

# ASCENSION ISLAND



**MANNED SPACE FLIGHT NETWORK STATION**

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PREPARED BY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
GODDARD SPACE FLIGHT CENTER

GREENBELT, MARYLAND



# INTRODUCTION

The Manned Space Flight Network (MSFN) is made up of a series of tracking stations located at various intervals around the earth. These stations track, communicate with, and give data support for the Apollo project missions.

All stations come under the National Aeronautics and Space Administration (NASA), which is located at the Goddard Space Flight Center (GSFC) in Maryland. (NASA, an agency of the United States Government, is responsible for developing the peaceful space sciences, both in manned and unmanned space efforts.)

The network consists of 17 tracking stations. Three of these stations are equipped with 85-foot diameter antennas which are used to cover the tracking of the translunar and lunar phases of the Apollo spacecraft at distances of more than 10,000 miles from the earth. These stations are placed at intervals of approximately 120 degrees longitude and are used to cover more distant tracking. They are located at Goldstone, California; near Madrid, Spain; and at Tidbinbilla, Australia.

The rest of the stations are equipped with the smaller 30-foot diameter antenna "dishes" for the near-earth phases of the Apollo missions. This includes parking orbit injection, translunar trajectory, etc.

The network also includes a number of tracking ships and aircraft to cover the areas where it is impossible to build land stations.

Also under NASA and often closely connected with the MSFN is the Deep Space Network (DSN). This network can, if necessary, provide a backup for the manned flights or, on the other hand, receive a backup from the MSFN. DSN stations are usually located near the MSFN stations or, as at Ascension, both are located in the same building, but each with its own tracking equipment.

Signals received from spacecraft are often extremely weak; therefore, the tracking stations are located several miles from built-up areas to reduce man-made interference.

# THE HISTORY OF ASCENSION ISLAND

Ascension Island was discovered in 1501 by Portuguese Admiral Jose Da Nova Gallege, on his way to India, but it was left unnamed until two years later when it was visited by another Portuguese, Alfonso de Albuquerque, on Ascension Day.

The island is 34 square miles in area. With its 42 volcanoes and little vegetation (the only exception being Green Mountain, which rises to 2,819 feet), it is not surprising that it was left undisturbed for over three centuries. In 1815 a British Naval garrison of 150 personnel was established to prevent the use of the island as a base for rescuing Napoleon, who was exiled on St. Helena, a lush island only 700 miles to the south. During the next seven years, the Royal Navy built the original Georgetown and the Mountain Farm where vegetation and livestock were introduced.

After Napoleon's death in 1821, Ascension was used as a refueling point and as a sanatorium for the British Navy Marines. The Marines employed West African "Kroomen" in payment for their freedom and continued fortifying and developing the island.

At the beginning of the twentieth century, Cable and Wireless, Ltd., a British concern, built a

relay station on Ascension for communication between West Africa, South America, South Africa, and the United Kingdom. In 1922, when the British Navy no longer used the island for refueling purposes, it was handed over to the Colonial Office and came under the jurisdiction of St. Helena. The then manager of Cable and Wireless, Ltd., was made responsible for governing the island. The company continued to govern the island until 1964, when, as a result of the development of several new British interests, including the building of the B. B. C. transmitting station, it became necessary to have an administrator.

In 1942 the American Air Force built an air field for refueling bombers enroute to the Middle East. Fifteen years later, in 1957, the first radar site was built on the flattened top of one of the volcanoes. Other sites rapidly followed, thus forming one of the most important stations of the Eastern Test Range, which is controlled by the American Air Force.

The most recent additions to the island are the NASA Apollo site, built in 1965 on the southeast side of the island at Devil's Ashpit, and the earth-satellite station, built in 1966 and operated by Cable and Wireless, Ltd., for communication through Intelsat II for the Apollo missions.

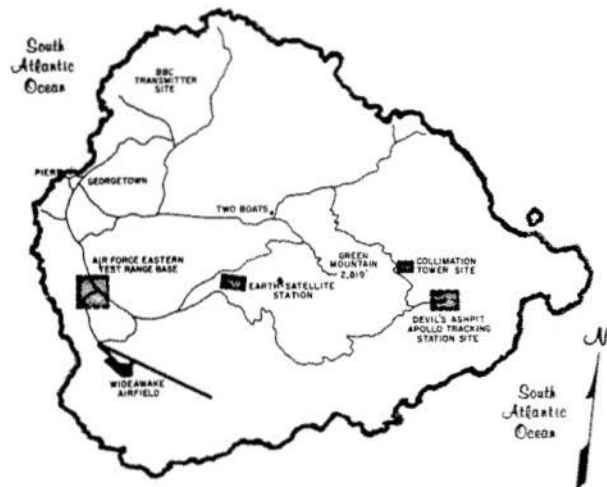
## DEVIL'S ASHPIT TRACKING STATION

Devil's Ashpit, the name of the tracking station site, is located in the southeastern part of the island. Green Mountain, which has an elevation of 2,819 feet, separates the station from the main activity area of the island. This ensures maximum protection from noise or interference from both the British concerns (the B. B. C. transmitter station and the Cable and Wireless, Ltd.) and the Eastern Test Range tracking sites of the American Air Force.

