

The Goldstone Story



**Field Engineering
Corporation**

THE GOLDSTONE STORY

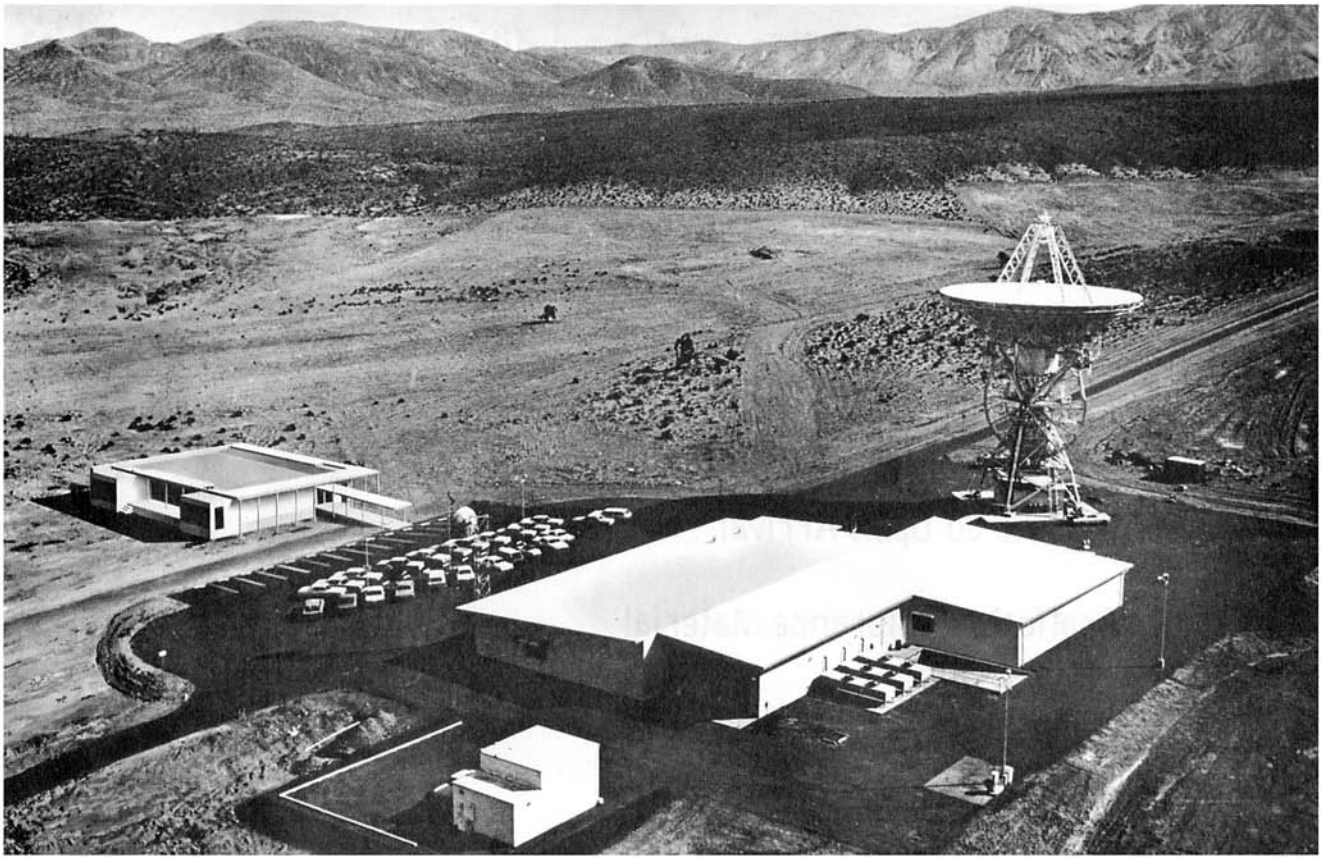
Some useful facts and figures for personnel proceeding
to the Spaceflight Tracking and Data Networks Station
at Goldstone, California.

prepared by:

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Goldstone Apollo STDN Station

THE GOLDSTONE STORY

I. THE STATION

A. Primary Mission and Brief History of the Station

The Goldstone complex is located in the Mojave Desert, approximately 45 miles from Barstow, California. This complex consists of the Goldstone Spaceflight Tracking and Data Networks (STDN) Station and the Deep Space Network (DSN). The STDN facilities are the Mojave Station and the Apollo Station. The DSN facilities include the Pioneer Station, Echo Station, Mars Station, and Venus Station.

1. Mojave Station

The Mojave Station is an STDN facility which dates back to late 1960. At that time NASA Headquarters decided to move the former Naval Research Laboratory Minitrack Station at Brown Field, California, to a new location—the Goldstone Dry Lake area of the Mojave Desert. A building was constructed in the Spring of 1961 for this purpose. The first building, which is the present logistics building, was called at that time Mojave Operations. By September 1961, Mojave became active in STADAN. In December 1962, two vans of equipment associated with Project Relay were mounted at the present location of the ATS operations building. The name of the site became "The Mojave Relay Test Station." Prime responsibility for the Relay Spacecraft was shared by the Mojave and Nutley, New Jersey, stations. Hundreds of demonstrations were conducted including 80 television operations.

In 1965, the testing program with the Relay satellite was completed. The program was an unqualified success. The knowledge gained was immediately used as a base for the new Applications Technology Satellite (ATS) Project. Construction was started on the ATS operations building and the STADAN telemetry building. By June 1966, both buildings were ready for their operational missions. Due to a funding problem, NASA decided to close down the STADAN telemetry operation in November 1966. The operation was reopened in January 1969. The test and experimentation program with ATS has continued to the present.



Goldstone Mojave STDN Station

STADAN telemetry operations at Mojave included many of the 45 to 50 spacecraft supported by STADAN. Equipment throughout the network was of a standard type that included a SATAN receive and command antenna, telemetry receivers, command equipment which enabled Mojave to reconfigure various spacecraft, and data handling equipment for decoding "house-keeping" information about the spacecraft's condition and recording equipment.

Among STADAN's many accomplishments were the discoveries of the Van Allen Radiation Belt, the pear-shaped Earth, solar winds, and countless other natural phenomena that were unknown before the space age.

During the 7-year period between December 1966 and May 1974, an unique series of 6 satellites were launched into space to conduct approximately 30 technological experiments and approximately 10 scientific experiments. The program has been named the Applications Technology Satellite (ATS) Project, and it originated due to the necessity for rapid increase of knowledge of spacecraft design, meteorological concepts, and communications systems for space.

To date two spacecraft, ATS-A and ATS-D, did not achieve orbit because of launch vehicle failures. ATS-1 was launched December 7, 1966, ATS-3 was launched November 5, 1967, ATS-5 was launched August 12, 1969, and ATS-6 was launched May 30, 1974. Some of the major achievements credited to the ATS Program are indicated below:

- The transmission of weather photos and charts to thousands of user stations via satellite.
- Communications, ground-to-air or ship via satellite.
- Position location systems.
- Use of TV camera at stationary orbit distance.
- Spin Scan Cloud Cover photographs from orbit showing one-third of the Earth.
- First use of mechanically despun antenna systems.

