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HIGHLIGHTS OF 1975 ACTIVITIES

The nation's most ambitious unmanned space venture -- the launch of two Viking spacecraft towards Mars -- and the first manned international space flight -- the Apollo Soyuz Test Project, were among the highlights of 1975 for the National Aeronautics and Space Administration.

NASA had 21 launch attempts during the year, 19 of them rated as successes.

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SPACE FLIGHT

On July 17 at 3:19 p.m. EDT, astronaut Thomas P. Stafford extended his right arm and clasped the hand of cosmonaut Alexey A. Leonov highlighting the success of the first manned international space flight -- the Apollo Soyuz Test Project.

Following years of negotiations, planning and training the joint U.S-Soviet space mission became a reality July 15 when the Soyuz and Apollo spacecraft were launched to rendezvous and dock in Earth orbit two days later.

During the two days that the spacecraft were linked astronauts Stafford, Vance D. Brand and Donald K. Slayton visited the Soyuz spacecraft and cosmonauts Leonov and Valeriy N. Kubasov made trips to the Apollo craft. After undocking July 19, the Soyuz spacecraft landed safely at Kazakhstan, U.S.S.R. July 21. Three days later on July 24, Apollo splashed down in the Pacific Ocean west of Honolulu.

All primary objectives of the Apollo Soyuz mission were met including rendezvous, test of the compatible docking system and joint control center operations. And although the scientific experiments analysis is not yet complete, some significant results have already appeared.

In the Extreme Ultraviolet Experiment a strong source of radiation was detected which is believed to be a white dwarf star. This is the first successful investigation in the EUV wave length for sources outside our solar system.

The Ultraviolet Absorption Experiment for the first time very accurately measured the concentration of atomic oxygen and nitrogen in the upper atmosphere.

Two electrophoresis experiments demonstrated how living cells and other biological materials can be separated in zero gravity much better than on Earth. These techniques will be useful on Space Shuttle flights in the 1980s for such tasks as separating lymphocytes for use in cancer research and separating kidney cells for production of the enzyme, urokinase, which can help in treatment of strokes and phlebitis.

Data from the ASTP Earth Observations Experiment is being analyzed for many applications. One interesting discovery is that relative ages of deserts can be determined by color difference which results from the amount of iron oxide present. This enables investigators to trace the direction and rate of growth of deserts and will be of considerable help in studying droughts, particularly those in Northern Africa.

During 1975, elements of the future Space Transportation System began to take shape. Development of the Space Shuttle proceeded on schedule and peak activity will soon be reached.

The development of the Space Shuttle Launch Processing System is proceeding on schedule at the Kennedy Space Center, Fla. Concrete paving for the orbiter landing runway and tow way at KSC was completed in October. Construction has begun on the Orbiter Processing Facility and modification to the existing Apollo Launch Pad 39 for Shuttle flights has started.

Considerable progress was made in 1975 by the European Space Agency in the development of Spacelab, the versatile laboratory to be carried in the cargo bay of the Space Shuttle. Test hardware has been assembled in Europe and testing is underway.

A major decision to use a solid propellant for the Interim Upper Stage (IUS) was made in 1975. The IUS, being developed by the Air Force, will be used to place payloads into orbits beyond the capability of the Shuttle. The solid-stage IUS concept accomplishes all but a few of the very high energy NASA missions in its basic configuration and is expected to be able to accomplish all missions with modifications.

In the Advanced Programs area, several significant studies were completed. Completion of the Manned Orbital System Concept study provided these results:

- A small four-to-six-man space station is feasible using Skylab, Shuttle and Spacelab technology and hardware with minimum modifications.

- Using a completely modular station, each module can be transported to Earth orbit in the Shuttle cargo bay.

- The assembled space station would permit uninterrupted work in such areas of life science studies on humans, animals and plants; commercial space manufacturing of products such as large perfect crystals or large scale electrophoretic separation of biologicals; and assembly of large structures in orbit.

A key study of in-orbit assembly of large structures in space was completed this year. The study concerned packaging, transportation and erection of very large structures, such as would be required for a solar power station.

Another study area concerns future Space Transportation Systems. Looking at the period 1985 to 2000, these studies indicate the probable need for well beyond the 60 Shuttle flights per year as is currently predicted. The study objective is to determine the most economical approach to meet these requirements by evolving new space transporation elements from the Space Shuttle system.

