bad weather on parallel runways spaced as closely as 2,500 feet apart.
- Airports where this new approach, which expands on existing communication and navigation technology, could improve on-time arrivals are Detroit, Seattle, Minneapolis and Memphis.
- Administrator Goldin has worked to ensure that the taxpayers see a return on investment.
 - Many technologies developed for space or aeronautics research use have been applied to everyday life on Earth.
 - Earth sensing technologies have led to precision farming techniques, disaster mitigation and recovery planning, and the tracking of diseases.
 - A device to safely remove land mines has been developed using NASA technology and left-over rocket fuel, as well as a heart assist pump for heart patients awaiting a transplant.
 - Research now underway using NASA robotics may help some spinal injury patients walk again.
- In 2001, NASA's remotely piloted, solar-powered Pathfinder-Plus flying wing reached a record altitude of more than 80,000 feet during a developmental test flight on Aug. 6 in Hawaii. The altitude is the highest ever achieved by a propeller-driven craft.

BUSINESS OPERATIONS

He has remade the way the Agency does business.

- Faced with the challenge at his confirmation hearing to fund NASA's programs with far less funding, he has made the Agency to do more with less, carrying out the programs for \$40 billion less than the budget plan envisioned when he took over the leadership.
- Downsized the Headquarters operation from over 2,100 civil servants and 1,800 contractors in 1992 to about 1,000 civil servants and 500 support contractors.
- Reduced the number of NASA full-time permanent civil servants by over 6,000 from over 24,000, and refocused the civil servants engaged in supporting routine operations to research and technology.

- Strongly supported the changes in accounting operations that enabled NASA to receive clean opinions from its outside auditors on the Agency's financial statements.
- Organized the agency into strategic enterprises and made strategic planning a key element of NASA's program planning and budgeting cycle.
- Developed the first true commercialization efforts across NASA.
- § Changed NASA's procurement approach by insisting on performance-based contracting being used in place of level-of-effort contracts.
- § Emphasized the need to engage more small businesses in NASA's programs, leading the amounts awarded to small businesses to increase in value from \$1.5 billion to \$3.5 billion.
- § Made a very high priority increasing the amount of contracts awarded to small disadvantaged business, with the result that award values have increased from \$865 million to \$2 billion, and contracts awarded to women-owned businesses have more than doubled.

BROADENING NASA'S REACH

The Administrator initiated programs of international cooperation that would have been unthinkable only a few years ago.

- In 1992, Administrator Goldin and his Russian counterpart sign a history-making agreement for unprecedented cooperation in space between the two former adversaries.
 - Prepared the groundwork for the first American astronauts to live aboard the Russian Mir space station.
 - Americans have flown into space on Russian Soyuz space capsules and Russian cosmonauts fly on NASA's Space Shuttles.
 - The agreement laid the foundation for the addition of Russia to the 14 other nations engaged in the development, assembly and operation of the International Space Station.
- Administrator Goldin has worked tirelessly to foster educational programs that will help create a cadre of young, highly skilled aeronautical engineers for America in the next century.
- He has asked academia and business to join him in making this goal a reality
- NASA was one of the first government agencies to use the Internet to communicate directly with the public. In 1997, millions of people around the world logged on to NASA's Mars Pathfinder Web site to see images of Mars as they were posted.