ATS-6 will contribute even more to the achievements of the ATS series of satellites by collecting and confirming data gained through 12 technological experiments and several scientific experiments.

Four ground stations provide the main support for the ATS operations. Two of the stations are co-located at Mojave. Mojave's mission support consists of collecting range and range rate data for orbit determination, collecting polarization data for spacecraft attitude determination, configuring and maneuvering the spacecrafts, and performing technological and scientific experiments.

2. Apollo Station

The Apollo Station was constructed in 1966 as one of three, 85-foot antenna lunar support stations of the Manned Space Flight Network (MSFN). It supported the highly successful Apollo program from the unmanned Apollo 4 flight in November 1967 until the splashdown of Apollo 17 in December 1972. To enable the station to support Earth Resources Technology Satellite (ERTS) and other satellites, the 30-foot antenna and Unified S-band equipment from the former MSFN station at Guaymas, Mexico, was installed at Goldstone during the latter half of 1971. The Apollo Station has supported ERTS-1 continuously since its launch in July 1972.

The Apollo-Goldstone Spaceflight Tracking and Data Networks (STDN) Station is used for support of both manned and unmanned earth orbiting satellites and for acquiring data from Apollo Lunar Surface Experiments Packages (ALSEP) left on the surface of the Moon by the Apollo astronauts. The station is one of three, primary Earth Resources Technology Satellite (ERTS) ground stations. It plays significant support roles of Atmosphere Explorer (AE) and other GSFC launched scientific satellites.

3. Deep Space Network Stations

Included at the Goldstone complex are the Deep Space Network Stations. These stations are named for the projects supported by the Deep Space Instrumentation Facility (DSIF). In addition to participating in tracking operations, these stations also serve as the research and development center of the DSIF.

4. Goldstone Complex — Deep Space Network Stations

The Pioneer Station was the first Deep Space Network Station constructed at Goldstone in 1958. Pioneer Station with its 26-meter (85-foot) polar mount antenna is named for the first U.S. space probe to escape Earth's

gravitational pull. This is a joint use station supporting both manned and unmanned space flights. The Deep Space Network training facility is also located at this site.

Venus Station is a research and development facility of the Deep Space Network. It is named to commemorate the detection of the planet Venus by radar facilities at Goldstone. The station is equipped with a 26-meter (85-foot) azimuth-elevation mount antenna and a 9-meter (30-foot) experimental antenna.

Mars Station is the site of the largest antenna. Its reflector is 64 meters (210 feet) in diameter. It is capable of tracking spacecraft to the edge of the solar system, the Mars antenna represents the latest design in sensitive tracking antennas. Because of its versatile tricone feed system, it supports a variety of NASA projects in deep space.

Echo Station is equipped with a 26-meter (85-foot) polar mount antenna. It is named for the communications experiment conducted with the passive satellite, Echo I.

B. Brief Description of Site Layout

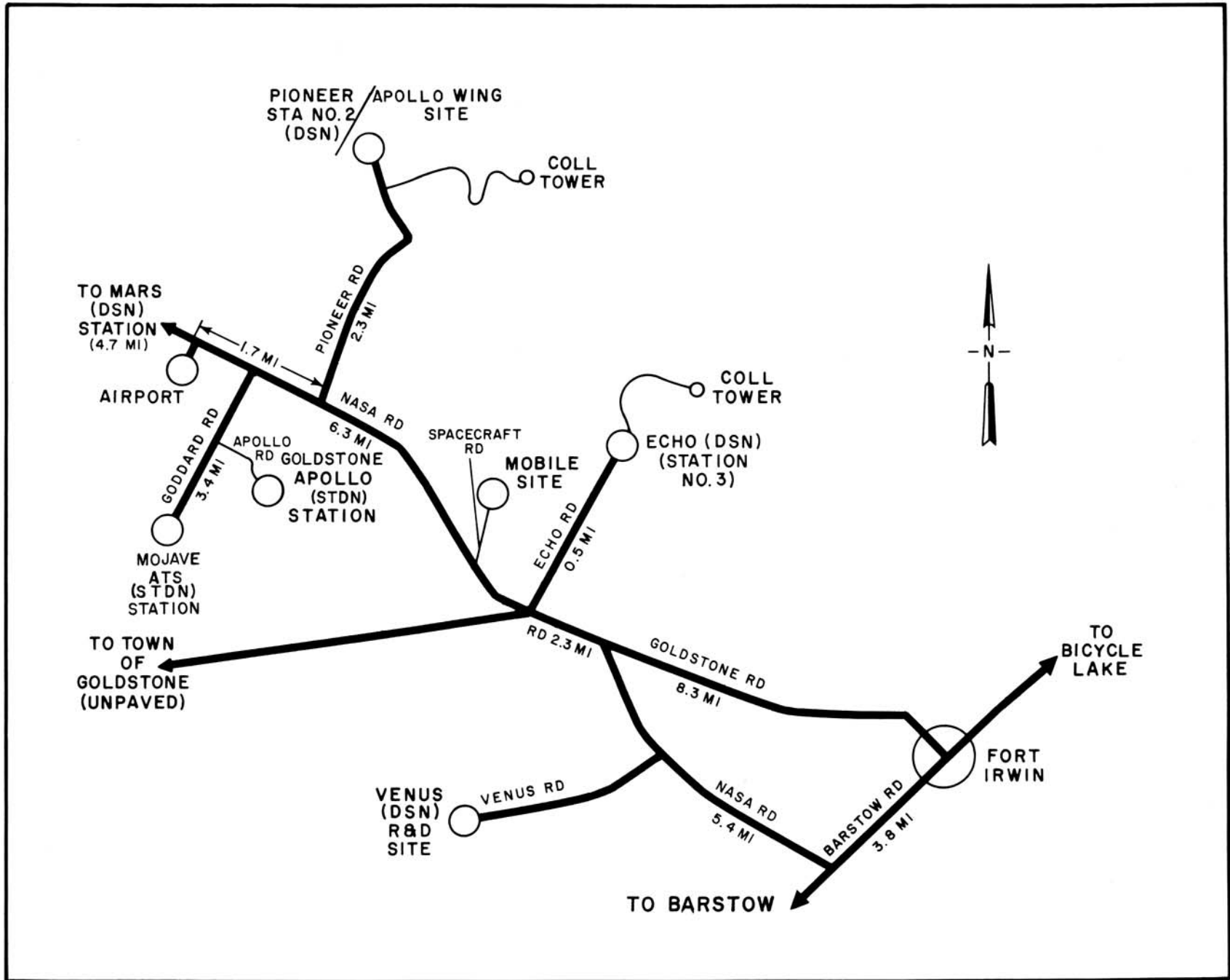
See appropriate photographs and site map incorporated in this booklet.

