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Mary Sandy
Headquarters, Washington, D.C.
(Phone: 202/453-8400)

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NASA MARKS THIRTIETH ANNIVERSARY ON OCTOBER 1

On Oct. 1, 1988, NASA marks 3 decades of achievements in aeronautics and space. In retrospect, it has been a period of remarkable scientific and technological accomplishments that pioneered the space frontier, made quantum leaps in man's understanding of his planet and his universe and saw revolutionary advances in the aeronautics field.

NASA Administrator Dr. James C. Fletcher states, "As we celebrate the establishment of NASA 30 years ago and take account of our agency's many accomplishments since then, I hope we will also take a moment to reflect on how privileged we are, as public servants, to have been entrusted by the American people with such exciting and challenging missions -- missions of critical importance to the scientific, technological and economic strength and well being of this country.

"Our record over the 30 years testifies to how well we have met the goals and challenges of these missions. It includes many exciting high points such as the early manned space flights, the fly-bys of the planets, the unmatched success of the Apollo landings on the moon, and the flights of the Space Shuttle. And the record includes countless other accomplishments in space science and applications, advanced technology, aeronautics and practical spin-offs of space technology.

"After 30 years, NASA has achieved a vigorous maturity. Now, we have the ability, the unending challenge, and, I believe, the support of the American people to make the next 30 years just as memorable as those we celebrate today."

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NASA's Beginnings

On April 2, 1958, the Eisenhower Administration submitted a bill establishing a national aeronautics and space agency. After refinements, President Eisenhower signed into law the National Aeronautics and Space Act of 1958. The National Aeronautics and Space Administration came into being on Oct. 1, 1958.

The Soviet launch on Oct. 4, 1957 of Sputnick I, the world's first artificial satellite, had a profound effect on the United States. At the time of the launch, the United States considered itself the world leader in technology. There were many individual space efforts spread across several government organizations, but none was truly ready to progress to a launch. Sputnick spurred the growing political consensus that a national space program was essential.

The act established a broad charter for civilian aeronautical and space research. It absorbed the existing National Advisory Committee for Aeronautics (NACA) and made broad transfers from other government programs. NASA received Project Vanguard from the Naval Research Laboratory; lunar probes from the Army; lunar probes and rocket engine programs, including the F-1, from the Air Force; and over $100 million of unexpended funds. T. Keith Glennan was named administrator. The broadest possible dissemination of information to the public was a unique part of the act.

The agency's resources included 8000 people, three laboratories (now the Langley Research Center, Hampton, Va.; the Lewis Research Center, Cleveland and Ames Research Center, Mountain View, Calif.) and two stations, with a facilities value of 300 million dollars and annual budget of 100 million. The Jet Propulsion Laboratory (JPL), Pasadena, Calif., and the Army Ballistic Missile Agency, Huntsville, Ala. were soon added to the list of facilities. Today NASA has 18 facilities located nationwide.

On Jan. 31, 1958, the first American satellite, Explorer 1, went into orbit. An on-board experiment developed by Professor James A. Van Allen encountered mysterious levels of radiation at 603 miles altitude, leading to the discovery of the Van Allen radiation belt. On March 17, 1958, Vanguard 1 joined Explorer 1 in orbit.

The problem of launch vehicles occupied much attention in NASA's early years, leading to the development of Scout, Centaur and Saturn launch vehicles.

Manned Space Flight

The Soviets achieved the first successful manned space mission when Cosmonaut Yuri Gagarin was launched into space aboard Vostok 1 on April 12, 1961. The Mercury program, which began just after NACA became NASA, was America's pioneering manned space flight program. Alan B. Shepard, Jr. was the first American to fly in space in the Freedom 7 Mercury spacecraft on May 5, 1961. When the program began, there were serious questions as to man's ability to function or even survive in the space environment. The Mercury program of one-man spacecraft proved that man could live, eat, work and sleep in space.