APOLLO SOYUZ CREW TOUR

The Apollo and Soyuz crews who took part in history's first international space flight last July, visited each others countries in September and October.

The Apollo astronauts -- Major General Thomas P. Stafford, Vance D. Brand and Donald K. Slayton, their wives and children toured the U.S.S.R. Sept. 21 through Oct. 5.

The visit to Moscow included a courtesy call on Secretary Leonid I. Brezhnev. Other stops in the Soviet Union included Leningrad, Kiev, Volgograd, Novosibirsk in Siberia, Sochi on the Black Sea and Tblisi in the Republic of Georgia.

The U.S. portion of the tour began in Washington on Oct. 12. The Russian delegation was headed by General Vladimir Shatalov, Deputy Director of Cosmonaut Training, Soyuz spacecraft Commander Major General Alexsey Leonov, Cosmonaut Valeriy Kubasov, their wives and children.

Highlighting the Washington visit was a presentation to President Ford in the Rose Garden at the White House. The U.S. tour included a tickertape parade in Chicago; a civic ceremony and luncheon in Omaha; a reception and dinner in Salt Lake City; sightseeing in San Francisco; and a rest in Lake Tahoe as guests of Nevada Gov. Michael O'Callaghan.

The two crews stopped at Rockwell International's Space Division at Downey to thank workers who built the Apollo spacecraft and the docking module used during the joint mission activities.

After returning to Washington from Los Angeles and spending a day at a Congressional reception, the tour moved on to Atlanta where the astronauts laid a wreath on the grave of Dr. Martin Luther King, Jr.; and to Nashville where they were guests at a Grand Ole Opry performance.

The final stop on the two-week tour of the U.S. was in New York City where the two crews were honored at receptions hosted by Mayor Abraham Beame and U.N. Secretary General Kurt Waldheim.

SPACE SCIENCE

The United States continued its systematic exploration of the solar system in 1975, launching two spacecraft toward Mars, conducting a third and final flyby of Mercury, and preparing for flights to the outer planets by the end of the decade.

The United States' most ambitious unmanned space venture got underway with the launch of two Viking spacecraft toward Mars in August and September. Composed of an orbiter and a lander, each of the instrument-lander Viking spacecraft is designed to conduct a detailed scientfic examination of the Red Planet, including a search for life.

Viking 1 will touch down about July 4, 1976, and Viking 2 will arrive about a month later, culminating a 736-million-kilometer (460-million-mile) journey from Earth. Near year's end, the Vikings were more than 320 million km (200 million mi.) from Earth, traveling at speeds of 26,000 km (16,000 mi.) an hour.

Mariner 10, the spacecraft that refused to quit, encountered Mercury for the third time on March 16 after twice looping around the Sun and flying past the planet in March and September of 1974. Skimming the surface at a distance of 320 km (200 mi.), Mariner 10 provided man with his closest look yet at this tiniest of the planets, closest to the Sun.

Preparations continued for the 1977 launch of a Mariner-type spacecraft toward Jupiter and Saturn, a 1978 launch of two Pioneer spacecraft to Venus for the most detailed examination yet of that cloud-shrouded planet, and a possible 1979 launch of a Mariner toward Jupiter and Uranus.

A variety of scientific spacecraft was launched by NASA in 1975, including satellites designed to provide information on the effects of manmade pollutants on Earth's protective ozone layer in the atmosphere. These included Atmosphere Explorer E (Explorer 55), launched Nov. 19.

At year's end, the United States was preparing for a mid-January launch of the second of two probes designed to fly closer to the Sun than any previous spacecraft. Flying within 45 million km (28 million mi.), Helios B, a German-American probe, will supplement the information gathered by its sister craft, Helios A, on interplanetary space in the region closest to the Sun.

SPACE APPLICATIONS

The year began with the launch on Jan. 22 of NASA's second Earth resources survey satellite, LANDSAT-2. At mid-year, its twin, LANDSAT-1, designed to last a year from launch in 1972, began its 36th month at work.

By year's end, the two together had logged 22,345 circuits of the globe, returning data for four-color pictures used in helping to manage Earth's limited natural resources and monitor the threatened environment.