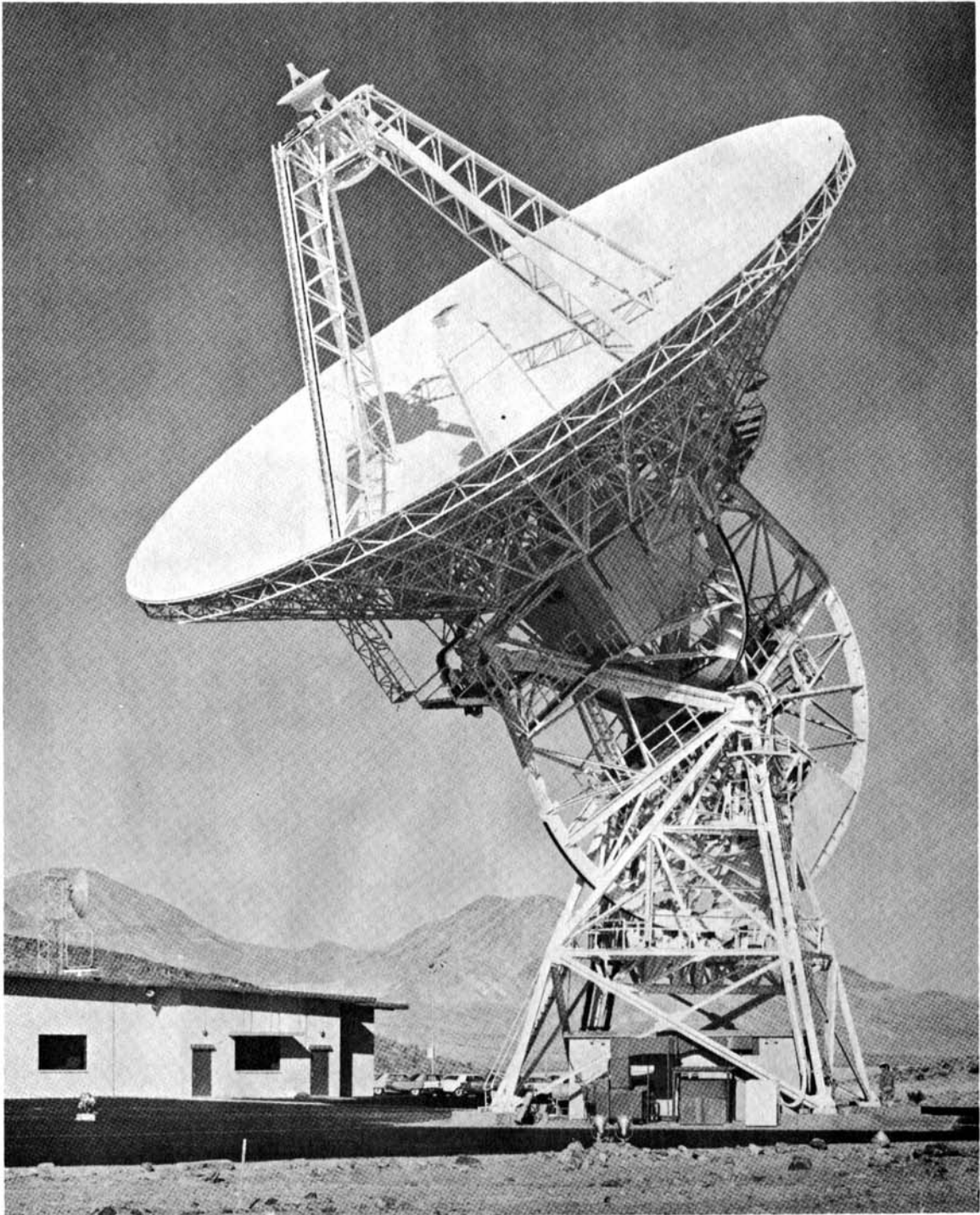
The Mojave STDN Station is located on the Goldstone Space Communications Complex, approximately 45 miles north of Barstow, California. Four major buildings are included in the Mojave STDN Station. On entering the site, one first sees the logistics building on the right. The second building of more modern construction is the old STADAN telemetry operations building; this building is about half-way between the logistics building and power generator plant. The final building, which is also the largest on site, is the Applications Technology Satellite (ATS) operations building.

C. Major Operational Systems (Mojave and Apollo)

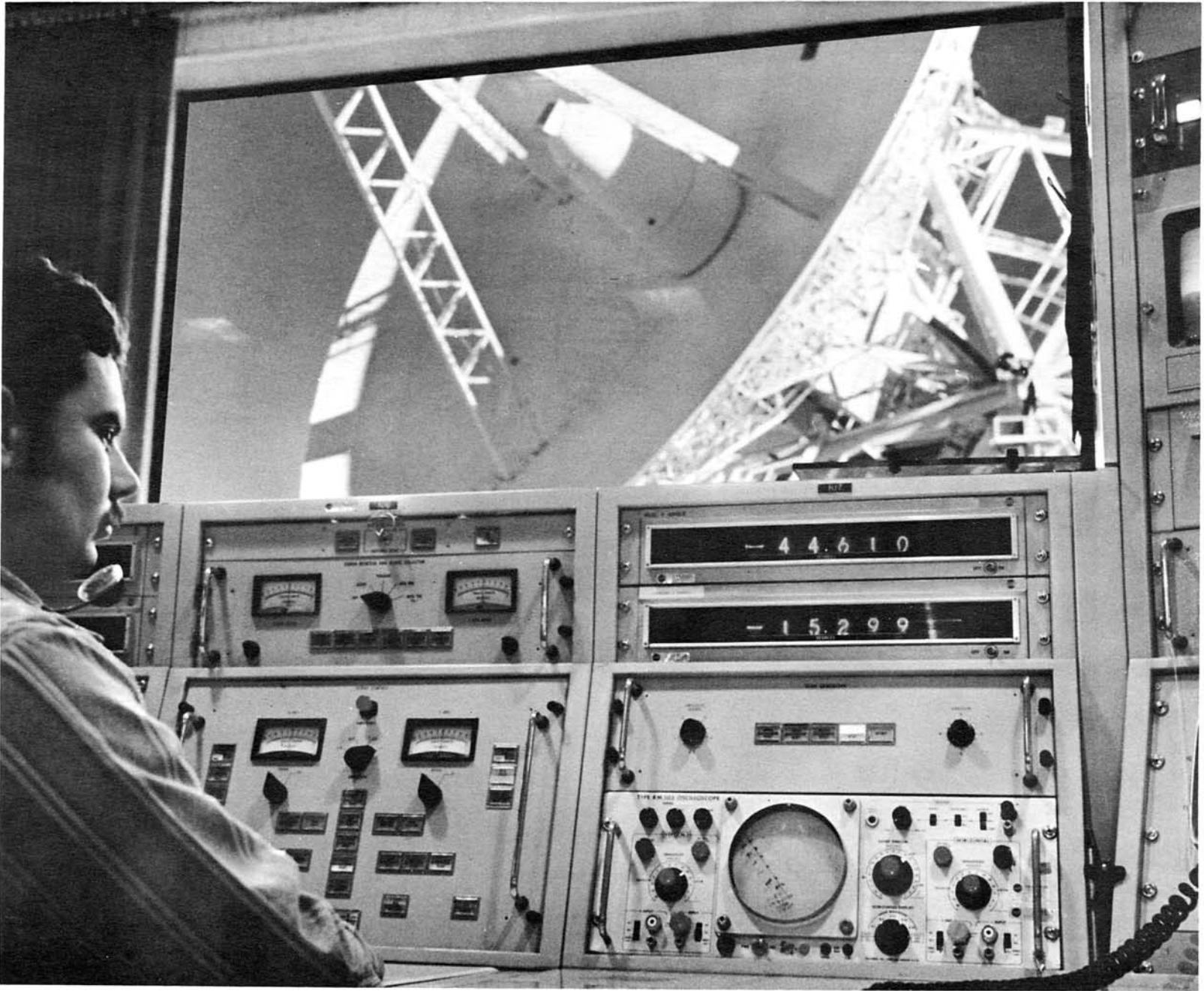
The Mojave Facility uses the 40-foot parabolic antenna for C-band and the 15-foot antenna for S- and L-bands. The 40-foot antenna uses monopulse technique to track spacecrafts at C-band. Polarization tracking is also provided. Communication signals are transmitted, received, and processed as required by the various ATS experiments. In addition, a Communication Test and Evaluation Console (CTEC) is used for evaluation of the spacecraft communications link.