The space flights in the two-man Gemini spacecraft in 1965 and 1966 provided mastery of technology and skills that were crucial to Apollo: maneuvering in space, rendezvous and docking with another vehicle in space, extravehicular activities and demonstrating that man could function effectively in space for as long as 2 weeks with no lasting harmful aftereffects. In addition, photographs and other data acquired during Gemini's orbital missions provided a wealth of information related to the Earth's geography, environment and resources as well as astronomy.

On May 25, 1961, President Kennedy addressed a joint session of Congress embracing a national goal of "landing a man on the moon and returning him safely to Earth" within a decade. Apollo vastly expanded knowledge about the moon and Earth. Six Apollo expeditions explored the moon, the last in December 1972.

Skylab was America's first space station where three American astronaut crews lived and worked for long periods, the longest lasting 84 days. The mission provided a wealth of Earth survey and solar pictures, as well as good science studies, and proved that man could work for prolonged periods in space without lasting harmful aftereffects upon return to Earth.

The Apollo-Soyuz Test Project in 1975 was the world's first international manned space mission. It tested compatible rendezvous and docking systems for manned spacecraft and conducted a variety of experiments in Earth survey, astronomy, life sciences and industrial and pharmaceutical processing.

With the launch of the Space Shuttle Columbia on April 12, 1981, the United States entered a new era in transportation between Earth and space. The National Space Transportation System opened space for regularly scheduled transportation of people and cargo between Earth and Earth orbit.

The space transportation system has achieved 24 successful flights. The 25th Shuttle flight in January 1986 ended in the explosion of the orbiter Challenger and the deaths of its crew. The Challenger accident led to a reevaluation of the Shuttle's systems and the Shuttle management process.

The Shuttle program returns to flight status with the launch of the Discovery, now set for September 29. The second in a series of Tracking and Data Relay System satellites will be the primary payload for the STS-26 mission, which also includes microgravity, life science, atmospheric science and infrared communications experiments, as well as two student experiments.

Aeronautics

When NACA became NASA in 1958, the agency already had been involved in basic and applied aeronautics research for more than 40 years. Many of the aeronautics advances in performance, speed, safety and efficiency from NACA/NASA research are considered so fundamental today that they are taken for granted.

NACA was created in 1915 "...to direct the scientific study of the problems of flight with a view to their practical solution." The National Aeronautics and Space Act of July 27, 1958, stated among its objectives: "the preservation of the role of the U.S. as a leader in aeronautical science and technology." U.S. aeronautical products provide the largest positive contribution of any industry to the nation's trade balance. Maintaining a world position of aeronautical leadership among fierce international competition is important to the U.S. economy.

In April 1985, Dr. G. A. Keyworth II, science advisor to the President, announced three national aeronautics goals which have provided the framework for the agency's aeronautics program planning for 1986 and beyond. They are:

- Subsonic Goal -- Technology for an entirely new generation of fuel-efficent, affordable U.S. aircraft operating in a modernized National Airspace System.

- Supersonic Goal -- To develop pacing technologies for sustained supersonic cruise capability for efficient long-distance flight.

- Transatmospheric Goal -- To pursue research towards a capability for extremely fast passenger transportation between points on Earth, and also offer a vehicle that could provide routine cruise and maneuvers into and out of the atmosphere with takeoffs and landings from conventional runways.

NASA continues to expand U.S. capabilities in civil and military aviation and to contribute significantly to the nation's aviation leadership and national security. Aeronautical programs run the gamut from fundamental disciplinary research to flight testing, with primary research subjects being the vehicles and power plants that use the Earth's atmosphere for flight. Aeronautic research also focuses on the aerodynamics of space vehicles.

In President Reagan's 1986 State of The Union address, he announced a bold new program of research leading to an aerospace plane. The National Aero-space Plane program is an accelerated technology development program leading to a flight research vehicle (X-30) to validate a wide range of aerospace technologies and capabilities, including horizontal takeoff and landing, single-stage operation to orbital speeds and sustained hypersonic cruise within the atmosphere using airbreathing propulsion.