Examples:

- Measuring crop acreage and estimating yield in a step toward world food production forecasts that could reduce the shocks of shortages and gluts;
- Mapping mountain snow cover to forecast spring runoff for irrigation and generating power;
- Detecting oil slicks on marine waters;
- Helping cities, states, regional authorities and developing nations to plan wiser use of their land resources;
- Monitoring the environmental effects of developing new energy sources, such as strip mining;
- Mapping floods to help states evaluate damage and plan relief;
- Surveying forest and rangeland resources;
- Detecting potential earthquake zones as an aid in planning future construction;
- Monitoring offshore dumping of sewage sludge and industrial wastes;
- Guiding oil drillers and mineral prospectors to likely new deposits.

In June, 1,500 people from Federal agencies, state and local governments, regional planning authorities, private industry and foreign nations heard more than 100 reports of such practical applications of remote sensing from space at a week-long Earth Resources Survey Symposium in Houston, Tex.

And as LANDSAT-1 and LANDSAT-2 continued surveying the western hemisphere every nine days and the entire world every 18, a LANDSAT-C, with improved sensors, was being assembled for launch in 1977.

NASA's second spacecraft launch of 1975, on Feb. 6, was the second Synchronous Meteorological Satellite. With SMS-1, launched the year before, it completed a new operational weather-observing system for the National Oceanic and Atmospheric Administration.

Spaced 60 degrees apart over the equator at speeds that match Earth's rotation, the two new satellites kept constant watch over North and South America and the adjacent oceans. Returning high-resolution pictures every half hour day and night, they could provide hurricane warnings and track short-lived but severe thunderstorms such as those that produce tornadoes.

A third one, called a Geostationary Operational Environmental Satellite, was launched in October as a standby to assure continuity of service. In late November it took over from SMS-1.

Meantime, the sixth of NASA's Nimbus research meteorological satellites, launched June 12, began making the most accurate worldwide measurements to date of Earth's incoming and outgoing radiation -- information crucial to determining climate changes.

Nimbus-6 also collected weather data from 400 balloons circling the globe at fixed altitudes and from automatic weather stations in remote areas on land and at sea, including floating ice fields in the Arctic.

On May 20 the powerful Applications Technology Satellite-6 completed a year's experimental broadcasting of high-quality color television programming to small, inexpensive ground receivers in remote regions of the United States. Educational material and medical-aid information, otherwise unavailable, were transmitted to scores of isolated communities in Alaska, Appalachia and the Rocky Mountain states.

From its fixed position in Earth-synchronous orbit over the Galapagos Islands, ATS-6 then was moved a third of the way around the globe to a new station over East Africa. There it relayed live television of the July meeting of American and Russian crews in space in the Apollo Soyuz flight.

In August, the satellite began a year's use by the Government of India, transmitting instructional television to about 5,000 isolated villages, most of whose people had never seen a TV picture. The instructional material includes family planning, health and hygiene, agricultural and other vocational information, child education, and national development.

In other programs of NASA's Office of Applications:

- A Geodynamic Experimental Ocean Satellite, launched April 9 and carrying a precision radar altimeter, is measuring small variations in the level of the ocean surface to an accuracy of less than a meter.

- Experiments in processing metals, biological preparations and electronic materials in the weightless environment of space were carried in the Apollo Soyuz mission and, beginning in December, a series of vertical sounding rocket flights. The investigations, to be continued in the Space Shuttle, are expected to lead to the production in space of products more costly or next to impossible to produce on Earth.

- Design and construction of a municipal plant using a new cost-saving sewage treatment process derived from space research began in California. The new system converts solid sewage materials to activated carbon that then is used to treat the incoming waste water. The process is a byproduct of research on rocket engines.

AERONAUTICS AND SPACE TECHNOLOGY

Considerable progress was achieved in NASA's aeronautical technology programs for aircraft noise and pollution abatement, aviation safety and efficiency of aeronautical flight as well as technology development for future generation aircraft.

NASA conducted a study to identify the technology required to achieve a 40 to 50 per cent reduction in fuel consumption by civil aviation transport aircraft, without degrading the environment or reducing aircraft safety.

NASA estimated that, based on an annual 5.4 per cent passenger growth rate, one million barrels of fuel could be saved each day by the year 2005 through successful technology development and implementation in the civil air fleet.