Goldstone Complex

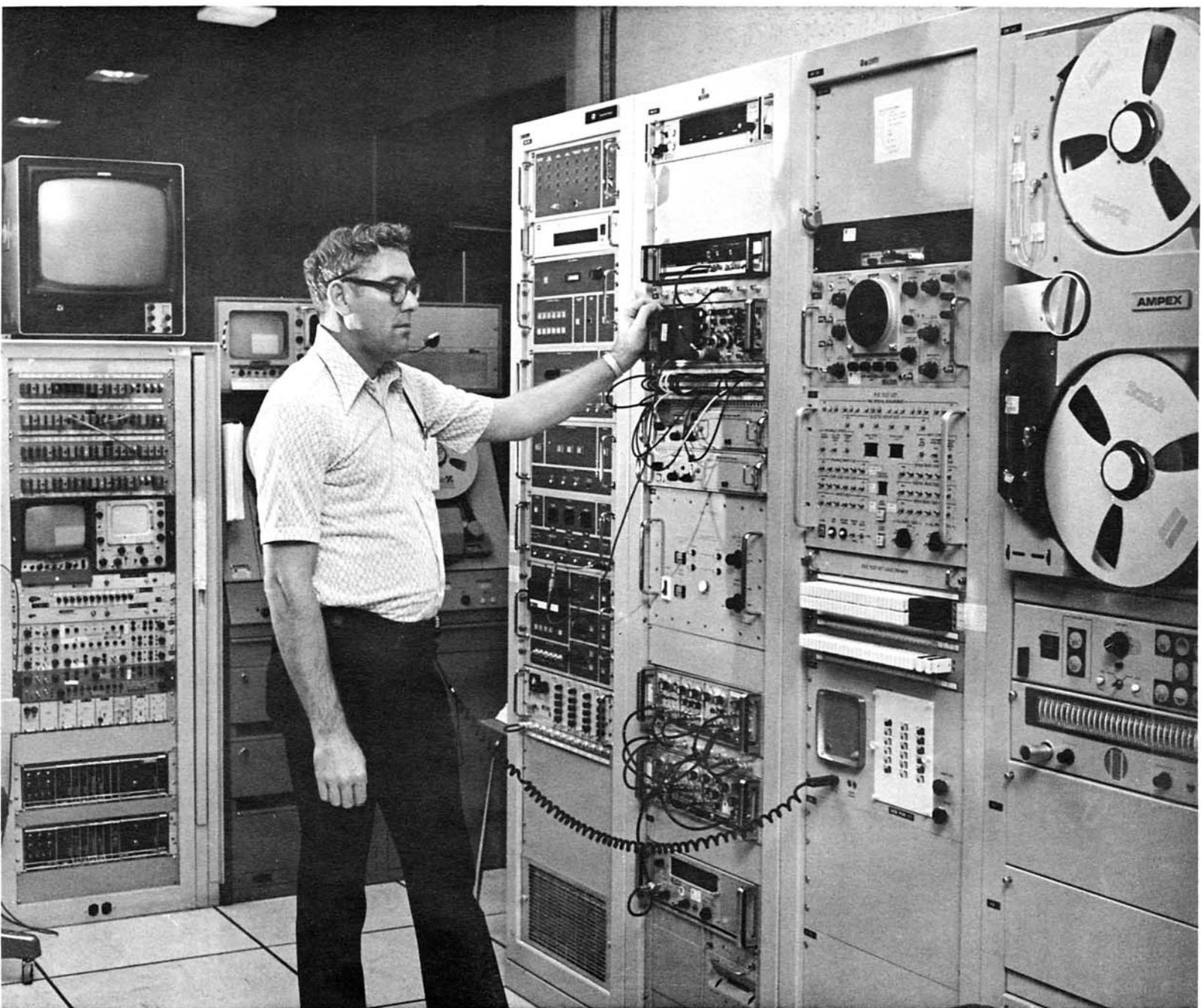




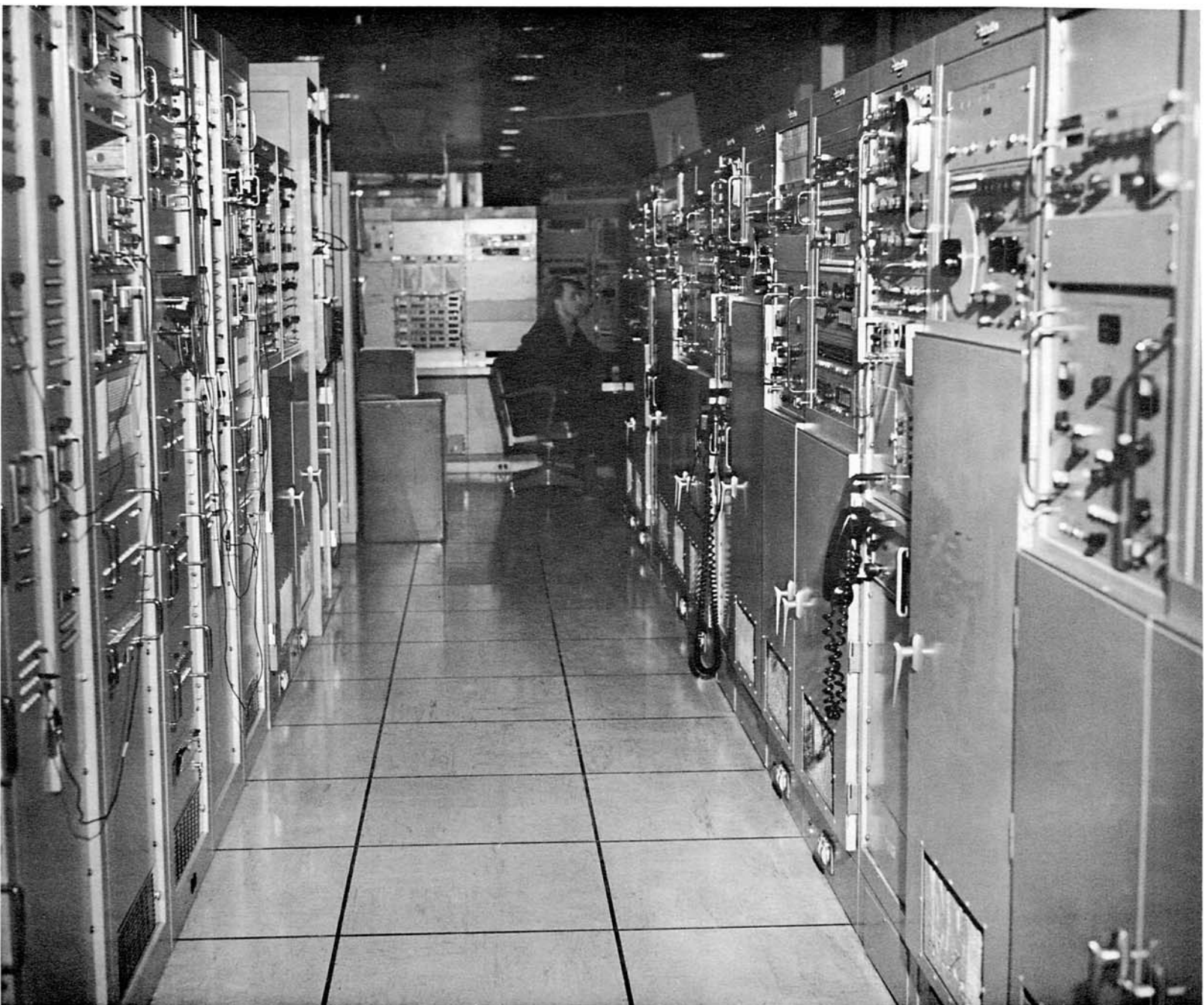
85-Foot Antenna



85-Foot Antenna Console



ERTS Ground Station



PCM Area

	FIRST WEEK	SECOND WEEK	THIRD WEEK	FOURTH WEEK
DAY OF WEEK	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S
0000-0830	D D D D D B B	B B B B B A A	A A A A A C C	C C C C C D D
0800-1630	A A C C C C C	C C D D D D D	D D B B B B B	B B A A A A A
1600-0030	B B B B A A A	A A A A C C C	C C C C D D D	D D D D B B B
DAY OFF	C C A A B D D	D D C C A B B	B B D D C A A	A A B B D C C

This schedule involving four continuous rotating shifts is currently in use for all operational personnel and some support personnel at Goldstone.

Spacecraft commands are encoded, transmitted, and verified by the Telemetry and Command (T&C) System. Spacecraft housekeeping and discrete real-time functions are also received, processed, recorded, and displayed by the telemetry subsystems.

The Apollo Station is equipped with two S-band RF systems, enabling it to support two different S-band satellites at the same time. The station has specialized ground equipment, additional recorders, and PCM and computer systems for support of the ERTS project. There are seven wideband