This joint NASA and Department of Defense (DOD) program could provide the technology leading to a wide variety of operational aerospace vehicles, including civil space launch vehicles, hypersonic transports and long-range air defense interceptors. A future aerospace plane could be capable of taking off from a runway and flying to orbit or be a hypersonic airliner flying between continents. The conceptual design phase has been completed and the program is now into the vehicle technology development phase that will result in ground testing of large scale engines and selected aircraft components and in preliminary designs of the X-30 experimental vehicle.

NASA is engaged in many other joint NASA/DOD research programs which continue to ensure the superiority of U.S. military aviation.

In the area of flight safety, NASA research programs focus on the problems of lightning, wind shear, icing and heavy rain, as well as runway and tire studies.

The 1987 dedication of the Numerical Aerodynamic Simulation (NAS) Facility at Ames Research Center, Moffett Field, Calif. provided a new national capability in the field of computational fluid dynamics. Considered the world's most powerful computing system, it opens a gateway to a new era in many types of research, ranging from computational chemistry, astrophysics, aerodynamics and biological research to weather modeling. Capable of computing complex air-flow conditions encountered in actual aircraft, NAS is being used to perform pioneering aeronautical research.

Other new testing facilities have enhanced aeronautical testing. The National Transonic Facility at the Langley Research Center is a unique, world class wind tunnel using a cryogenic test gas capable of simulating actual flight parameters for advanced aerodynamics research. Also the world's largest wind tunnel, NASA's 80-by-120 Foot Wind Tunnel located at Ames Research Center, became fully operational at the end of 1987. The facility is particularly valuable for its full-scale aircraft test capability.

NASA's research programs continue to reshape future aircraft for enhanced efficiency and maneuverability, and its materials and structures research has greatly expanded the range of lighter, stronger, more durable materials available for aircraft construction.

In recent years business and commercial transport aircraft have successfully demonstrated the NASA-developed natural laminar flow concept which can increase flight efficiency. At NASA's Lewis Research Center, advanced propulsion research programs are expected to lead to more economical propulsion for commercial transport aircraft and for advanced hypersonic vehicles.

Flight testing of the NASA High Alpha flight research vehicle, a highly-instrumented F/A-18 aircraft, will provide valuable information for future supersonic aircraft capable of unprecedented agility and maneuverability. Flight tests are being conducted at the Dryden Flight Research Facility in Edwards, Calif.

Rotorcraft research will lead to future aircraft that could hover like helicopters, yet use their stationary rotors as wings for airplane-like speed. A joint United Kingdom, DOD and NASA program is underway to develop technology for advanced, short take-off and vertical landing type aircraft.

Space Science and Applications

NASA's space science programs have contributed significantly to a new golden age of discovery. They have substantially advanced the frontiers of knowledge about our home planet, the relationships of sun and Earth, and celestial phenomena.

NASA programs and projects have explored virtually the entire solar system. The Voyager II spacecraft is expected to reach Neptune in August 1989, which would leave only planet Pluto as yet unexplored by deep space probes. Voyager I is in interstellar space after successful flybys of Jupiter and Saturn. After extensive interplanetary exploration, the Pioneer 10 spacescraft has left our solar system. As the most distant human-made object in existence, it continues to make discoveries about interstellar space.

Thirty years of life science studies have provided an understanding of the physiological effects of space flight, though much remains to be understood about the causes. In astronomy, the agency has looked at the universe in the various wave lengths and is examining that information in detail.

With respect to Earth, NASA projects have studied and now understand most of the chemical processes affecting our planet. NASA satellites and airborne studies are providing global profiles of stratospheric aerosol and ozone, helping us to better understand the impact of the greenhouse gases. Expanded weather satellite system capabilities allow for sophisticated, high accuracy weather forecasting.

NASA's space applications program, in which satellite technology is directly applied to benefit people, has been a driving force for human programs. Often involving international partners, the program has had a value that is incalculable and steadily growing. The Landsat program, for example, has provided an invaluable survey of the Earth's surface with applications to such diverse problems as agricultural management, environmental protection, beach-erosion forecasting and prospecting for minerals and hydrocarbons -- to name a few. Landsat is now an operational system managed by the National Oceanic and Atmospheric Administration.