A demonstration combustion test was performed using "synthetic" jet engine fuel derived from Colorado shale, as part of a Defense Department alternate fuels program in which NASA is participating. No significant differences in combustor behavior were note when operated with the shale derived jet-engine fuel as compared with conventional petroleum based jet-engine fuel. Further investigations of shale derived jet-engine fuel are scheduled. Jet fuels derived from coal will also be evaluated.

Successful completion of the NASA engine refan program, aircraft two-segment landing approach and business jet approach noise program have provided technology and new options for the U.S. aircraft noise abatement efforts.

Results of initial phases of the experimental clean engine combustor program indicate that the desired goals of 75 to 80 per cent reduction in hydrocarbons and carbon monoxide emissions for large turbofan engines are achievable for the low power (idle/taxi) operating conditions. The low power emission levels have been achieved by combustor designs that also result in improved fuel efficiency.

The emission goals at the high power (takeoff) conditions are more elusive and reductions of about 50 per cent in nitric oxide emissions have been demonstrated.

Through research and technology activities, the NASA supersonic cruise aircraft research program has produced significant results toward reduced engine fuel consumption, engine noise reduction and in-flight efficiency. The studies included variable cycle engines, coannular engine nozzles and aircraft wing-body blending.

The first successful automatic landings of a powered-lift short take-off and landing (STOL) aircraft was achieved by NASA. The concept would permit aircraft operations from short runways, steeper climbouts and approaches and maneuvers in less airspace than conventional aircraft, offering potential relief for air traffic congestion.

In ground simulations and in flight tests, NASA continued a research effort to reduce the wake vortices that trail behind aircraft, which today pose a substantial hazard to smaller aircraft flying closely in their paths. A number of promising concepts to reduce this hazard are being tested.

Improved ride quality, reduced pilot workload and improved flight safety are the goals of a new NASA general aviation program, which is currently flight testing a low-cost advanced flight control system developed by NASA.

Reduced fuel consumption by 20 to 25 per cent and significant reduction in pollution emissions from general aviation reciprocating engines are sought in a NASA technology program employing hydrogen injection technology initiated this year.

In another new general aviation effort, NASA began a quiet, clean general aviation turbofan engine program, aimed at reducing both noise and pollution produced by these engines.

NASA's ATLIT general aviation research airplane began a flight test program incorporating advanced aerodynamic technology to improve safety through better climb capability, to improve by 10 per cent its fuel efficiency and to improve utility with greater payload capability.

NASA developed a new ball bearing design with a life expectancy 20 times greater than the best ball bearings now in use in large gas turbine engines. Technology experts consider this development the single most significant improvement in high speed ball bearing design in recent decades.

The only rocket-powered aircraft known to be flying, the USAF/NASA X-24B completed its flight test program ending another era in experimental rocket-powered flight testing. The rocket powered airplane has been one of this country's most valuable tools for advanced aeronautical research and has made many contributions to future airplanes and to manned space flight.

TECHNOLOGY UTILIZATION

NASA's highly successful Technology Utilization Program, now in its 13th year, continued to play a key role in the agency during 1975.

The program -- one of the pioneering efforts of its type in government -- is designed to speed the transfer of space-developed technology and techniques into other segments of the national economy.

An insight into the scope of this effort during the year may be gained from the following statistical highlights:

- Over 600 new technical innovations were reported in Tech Briefs and special publications,
- An extensive program consisting of 60 engineering applications projects was continued in an effort to apply space-developed technology to the solution of public sector problems ranging all the way from advanced medical devices to pollution control,
- Several thousand business and industrial clients obtained technical information from the vast NASA data bank through six Industrial Applications Centers located at academic and research institutions throughout the country.

A significant milestone during the year was the announcement in September by the Scott Aviation Co., Lancaster, N.Y., that it was starting production of a commercial verision of the Johnson Space Center, Houston, developed firefighter's breathing system.

This device, successfully field tested by fire units in New York City, Los Angeles and Houston, is the first major improvement in compressed air breathing systems in the past 20 years. Its important new features -- all direct and indirect spin-offs from space research -- include a lightweight air bottle, an improved face mask and a better fitting pack frame and harness.

