FACT SHEET

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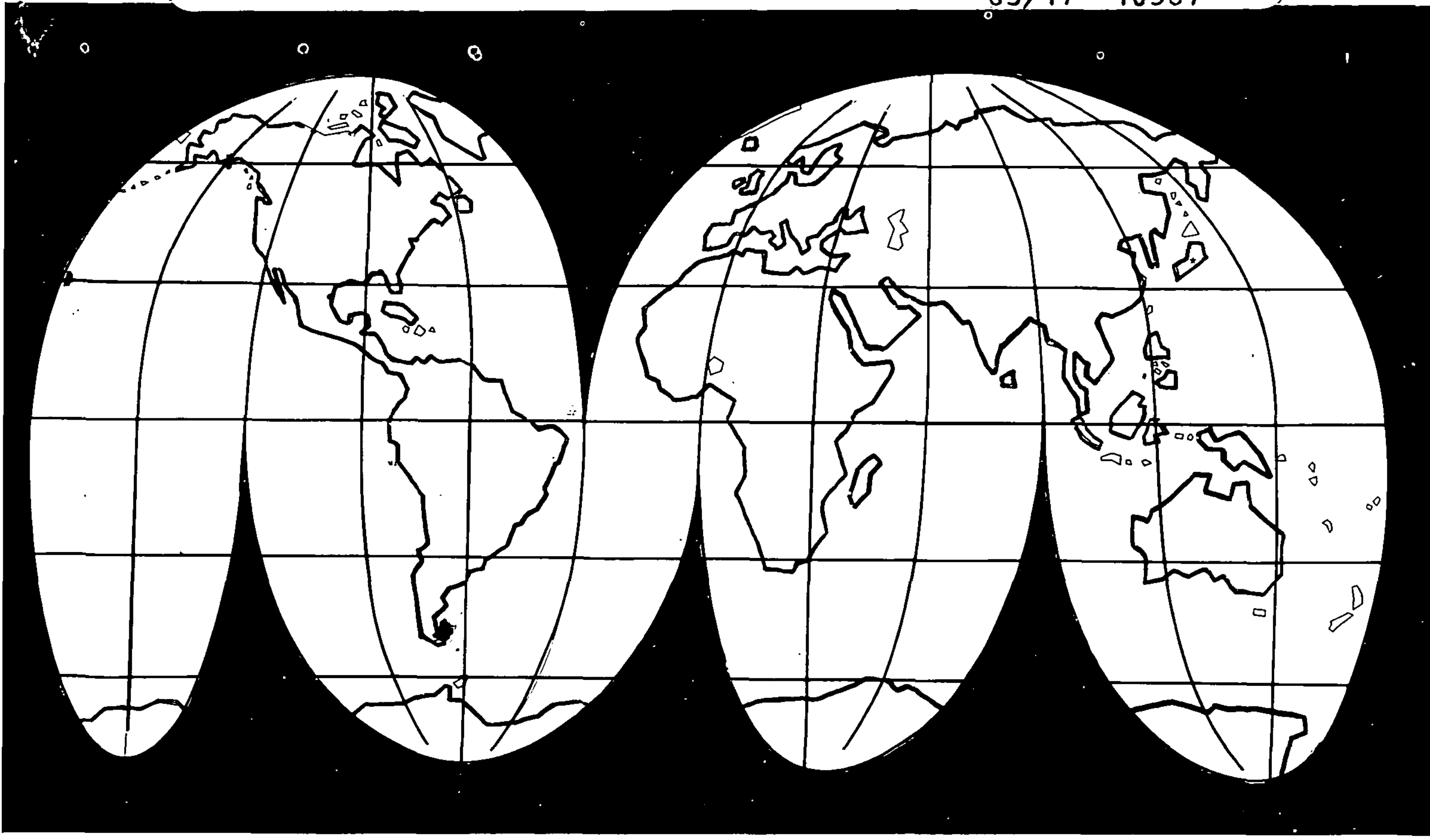

OFFICE OF TRACKING & DATA ACQUISITION

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CONTENTS

OFFICE OF TRACKING AND DATA ACQUISITION

The Office of Tracking and Data Acquisition (OTDA) is NASA's eyes, ears, and memory, providing responsive and precision tracking data acquisition, communications and related support to meet NASA flight program requirements.

OTDA supports a wide variety of experiments both within the Earth's atmosphere and in space. Because research and development programs constantly change in volume, scope and purpose, few NASA projects are alike. Therefore, OTDA operations are broadly classified and organized to deliver information to and from a variety of experiments conducted anywhere by NASA flights.