NASA technology has contributed to a vast increase in commercial communications service. The first was global TV, which gave people front row seats to historic events. Among others are the linking of airliners on transoceanic flights with ground terminals and direct broadcast of satellites to rooftop antennas rather than through huge ground stations. Researchers at JPL are conducting a series of technology-related tests that are expected to play a major role in the development of a mobile satellite communications sytem for the 1990s. The new technology would extend mobile cellular service to remote areas throughout the country.

Astronomical observatories and astronomy satellites have dramatically altered our conception of the universe. Earth's atmosphere blocks most of the electromagnetic radiations that can tell us about the nature of celestial objects. Our Earth-bound capability to observe the universe also is limited by the turbulence and brightness of the atmosphere.

Satellite observatories viewing the heavens from above Earth's appreciable atmosphere have opened a window on the universe. They have provided new findings on Earth's magnetic field, enhanced our understanding of how solar activity interacts with Earth's magnetic field, provided new critical information on Earth's atmosphere and confirmed the existence of the solar wind. The Hubble Space Telescope, expected to be placed in orbit above the atmosphere in 1990, will distinguish fine details in planetary atmospheres or nearby star fields -- with 10 times the clarity of the best ground observatories.

The Galileo mission to Jupiter, a joint project with the Federal Republic of Germany, will make a comprehensive long-term study of the planet's atmosphere, magnetic field and its moons.

The Ulysses mission, a cooperative effort between NASA and the European Space Agency slated for launch in 1990, will provide the first view of the sun and the solar system from above the ecliptic plane, offering first knowledge about the sun's magnetic poles.

Space Station

President Reagan made the development of a permanently manned U.S. space station a national goal in his 1984 State of the Union message. Reagan invited friends and allies of the United States to participate in the program and called for commercial private sector involvement. The space station has been named Space Station Freedom.

Space Station Freedom will provide an unsurpassed research facility for scientific, technology and commercial activities in space and will serve as a base for continued exploration of the solar system in the next century. It will be capable of growth both in size and capability and is intended to operate for several decades, well into the 21st century.

NASA has spent the last 4 years defining requirements for Space Station Freedom. Four aerospace firms were awarded development contracts in December 1987. NASA will initiate detailed designs in January 1989 which will lead to a first element launch in 1995. Twenty launches will be required to assemble the station, with Space Station Freedom expected to be permanently manned in 1996. A final agreement with three international partners, the European Space Agency, Japan and Canada will be signed on September 29, 1988.

Space Technology

NASA's space research and technology program provides advanced technology to ensure continued U.S. leadership in civil space programs.

NASA's Civilian Space Technology Initiative is a focused program that will enhance the technologies for reliable, low-cost access to Earth orbit and support effective operations and science missions therein. Pathfinder will pursue those emerging and innovative technologies that support a broad set of future space exploration missions including a return to the moon, autonomous and piloted missions to Mars and other solar system bodies, and an intensified planet Earth focus. Academic sector participation has been encouraged through programs such as the University Space Design program and the University Space Engineering Research program.

Many of NASA's space technology programs are concerned with the problems of providing power, controls and structures, and assembly of large space structures. Examples of other research areas include spacesuit studies, research for more efficient reentry from space, advanced power systems for future lunar and Mars bases, and lighter weight tanks for cryogenic fuels. Other areas of concentration are in studies for control systems for future large lightweight spacecraft and the assembly of large space structures with teleoperated manipulators, as well as a program to allow free-flying telerobots to grapple and dock with gyrating satellites to stabilize and repair the spacecraft.

Technology Utilization

NASA programs by nature are demanding of technological input. Meeting the aeronautical and space goals of the past 3 decades has required advancements across a broad spectrum that embraces virtually every scientific and technological discipline. Making this storehouse of "know how" available in the public interest is mandated by the National Aeronautics and Space Act.