Earlier in the year, a unique voice-controlled wheelchair with a voice-operated manipulator hand, was exhibited at the annual meeting of the President's Committee for Employment of the Handicapped. Developed by NASA's Jet Propulsion Laboratory, Pasadena, Calif., in cooperating with the Veterans Administration, the chair responds to 32 voice commands using tele-operator and robot technology developed for space use. The chair is now undergoing clinical testing at Rancho Los Amigos Hospital in Downey, Calif.

In mid-year, a section of the Golden Gate Bridge was painted with a NASA-developed inorganic paint developed at the Goddard Space Flight Center, Greenbelt, Md., as an anti-corrosion coating for spacecraft. The paint is a potassium silicate, zinc-rich coating which sprays on easily and provides protection from salt spray, fog, heat and the thermal shock of rapid temperature changes. Patent licensing rights for production and marketing of the paint are available from NASA.

Work on development of an ultrasound medical diagnosis system continued at the Jet Propulsion Laboratory during 1975. Pictures are produced on a cathode-ray tube screen to obtain visual diagnostic information much like that now provided by X-rays. Sound waves well above the range of human hearing are passed continuously through the body, rather than by means of the conventional echo technique. The resulting picture looks like an X-ray and clearly shows bones, muscle, organs and differences in soft tissue. Still being clinically tested, the device is expected to play an important role in detection and identification of tumors in the female breast.

Meanwhile, at the Marshall Space Flight Center, Huntsville, Ala., work began on a joint project with the U.S. Coast Guard to design and build a prototype light-weight, portable firefighting module for use in combatting shipboard and dock fires. The completely self-contained unit will carry its own pumps, hose, fireproof suits and other necessary equipment. It will be capable of pumping water from the sea at a rate of up to 2,000 gallons per minute for periods of up to three hours. The unit will be lifted by helicopter or dock crane onto the deck of almost any type of boat. Work on the prototype unit is expected to be completed late next year.

INTERNATIONAL AFFAIRS

NASA's cooperative projects with other nations in 1975 brought instructional television transmission to 5,000 villages in India, brought new and significant foreign contributions to the U.S. Space Transportation System, increased foreign participation in the LANDSAT Earth resources program, substantially expanded cooperative programs with the Soviet Union and augmented knowledge of the Earth and Sun.

On Aug. 1, Prime Minister Indira Ghandi inaugurated India's year-long Satellite Instructional Television Experiment (SITE), using NASA's Applications Technology Satellite-6 (ATS-6) -- the most powerful communications satellite ever launched.

The Indian Space Research Organization provides all ground equipment for transmission to and reception from ATS-6 and the Indian government produces the television programs for satellite broadcast to some 5,000 villages beyond the reach of conventional television.

The SITE project will gauge the effectiveness of satellite broadcasting for instructional purposes in developing countries. School attendance increased sharply as an immediate by-product of SITE and the viewing audience remains large.

A Remote Manipulator System for the Space Shuttle will be developed by Canada under a cooperative arrangement agreed to this year. Astronauts aboard the Space Shuttle Orbiter will use the mechanical arms to deploy and retrieve payloads in space. The project represents a Canadian contribution of some $30 million to the Space Shuttle program. The first flight unit is to be delivered to NASA at no cost in 1979.

The European Space Agency (ESA) continues on schedule with the development of Spacelab, a modular laboratory facility that will be carried in the Space Shuttle on flights lasting up to a month. The Systems Requirements Review was completed in May. The 10 participating European nations are spending an estimated half billion dollars to provide this essential element for America's Space Transportation System. The first flight unit will be delivered to NASA at no charge in 1979.

Spacelab's first use will be in a jointly planned NASA-ESA mission scheduled for 1980.

During the year, Zaire and Chile signed agreements to build and operate their own ground stations to receive data directly from NASA's two LANDSAT Earth resources satellites. An Italian station began acquiring LANDSAT data this summer, joining facilities already in operation in Brazil, Canada and the U.S. Iran is also planning a LANDSAT station.

Agencies in 50 nations are now funding projects that will assist NASA in judging LANDSAT's usefulness. Foreign scientists have reported significant practical achievements in regional planning, pollution monitoring, mapping, managing natural resources and other areas.

In July, America's last Apollo docked with a Soviet Soyuz in a successful test of a new docking system designed for future manned spacecraft of both nations. This first major cooperative space project between the two nations was stimulated by a NASA initiative in 1969 and formally approved in 1972. The new docking system makes possible future cooperation which could involve joint operations of manned spacecraft and space stations built by the two countries. Negotiations looking toward future joint projects are expected to begin early next year.