tape recorders, six PCM systems, and seven computers which provide the wide range of mission support required of the station. VHF telemetry reception in the 215- to 260-MHz region is provided through the use of a Teltrac antenna and associated telemetry receivers. Communication with VHF equipped manned satellites is accomplished through a Comtech console and VHF transceivers.

D. Station Management Policies

Normal working hours at the station are from 8 a. m. to 4:30 p. m. Refer to attached schedule involving four continuous rotating shifts. This schedule is currently in use for all operational and some support personnel at Goldstone. STDN badges will be issued to assigned personnel; they must be worn at all times while on the complex.

Any BFEC complex employee who, for any reason, is absent from the regularly scheduled work shift, must report such absence to the supervision and state the reason for the absence.

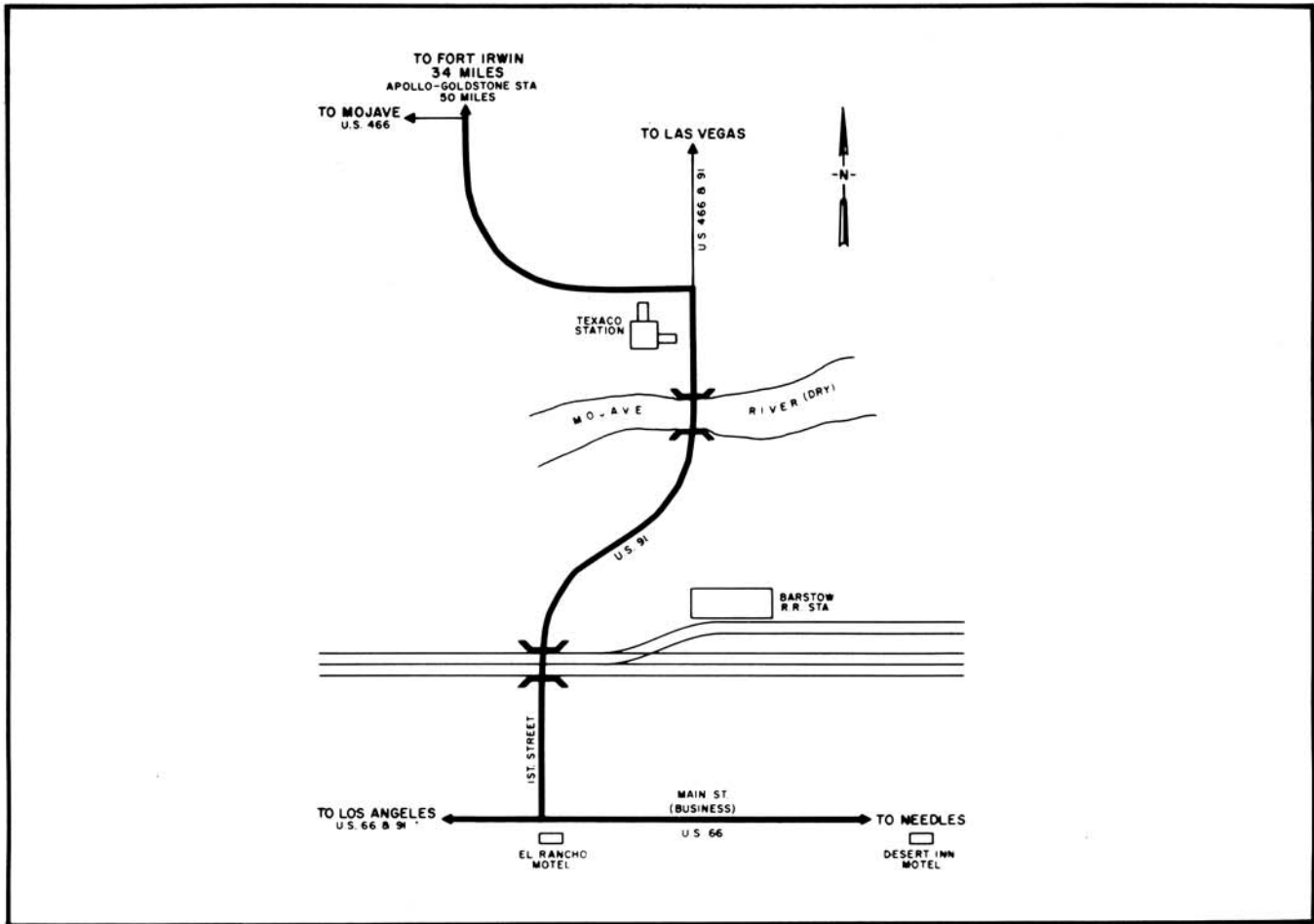
All Complex Instructions, Station Instructions, and Station Notices shall be issued by the Complex Manager or a person designated by him. Specific policies and procedures of the station will be presented in a briefing to station personnel upon arrival at the station.