The examples of technology transfer to benefit mankind are incalculable and pervasive, affecting daily lives in many ways. Spinoffs from micro miniaturization technologies have led to medical devices ranging from programmable pacemakers to other biomedically implanted devices such as insulin pumps. In the medical field alone, thousands of direct spinoffs from NASA programs can be cited in areas such as body imaging, laser technology and filtering processes such as those now used for blood.

Public safety uses of NASA technology include smoke and fire detection devices and a wide variety of fire resistant materials. Grooved highways, a surfacing technique that has dramatically reduced highway accidents, are a spinoff of an aeronautics runway safety program. A passive sewage treatment system using water hyacinths, such as the one being initiated by the city of San Diego, is one environmental application of NASA research, as are the anti-corrosive coatings receiving wide commercial use.

The list of spinoff applications for consumer, home and recreational use alone is particularly broad. Materials originally developed for space suit use are now found in a wide variety of products as diverse as tennis shoes, food packaging and window shades. The range of spinoffs embraces areas such as transportation, structural analysis, food and agriculture, manufacturing technology, industrial productivity, energy systems and construction. The impact on computer applications has been phenomenal.

Commercial Development of Space

The 1980s has witnessed an emerging awareness of the potential economic value of space. Amid a growing consensus that U.S. leadership in the commercial development of space is in the national economic interest, the President directed in 1984 that NASA take steps to significantly expand commercial space activity. The Congress enacted legislation assigning NASA to "seek and encourage, to the maximum extent possible, the fullest commercial use of space."

NASA responded by adopting a Commercial Use of Space Policy and establishing the Office of Commercial Programs to provide a focus for action to expand U.S. private sector investment and involvement in the civil space program.

Throughout the agency's 30-year history, cooperative activities with U.S. industry have helped accelerate the commercial application of aeronautical and space technology. Such efforts in the 1960s led to the emergence and growth of satellite communications, which has become a $3 billion a year industry.

Today, over half of the 50 largest U.S. industrial corporations are participating in one or more of NASA's programs to stimulate commercial space activity. They are joined by scores of other companies, small and large, which are actively investigating the commercial opportunities in space. These include the private firms which comprise the vanguard of a U.S. commercial launch vehicle industry. NASA is encouraging and supporting this new industry through agreements to privatize government-developed rockets, provide access to NASA facilities and become users of commercial launch services.

Well over 100 U.S. companies have become affiliated with NASA's 16 Centers for Commercial Development of Space, which combine the support of government with the talent of universities and the interest and investment of industry. Other firms, like 3M Co., have entered into joint endeavor agreements in which NASA sponsors spaceflight opportunities for privately-supported industrial research and development.

Since 1983, a growing number of America's small businesses have been contributing to NASA's mission through a program called Small Business Innovation Research (SBIR).

NASA finances SBIR by setting aside over 1 percent of its annual research and development appropriation for the award of Phase I and Phase II contracts to small businesses. Proposals are requested annually in areas of interest to the agency, many of which have commercial potential. Contracts are placed and projects are managed by nine NASA field installations across the country. To date, the agency has spent or committed $175 million for 755 Phase I and 299 Phase II contracts placed with 446 small businesses in 40 states, territories and the District of Columbia.

Tracking and Data

NASA provides vital tracking, command, telemetry, communications, data relay and data processing support to meet NASA's flight program requirements. STS-26 will launch the second of three Tracking and Data Relay Satellites (TDRS) which will continue the transition from a ground-based tracking network to a space-based network for low-Earth orbit missions.

NASA's early Space Tracking and Data Acquisition Network evolved from the Minitrack tracking stations (11 of them) set up by the U.S. Naval Research Laboratory for the Vanguard Program in 1956 and 1957. These stations had radio interferometers which formed electronic "fences" to search the sky for any spacecraft carrying 136 megaherz radio beacons.

Over the past 30 years, technological developments and requirements led to a unified S-band system which unified all tracking and communications functions (voice, telemetry and command) into a single communications link. Called the Manned Space Flight Network, it is comprised of ground stations, ships at sea and antennae-carrying aircraft all linked together by the globe spanning NASA Communications Network.