On Dec. 15, the Soviet Union launched Cosmos 782, the first Soviet satellite to carry U.S. experiments into space, returned to Earth after a successful space mission. The biological satellite carried four small NASA packages to determine the effect of weightlessness on life processes and to measure cosmic radiation during a 22-day flight. American scientists are also analyzing tissues provided by the Soviets from their experiments aboard the satellite.

Work was completed this year on a joint U.S.-U.S.S.R. publication entitled Foundations of Space Biology and Medicine. The English version of this three-volume work, with contributions from distinguished scientists in both nations, is now in press. A Russian-language edition was published recently in Moscow.

Peru and the U.S. cooperated this summer in atmospheric studies using 30 sounding rockets and 14 balloons launched from Peru's Chilca Launch Range near the Earth's magnetic equator. Among the 12 experiments were several designed to measure the concentration of ozone at various levels in the Earth's atmosphere. NASA is currently seeking additional cooperation from foreign countries to study changes in the protective blanket of ozone surrounding the Earth.

On March 15 the Helios solar probe, built by Germany and launched last December by the U.S., passed within 28 million miles of the Sun, closer than any previous spacecraft. The largest cooperative scientific spacecraft ever launched, Helios reached a maximum speed of 143,000 miles an hour -- making it the fastest manmade object in the universe. A second Helios, scheduled for launch Jan. 15, will venture even closer to the Sun to collect additional data on its outer atmosphere.

ENERGY PROGRAMS

Working with the Energy Research and Development Administration (ERDA) and other organizations, NASA has identified nine areas of emphasis where its experience and capabilities could aid in energy research and development. These areas include photovoltaics, wind turbo-generators, solar heating and cooling, advanced ground propulsion, energy conversion systems, gas turbines, fuel cell systems, hydrogen systems and advanced coal energy extraction.

NASA is also studying the possible use of space to help alleviate energy related problems. These include disposal of hazardous waste in space, satellite power systems and appropriate adaptation of remote data acquisition to selected energy resources problems.

The long range objectives of a low-cost silicon solar array project is to develop an industry capability for manufacturing up to 500 megawatts by 1985 at a cost of less than 50 cents per watt. Sixteen industry organizations are slated to begin work on the project this winter under the overall direction of the Jet Propulsion Laboratory.

In planning for the solar heating and cooling program, a comprehensive survey of industrial operations and methods on use of solar heating and cooling was conducted. The survey indicated that to assure orderly manufacturing, packaging, distribution, installation and maintenance of solar systems, the existing industry structure must be used. As a result, on Oct. 17, requests for proposals were released to industry by the Marshall Space Flight Center in five separate areas. These are: marketable subsystems; existing subsystems requiring development; existing systems requiring development; systems integration of marketable subsystems; and systems design and development.

NASA's Lewis Research Center in Cleveland, Ohio is also expected to become more actively engaged in advanced solar heating and cooling research and technology. Making use of equipment and facilities created for the space program such as solar simulators, Lewis has been testing a variety of solar collectors. One of these collectors developed with Minneapolis-Honeywell is based on a black-chrome coating. This joint work was recognized by Industrial Research Magazine as one of the 100 most significant new products during the past year.

NASA is responsible to ERDA for developing the technology for cost-competitive large wind-turbine generators. As a first step, the Lewis Center designed and built a 100 kilowatt generator. On Oct. 29, ERDA and NASA dedicated the completion of this windmill at the Plum Brook Facility near Sandusky, Ohio. It is the largest wind mill now in operation and the second largest ever built.

TRACKING AND DATA ACQUISITION

Tracking and data operational networks supported a total of 25 launches and approximately 35 spacecraft previously launched, which continue to provide valuable data.

A highlight in network activities was support provided to the Apollo Soyuz Test Project. Among the unique characteristics of this mission was the requirement that both control centers -- Houston and Moscow -- would receive all voice and television communications transmitted to either spacecraft. This required a merging of the United States and the U.S.S.R.'s voice communications and television capabilities. In addition to the tie-in of the two control centers, special arrangements were made to interconnect the two networks to allow voice communications with the astronauts and cosmonauts via any United States or U.S.S.R. station.