In addition to tracking space vehicles and telemetering data to the Earth, the network provides crew voice communications and command signals to operate systems; detects signals and records, processes and distributes the data; tests and verifies its own systems; trains its operations staff; determines trajectories and attitudes of flights; develops technically advanced radio and tracking systems to meet new project requirements; and participates in scientific experiments.

Large volume, integration and complexity make tracking today far different than it was at the start. The Minitrack, devised in 1957 for the Vanguard program, now forms only a small part of NASA's global Spaceflight Tracking and Data Network and operations are conducted with advanced computer methods and scientific equipment.

The stations and networks integrate their work on flight projects as needs arise. Such was the case with the Apollo flights which were served by both the Spaceflight Tracking and Data Network (STDN) and the Deep Space Network (DSN).

TRACKING NETWORKS

The majority of support for flight programs is provided through OTDA's two worldwide tracking network facilities. They are the Spaceflight Tracking and Data Network and the Deep Space Network.

The Spaceflight Tracking Network, under field management of the Goddard Space Flight Center, Greenbelt, Md., furnishes support to all Earth-orbiting missions (manned and unmanned). The Deep Space Network, under management of the Jet Propulsion Laboratory, Pasadena, Calif., supports NASA's planetary and interplanetary missions.

These facilities are interconnected by a communications network which provides instantaneous transmission of data and critical commands between spacecraft and the control centers in the U.S. from which the flights are directed.

The Spaceflight Tracking and Data Network (STDN)

Spaceflight Tracking has continued to carry a substantial workload, averaging 40 individual spacecraft yearly. Included in the Fiscal Year 1974 workload were the multiple flight Skylab program, LANDSAT-1, Orbiting Solar Observatory 7, Radio Astronomy Explorer 2, Atmosphere Explorer 3, Nimbus 4 and 5, and five Apollo lunar surface experiment packages left on the Moon's surface during the Apollo missions.

Spaceflight tracking stations include Fairbanks, Alaska; Rosman, N.C.; Tananarive, Malagasy; Johannesburg, South Africa; Canberra, Australia; Quito, Ecuador; Winkfield, England; Santiago, Chile; Madrid, Spain; Goldstone, Calif.; Kavai, Hawaii; Guam; Merritt Island, Fla.; Grand Canary Island; Ascension Island; and Bermuda.

For the ASTP mission, Spaceflight Tracking will employ a new approach to obtain greater television, voice and data communications during the flight. Plans include use of the ATS-6 satellite to relay ASTP communications directly between the Apollo spacecraft and the Madrid (Spain) Spaceflight Tracking station. Coverage during ASTP should increase from the current ground-based capability of about 15 per cent of each orbit to 50 per cent or more via the ATS-6 satellite.

The Deep Space Network (DSN)

The focus of the Deep Space Network is unmanned scientific spacecraft missions to the planets and interplanetary space.

The capability of the Deep Space Network was increased in 1973 with the addition of two 64-meter (210-foot) diameter antennas in Madrid, Spain, and Canberra, Australia. These are updated versions of the highly successful 64 m (210 ft.) antenna at Goldstone, Calif.

The DSN, with the three 64 m (210 ft.) antennas located approximately equidistant around the Earth, allows NASA to track continuously all flights above 16,000 kilometers (10,000 miles), as the Earth turns on its axis. The distance between Earth and Jupiter during the Pioneer encounter phase was nearly one billion km (600 million mi.). It was the availability of these 64 m (210 ft.) antennas that permitted the remarkable pictures of Jupiter to be received here on Earth.

During 1975, the Deep Space Network will be heavily involved in preparing to support the Viking, Mariner Jupiter/Saturn '77 and Pioneer Venus missions and in continued support to Pioneers 10 and 11 as they pass far into the outer regions of the solar system.

NASA Communications Network (NASCOM)

The NASA Communications Network is a ground support system provided almost entirely by commercial common carriers under contract and is rated with the most reliable systems in existence. The interconnection between tracking operations, flight missions and ground centers totals some 3.2 million km (2 million mi.) of telephone, microwave, radio, undersea cable and communications satellite lines, and includes use of special wideband circuitry.

Goddard Space Flight Center in Maryland operates the integrated communications network system, serving the agency's global communications needs. Network operations are computerized for maximum efficiency, effectiveness and reliability.

With a total complement of about 300 U.S. and foreign employees, the communications network operates a system of major switching centers with subsidiary interconnections wherever NASA experiments go. The major switching points are located at Goddard, JPL, Cape Kennedy, Canberra, Madrid and London.

Tracking and Data Relay Satellite System (TDRSS)

The planned relay satellite system consists of two specialized relay satellites to be placed in synchronous Earth orbit and a ground terminal located in the continental U.S. One of the satellites will be over the Atlantic and the other over the Pacific.