II. BACKGROUND INFORMATION ON STATION LOCALE

A. Geographic Description

1. Location

The Goldstone Spaceflight Tracking and Data Networks (STDN) Station is located in a natural bowl surrounded by rugged, rocky mountains near the



Surrounding Areas

southeast tip of the Goldstone Dry Lake, approximately 45 miles north from Barstow, California. An important consideration in placing an STDN station in this area is the natural shielding from man-made electrical noise provided by the mountains. The natural "quiet area" enhances the space tracking capability.

Barstow's location, approximately midway between Las Vegas and Los Angeles, has contributed to its growth as a desert hub for tourists and transportation. Barstow has grown from a population of 2,500 residents in 1949 to a current population of 18,600. The population of the surrounding area totals 45,000.

Located in the heart of California's high desert, with an altitude of 2,142 feet, Barstow is at the intersection of Interstate 15 and 40, U.S. Highways 66 and 91, and California Routes 247 and 58.

Local Mileage Chart		
From	To	Miles
Barstow	Las Vegas	157
Barstow	San Bernardino	68
Barstow	Victorville	31
Barstow	Goldstone Complex	32
Barstow	San Francisco	416
Barstow	Los Angeles	125

2. Terrain

Through the center of Southern California's high desert runs the Mojave River. Most of the time it appears dry, but it is really an underground river. The area abounds in dry lake beds and old lava flows. Barren, fissured, rocky mountains, slashed with canyons, crisscross the land which is colored with the different hues of the rainbow. Sparse vegetation and sagewood, greasewood, and cactus cover the valley floor.

3. Climate

The average annual temperature of Barstow is 65.9 degrees, with an average low of 50.5 degrees and an average high of 81.3 degrees. Temperatures in spring range from 45 to 77 degrees; in summer, from 65 to 112 degrees; in autumn, from 47 to 80 degrees; and in winter, from 31 to 59 degrees.

The climate is quite arid. The rain that does occur is usually in the autumn and winter months. Autumn and spring bring high winds and dust storms. In the winter it may snow in the high desert, but it lasts for only a few days. Relatively low humidity (annual average is 22.6 percent) minimizes discomfort on even the hottest summer days. Gentle, prevailing westerly winds give added relief from the summer heat.

B. History of Area

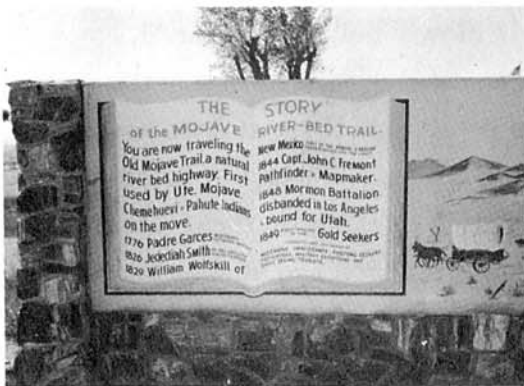
Approximately 3,500 years ago, this region was inhabited by the semi-nomadic Chemehuevi Indians. Their petroglyphs and relics are still evident. The San Bernardino County Museum is presently excavating tools and other Indian artifacts just east of Barstow.

The first written history of the area dates back to 1776, when Francisco Garces, a missionary priest, came through the valley on his way from the Colorado River to the San Gabriel mission.

The first American to come to the area was Jedediah Strong Smith in 1826, a trapper who brought his Bible and his gun and was followed by many other trappers and hunters. Caravan traders with pack trains of mules and horses carrying silks, cloth, ivory, jade, and coins of gold and silver used the Mojave River Trail on their way to and from the coast. Explorer John Charles Fremont, accompanied by scouts William Cody and Kit Carson, came over the trail enroute to old Fort Cady, north of Newberry. The Mormon Battalion brought the first wagon over the trail on its way to fight in the Mexican War in 1848. Robert Waterman, later a Governor of California, discovered silver in the area in 1880; and a town called Waterman grew up around the mill. With the advent of the railroad, the village became known as Waterman's Junction; but when the price of silver fell in 1887, the town was renamed Barstow in honor of William Barstow Strong, a former president of the Santa Fe Railroad.

Barstow suffered several devastating fires which necessitated that it be rebuilt. Each time that this occurred, the citizens rebuilt their town on higher ground to get farther from the river which frequently flooded. By this process, the town reached the area which it presently occupies.