The Tracking and Data Relay Satellite System (TDRSS) is the answer to the requirement for nearly continuous communication with newer and more sophisticated satellites. These revolutionary new tracking stations in space, launched from the Space Shuttle, operate at a geosynchronous orbit of 22,300 miles above the Earth's equator. At that altitude, because the speed of the satellites is the same as the rotational speed of the Earth, they remain "fixed" in orbit over one location.

A TDRS satellite which will be the second in the TDRSS network will be launched from the Space Shuttle Discovery on the STS-26 mission. A third is slated for launch in January 1989. A TDRSS ground terminal has been built at White Sands, N.M., a location that provides a clear view to the TDRS and weather conditions generally good for communications. The NASA ground terminal provides the interface between the TDRS and its network elements.

The worldwide NASA Deep Space Network (DSN) provides the Earth-based radio communications link for NASA's unmanned interplanetary spacecraft. The DSN has provided telecommunications and data acquisition support for deep space exploration projects since 1961.

Although DSN's primary activity is telecommunications support for unmanned space exploration, the stations also are used as scientific radio telescopes for radio astronomy experiments and in NASA's search for extraterrestrial intelligence.

NASA's DSN is preparing for the Voyager spacecraft fly-by of Neptune in August 1989, providing the support capability of the deep space antennas for this and future missions such as Magellan and Galileo.

International Affairs

Under the mandate provided by the 1958 National Aeronautics and Space Act, NASA must conduct "its aeronautical and space activities so as to contribute to ... cooperation by the U.S. with other nations and groups of nations in work done pursuant to this Act, and in the peaceful application of the results thereof ...." NASA has developed an extensive program of international cooperation which has opened a wide range of its space activities to foreign participation and contribution.

Cooperative activities have ranged from flight of foreign-built spacecraft to ground-based study and analysis of data. Japan, Canada and the European Space Agency are partners with NASA in Space Station Freedom. Other activities have included, for example, contribution of experiments or payloads to be flown in space by NASA, joint projects to develop flight hardware, use of data or lunar samples provided by NASA, training, visits and joint publication of scientific results. On a reimbursable basis, NASA provides certain services, including launching of satellites as well as data and tracking services.

More than 1000 agreements have been signed with 135 countries and international organizations over NASA's 30-year history.

Toward the Future

The presidentially appointed National Commission on Space was charged with proposing a national program that would "carry America's civilian space enterprise into the 21st century." The commission projected the next 50 years of America's future in space and proposed goals which assure America's continued leadership in space.

The commission's 1986 report, "Pioneering the Space Frontier", presented a pioneering mission for 21st century America -- "to lead the exploration and development of the space frontier, advancing science, technology and enterprise, and building institutions and systems that make accessible vast new resources and support human settlement beyond Earth orbit, from the highlands of the moon to the plains of Mars." Three major thrusts were recommended:

- Advancing our understanding of our planet, our solar system, and the universe;

- o Exploring, prospecting, and settling the solar system; and
- o Stimulating space enterprises for the direct benefit of the people on Earth.

In 1987, a task group chaired by then astronaut Sally Ride was appointed by NASA Administrator Dr. James Fletcher to evaluate potential U.S. space program initiatives.

In its report, "Leadership and America's Future in Space", the task group presented three major goals. They are: (1) the advancement of scientific knowledge of the planet Earth, the solar system and the universe beyond; (2) the expansion of the human presence beyond the Earth into the solar system; and (3) the strengthening of aeronautics research and the development of technology towards the promotion of U.S. leadership in civil and military aviation. NASA is studying these goals and considering appropriate initiatives.

On June 1, 1987, the NASA administrator announced the creation of the Office of Exploration to coordinate agency activities that would "expand the human presence beyond Earth," particularly to the moon and Mars. A key role of this office is to focus lunar and Mars initiatives, identifying the prerequisite investments that the nation must make in the near term to achieve these iniatives.

The National Commission on Space paid tribute to NASA as "... a national resource that plays a critical role in space exploration and development. It also provides a symbol of national pride and technological leadership. The Commission applauds NASA's spectacular achievements of the past and anticipates impressive achievements to come."

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