The system will relay data, commands and voice to and from mission spacecraft and the ground control center. It will provide nearly continuous communications contact with mission spacecraft in near-Earth orbit and will greatly improve tracking and data acquisition capabilities.

The relay satellite system will be able to support all Earth orbital spacecraft below approximately 5,000 km (3,000 mi.), including the Space Shuttle and Spacelab and the free-flying automated spacecraft in the 1980s. The system will provide at least 85 per cent coverage as opposed to the present 15 per cent average coverage capability of an orbital satellite by the current ground tracking system. The system will be capable of providing simultaneous support to as many as 20 spacecraft.

NASA expects to obtain relay satellite system service from private industry and a 10-year contractual period is anticipated. The system is scheduled to be deployed in 1979. Implementation of the system will permit closing many stations in the present ground network, with resulting cost savings.

OTHER OTDA TRACKING ACTIVITIES

The work of tracking and obtaining data goes beyond the global space networks. Hundreds of programs in aeronautical research, aerial survey and sounding rockets are also supported. Other OTDA facilities track with optical devices.

NASA's Flight Research Center, Edwards, Calif., is the scene of most OTDA aeronautical tracking work. The High Range, stretching 1,100 km (700 mi.) from Edwards to Ely, Nev., provides telemetry, tracking, communication and computing for a wide variety of aircraft. Originally built in 1959 for the X-15 rocket-powered research plane, the High Range today works actively with supersonic cruise research and a wide variety of flight test aircraft.

Nearly all sounding rockets fly from Wallops Flight Center on the Virginia coast. These small rockets usually splash down offshore within minutes of launch. The Center averages about 350 flights each year for U.S. and foreign space science interests. In addition to ground instrumentation, radar and optical equipment supporting this work, Wallops maintains mobile gear for special projects, some in international science. A substantial number of rockets are launched from other U.S. and foreign locations.

NASA's optical space tracking is performed under a grant to the Smithsonian Astrophysical Observatory, Cambridge, Mass. The Smithsonian Observatory has a network of eight small stations located around the Earth. Baker-Nunn cameras, lasers and other optical devices are used in support of various Earth satellite programs.

Ground support is also provided to aeronautical projects conducted at other NASA labs and to specialized flights in other science and technology programs.

OTDA MILESTONES

OTDA support has been a major contributor to many NASA achievements, including:

- Successful occultation experiments to test the Einstein theory of relativity, conducted by precise tracking of spacecraft, hundreds of millions of miles from Earth. Einstein's general theory of relativity states that electromagnetic radiation -- in this case the spacecraft radio signal -- passing close to the Sun will be slowed by the Sun's gravitational field.

- Radio astronomy experiments using the mysterious radio sources, quasars and pulsars. Large diameter antennas in the NASA network track noise outputs from celestial sources. By recording minute time differences in the arrival of these signals at remote points on the Earth's surface, the precise distance between these remote points can be determined. Over an appreciable period of time, changes in these remote distances indicate shifts in the Earth's surface. These Earth dynamic measurements have been conducted over intercontinental distances (Goldstone, Calif., to Madrid, Spain) and are valuable in studying Earth surface motions on extended regional and global bases, as distinguished from local motions in the vicinity of a specific fault, e.g., San Andreas.

- Radar mapping of the planet Venus, providing details of the cloud-shrouded planet previously unavailable.

- Successful flybys of the planet Mercury by Mariner 10 -- retrieval of closeup pictures of the planet's surface clearly depicting major landforms such as craters, ridges and plains.

- The Apollo Program -- the first landing by men on the lunar surface, live television transmission of manned lunar exploration events for viewing by millions around the world.

- Earth resources surveys with the LANDSAT spacecraft -- production of photographic data for use in studies of Earth resources disciplines including agriculture, oceanography, forestry and cartography.

- Flights of many thousands of sounding rockets for scientific studies by U.S. and other world scientists, support of cooperative sounding rocket programs conducted in foreign countries.

- Hundreds of flights of advanced research aircraft -- rocket and jet powered -- support of crosswind landing and other terminal approach investigations.

- Optical (laser) tracking of geodetic satellites such as Geodynamic Experimental Ocean Satellite (GEOS), leading to important corrections of maps of the Earth's southern hemisphere.

In the future, OTDA plans to utilize relay satellites for more effective data acquisition, to increase use of wideband communications transmission in the X-band of the frequency spectrum for interplanetary missions, and the improvement of other electronic and optical systems to meet constantly expanding needs of the space and aeronautical programs of the U.S.

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