The Applications Technology Satellite was used in a new approach to relay television, voice and data communications between the Apollo spacecraft and the Madrid Tracking Station. By using the ATS-6, network coverage was significantly increased over the conventional network coverage (50 minutes per orbit-coverage, versus 15 minutes), greatly aiding the ground controllers during the critical docking phase of the mission.

Nearly continuous support has been provided by the Deep Space Network to the two Viking spacecraft that were successfully launched in August and September. The Viking mission with its dual payloads, each consisting of an orbiter spacecraft and a lander capsule, is the most complex mission ever supported by the DSN. In the planetary phase of the mission the network must handle the data from the two Viking orbiters and landers simultaneously from the vicinity of Mars.

In addition to the normal S-band frequency used for many years in the DSN, the Viking mission will also use an experimental 8,400 megahertz (X-band) transmission capability which is expected to increase by ten-fold the amount of data that can be acquired by the network. The use of the higher frequency (X-band) is another step in the evolving technology to provide the improved ground systems necessary for advanced planetary missions.

The recently launched Atmospheric Explorer D (AE-4) is the second of three spacecraft which will conduct research on the chemistry of the Earth's atmosphere. This spacecraft, along with AE-3 which was launched earlier, place demanding requirements on the network systems.

Tracking and telemetry data must be acquired, processed and analyzed in near real-time to determine the condition of the spacecraft and its experiments. Complex orbit calculations must be performed to determine the precise location of the spacecraft and to issue commands at the proper time to both protect the spacecraft and to optimize experiment configurations.

EQUAL OPPORTUNITY PROGRAMS

NASA-wide recruitment goals for the 15-month period from July 1, 1975 through Sept. 30, 1976, are to hire 190 minority professionals, 130 non-minority female professionals and 250 minority non-professionals. Hiring accomplishments toward these goals during the three months July through September 1975 were:

	NASA Goal Jul '75 - Sep '76	Actual Hires Jul '75-Sep '75
Minority Professionals	190	36
Non-Minority Female Professionals	130	20
Minority Non-Professionals	250	45
Total	570	101

The number and percent of minorities in NASA's work force increased from 1,660 (6.8 per cent) on June 30, 1975, to 1,699 (7.0 per cent) on Sept. 30, 1975. That increase of 39 employees occurred while the total permanent work force during the same period decreased by 61. The female population also increased by 16 during the same period going from 4,258 (17.5 per cent) to 4,274 (17.6 per cent). During the same three months, female professionals rose by 18 going from 982 to 1,000. This brought female professionals from 6.5 per cent up to 6.6 per cent of total professionals. Minority professionals increased by 26, from 748 to 774, representing an increase from 4.9 per cent to 5.1 per cent of total professionals.

EXTERNAL PROGRAMS

The Office of Equal Opportunity Programs developed and funded a series of six nationwide one-day conferences to aid minority business people in using NASA spage age technology to develop new commercial products.

The Equal Opportunity Office also developed, funded and coordinated a pilot statewide symposium, involving all the minority colleges in the state of North Carolina. Purpose was to expose NASA technology and to stimulate careers in the sciences. A key feature was a meeting between NASA Administrator and the heads of the minority colleges from throughout the state.

LAUNCH RECORD

Nineteen spacecraft were successfully launched by NASA in 1975. Two launches, an Intelsat F-4 and the Dual Air Density, were unsuccessful.

The year began with the successful orbiting of LANDSAT-2, the second in a series of Earth resources survey satellites. Two Atmosphere Explorer satellites were launched, one into a polar orbit, the other into a near equatorial orbit. Aboard Explorer-55 is an instrument for measuring the presence of ozone in the Earth's upper atmosphere.

The only manned mission in 1975 saw the Apollo Soyuz Test Project successfully completed. A Saturn 1B placed the Apollo spacecraft into orbit where it linked up with the Soviet Union's Soyuz.

Two powerful Titan-Centaur rockets placed Viking spacecraft into Mars trajectories. The two Viking landers are scheduled to touch down on the Red Planet this summer.

Five geosynchronous communications satellites were launched on a reimbursable basis.

Other spacecraft launched in 1975 included meteorological, scientific and applications satellites for NASA, other government agencies or independent agencies.

Twelve of the launch vehicles were Deltas, three Atlas-Centaurs and two Scouts.