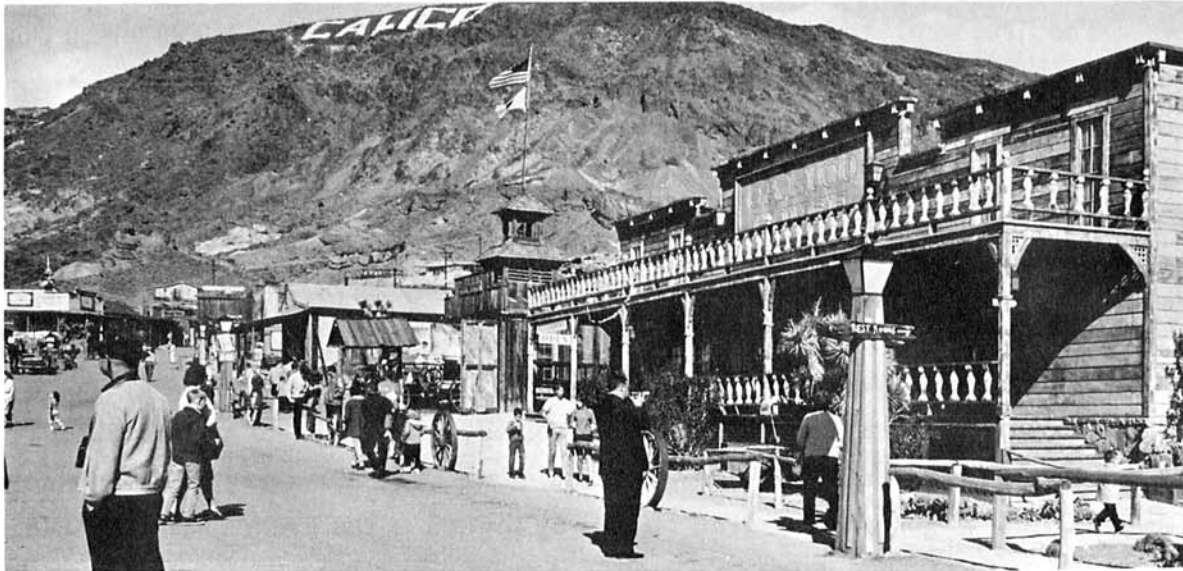
The convenient river bed trail, the discovery of rich silver ore, and the railroad were responsible for the founding of Barstow. It continued to grow as a railroad and tourist town until the start of World War II. Fort Irwin, an armor



Barstow/Mojave Museum



Santa Fe Switching Yard



Calico Ghost Town

and desert training center covering more than 630,000 acres, was established along with the Marine Corps Supply Depot and Repair Center. Both became permanent installations.

Calico was once America's largest producer of silver; it yielded millions of dollars worth of silver in the 1800's. Recently restored, Calico attracts thousands of tourists each day as an authentically reproduced ghost town.

Goldstone is a small mining settlement dating back to 1881. It reached an apex in 1915 with the discovery of gold. Today there are a few remaining old buildings. Near the old settlement is the NASA Goldstone Deep Space Tracking Station.

The history of the Indian people of this area is slowly being discovered. Archaeologists are presently preserving and continuing to discover artifacts and petroglyphs which are important in helping to determine the history of man in the Mojave Desert region. The areas of this region which provide both scientific research and recreational enjoyment are the Rainbow Basin Natural Area, Newberry Cave, the Manix Basin, and Inscription Canyon and Black Canyon.

III. LIVING ACCOMMODATIONS AND COMMODITIES

A. Housing

1. Temporary

The rent for a two- or three-bedroom house can range from \$135 to \$250 per month. One- or two-bedroom apartments are also available. Their rents range from \$100 to \$165 per month. There is only a limited number of duplex apartments whose cost vary from \$100 to \$165 per month. Many of these dwellings can be rented furnished.

2. Permanent

There are several residential areas within a 12-mile radius of downtown Barstow that offer homes at purchase prices which begin at \$15,000. The average price for homes in the Barstow area ranges between \$20,000 and \$22,000.

There are also several trailer parks available, with space rentals ranging from \$35 to \$90 per month.

B. Utilities

A deposit is required for electricity, gas, and water prior to initiation of services. This deposit, however, is refunded after the resident has lived a full year at the same residence.

Utility rates can range from \$30 to \$85 per month, depending on the usage and size and type of residence.

C. Food

Barstow is served by two large chain store supermarkets and several independent grocers. Prices for food are fluctuating in Barstow based on shortages and other factors. In June 1974, milk cost was \$1.44 per gallon, eggs were \$.69 per dozen, and a jar of Best Foods mayonnaise was \$1.09 per quart.

D. Laundry and Drycleaning

In many apartment dwellings, tenants will find that there are washing machines and dryers available for use. The washing machines are coin-operated, but the dryers use is usually free to the apartment tenants.



Von's Shopping Plaza



Safeway Shopping Center

There are also many public coin-operated laundromats available at five different locations around the Barstow area.

In addition, there are several drycleaners in Barstow that do cleaning at average prices.

IV. COMMUNITY FACILITIES

A. Religious Services

The Barstow area serves the community with a wide range of religious services of every denomination. There are 49 churches located within the general area which provide, in addition to services of worship, day nurseries, youth programs, and other fine programs within the community.



Saint Joseph Roman Catholic Church



Free Methodist Church

B. Educational Facilities for Dependents and/or Adults

Educational facilities in the Barstow Unified School District include 18 elementary schools, 2 junior high schools, 3 high schools, 1 junior college, and 2 parochial schools.



Barstow Junior College

Barstow Junior College offers credit and noncredit courses for both full-time and part-time students. A wide variety of courses can be pursued during day or night classes, making class scheduling convenient for Goldstone employees and their dependents. The college allows a combination of day and night classes for persons assigned to a rotating shift.

C. Health and Sanitation

Barstow has 8 dentists, including an orthodontist, 2 optometrists, and 19 consulting physicians and surgeons, including one internist. The Barstow Community Hospital is a new facility with 56 beds; there is another modern hospital in Apple Valley 38 miles away.

The city of Barstow has recently installed a modern water purification facility at a cost of \$17 million.

The water that is supplied is hard, and as a result, many residents use water-softening equipment.

D. Recreation and Entertainment

Community facilities include 2 motion picture theaters (1 of which is a drive-in), 11 parks, 7 playgrounds, 7 ball parks, swimming pools, a desert museum, and a country club and golf range. Barstow has two local radio stations. There are

seven Los Angeles stations, one Bakersfield TV station, one San Bernardino educational TV station, and the Los Angeles area FM radio station.

An interesting and unique pastime of the area and one that is a challenge to the mechanical ingenuity of the participant is the building and operation of dune buggies for short jaunts and exploring trips in the desert. Some of these buggies are built from kits. There are several active clubs.

An excellent swimming program is available for children between the ages of 8 and 18 with the Barstow Sea Serpents, a club in the High Desert Swim Conference. Many members swim in AAU Meets in Southern California.

Located just west of Lenwood (a 10-minute drive from downtown Barstow) is the Sun and Sky Golf Course and Country Club, with membership open to the public. In spite of being in the high desert, this facility boasts of an all-grass course, an excellent practice driving range, and putting greens.

In the surrounding area, there are numerous gem fields, Indian artifacts, and the Calico Ghost Town, which is a restored silver mining town.

Weekend trips can be made to scenic areas such as Death Valley, Sequoia National Forest, and Yosemite.

Such attractions as Mount Whitney (elevation, 14,496 feet), Bad Water, and Death Valley (279.8 feet below sea level), the highest and lowest points in the continental United States, are also convenient to the area.

Within 2 or 3 hours by car from Barstow, one can, when in season, be skiing or camping at Big Bear Resort Area; swimming at one of the many fine beaches along the coast; touring Disneyland, Marineland, or San Diego Zoo; or visiting Los Angeles, one of the entertainment capitals of the world.

There are many fine restaurants in the Barstow area and in the nearby town of Victorville.

E. Emergency Assistance

Emergency assistance can be easily obtained by calling the agency or department from which assistance is needed. The following gives a listing of some of the community services available:

Barstow Community Hospital (256-1761)
Fire (256-2251)

Police (256-2251)
Highway Patrol (256-1727)
San Bernardino County Sheriff's Dept. (256-1796)
FBI Barstow (256-7780)

V. TRANSPORTATION

A. To Work

When arriving by air, it is advisable to land at Las Vegas, Nevada, or the Ontario Airport outside of Los Angeles, if direct flights are available. For transportation between the airport and Barstow, it is suggested that Avis or Hertz car rentals be used for one day only. Company-provided transportation between Barstow and the Goldstone station is made available to all station personnel. GSA vehicles are provided for this purpose.

B. For Personal Convenience and Pleasure

Upon arrival, if you are from out of state, you will be given a copy of the California Driver's Handbook, which explains the rules that govern traveling by automobile in California. A California license must be obtained within 10 days of arrival. Vehicle registration is required after the current registration has expired; commercial vehicles are an exception.

VI. CURRENCY AND BANKING

A. Local Banking Facilities

There are numerous local banks and savings institutions in Barstow. There should be no problem in finding one to best suit your needs.

B. Tax Information

The various state taxes that are applicable to the residents of California are income, gasoline, sales, and property taxes. There are also various county taxes.

VII. CLOTHING/GROOMING

During the summer months it is quite warm in the Barstow area; therefore, it is necessary to bring light summer clothing with you.

Fall coats and sweaters are useful during the winter months; because it may become quite cold, especially at night. High elevation winter resort areas are close to Barstow; therefore, heavy winter clothing is advisable for these areas.

The mode of dress in the area is informal, except for certain business functions and some social affairs.

VIII. WHAT TO DO UPON ARRIVAL

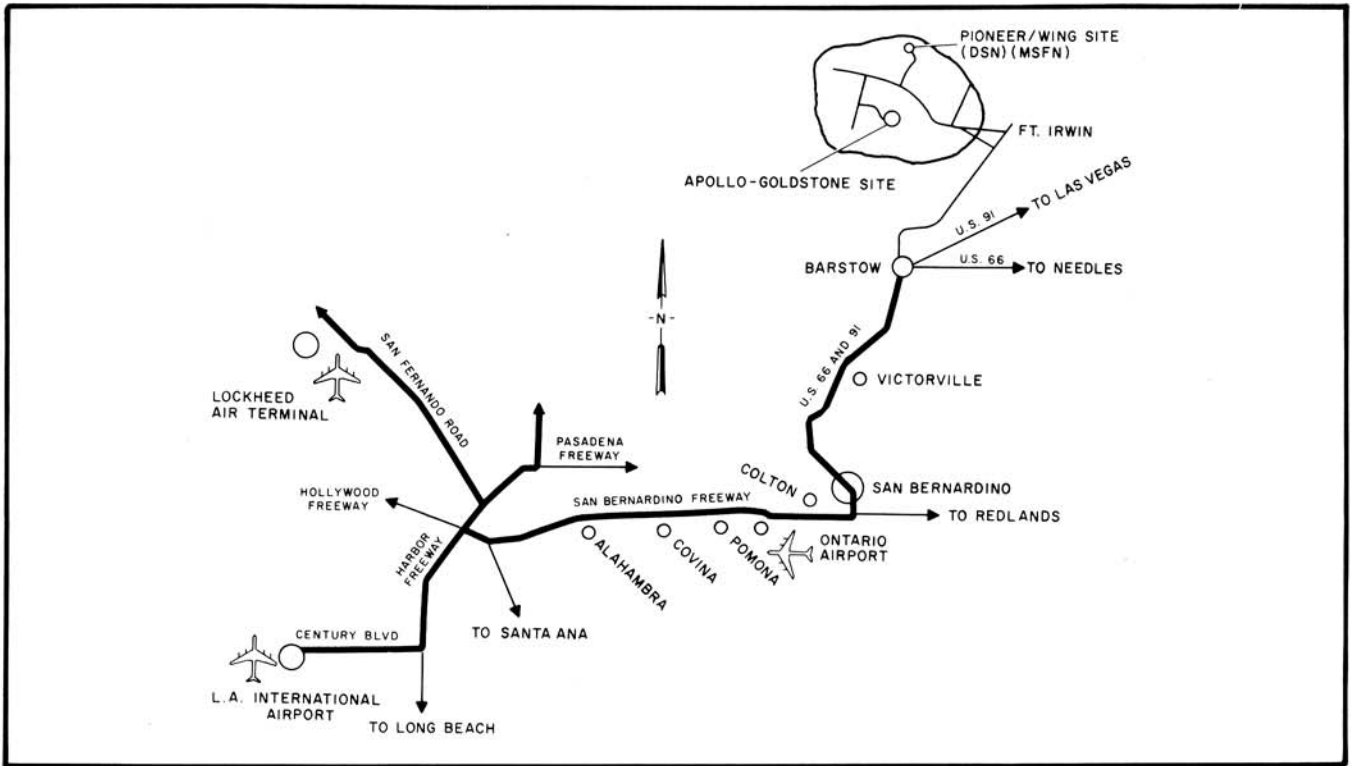
- A. When you arrive, contact the administrative assistant or the complex manager at the Goldstone Station by telephoning 587-0651 or 587-0652, area code 714. The station operates around the clock. The home telephone number of the administrative assistant or the complex manager may be obtained by calling the station at any time.

Prior to departing from Columbia, you may desire additional information concerning the Goldstone station. We invite you to call or write the complex manager or his administrative assistant for answers to your questions. The address is:

Apollo-Goldstone
P. O. Box 789
Barstow, California 92311

- B. Directions to Barstow from the Las Vegas Airport

When leaving the airport road, turn left and go approximately 1/2 mile to the first stoplight. Turn left at the stoplight, go approximately 1 mile, and cross over the freeway. Turn left onto the freeway (Interstate Route 15); but first make sure you have enough gas for the 155 mile drive to Barstow.



Los Angeles Freeways to Barstow, California



Aerial View of Barstow

IX. APPLICABLE REFERENCE MATERIAL

To obtain further detailed information about the area, it is advisable that you contact the Barstow Chamber of Commerce located at 220 East Buena Vista Street, Barstow, California.