On one side of the site area is the Ashpit, a deep gorge of black cinder that was once forced through a crack in the rock above. On the other side is the deep, almost circular Cricket Valley. The collimation tower for antenna testing stands on the far side of Cricket Valley.

The station is made up of two main buildings and two 30-foot diameter antennas. One is operated by the Manned Space Flight Network under Bendix Field Engineering Corporation, and is an X-Y axis type antenna, and the other by Jet Propulsion Laboratory, for the Deep Space Network. Both organizations have separate operations rooms in the same building, and share the

Communications Center (teletype and SCAMA, Switching, Conferencing, and Monitoring Arrangement), the powerhouse (a separate building), and the station facilities.



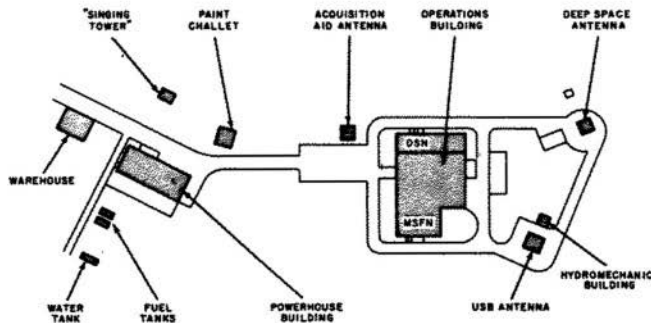
## DEEP SPACE STATION

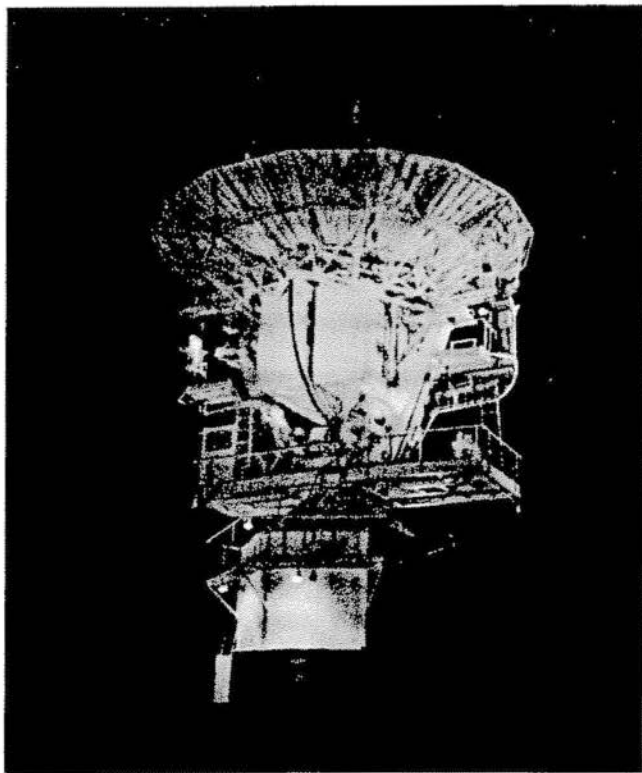
Ascension Island's Deep Space station (72) is operated by Bendix Field Engineering Corporation based in Owings Mills, Maryland, for the Jet Propulsion Laboratory, a department of the California Institute of Technology, under a contract to the National Aeronautics and Space Administration.

The station was built in 1965. Since operations began in April 1966, it has been utilized in nine missions, including two soft Moon landings, three lunar orbiting spacecraft, a Pioneer, and the recent Mariner-Venus mission to investigate the planet Venus.

Five contract employees ordinarily operate the station; however, they receive additional support from three or four men who arrive two weeks prior to the mission operations. As the first station to view a spacecraft after it has been launched from Cape Kennedy, Florida, the Ascension Island Deep Space Network station performs the spacecraft guidance and command functions in acquiring and tracking of the spacecraft, trans-

mitting data to JPL for computation, generation of trajectory, and predicting tracking information for other stations in the Deep Space Network. It also receives spacecraft telemetry data to monitor the performance of the vehicle and transmits commands to the spacecraft to provide primary and backup control of the craft during critical transfer trajectory/injectory phases of a mission.

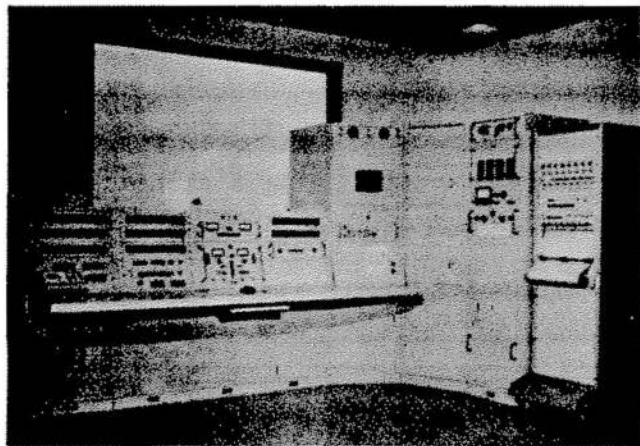




**DSN 30-Foot Diameter Antenna**

## **UNIFIED S-BAND SYSTEM**

The unified S-band system is made up of all the equipment necessary for receiving and transmitting data from the spacecraft, thus providing the actual communications between the ground and the spacecraft. The system includes the antenna control console, the tracking data processing equipment, and timing and ranging equipment.



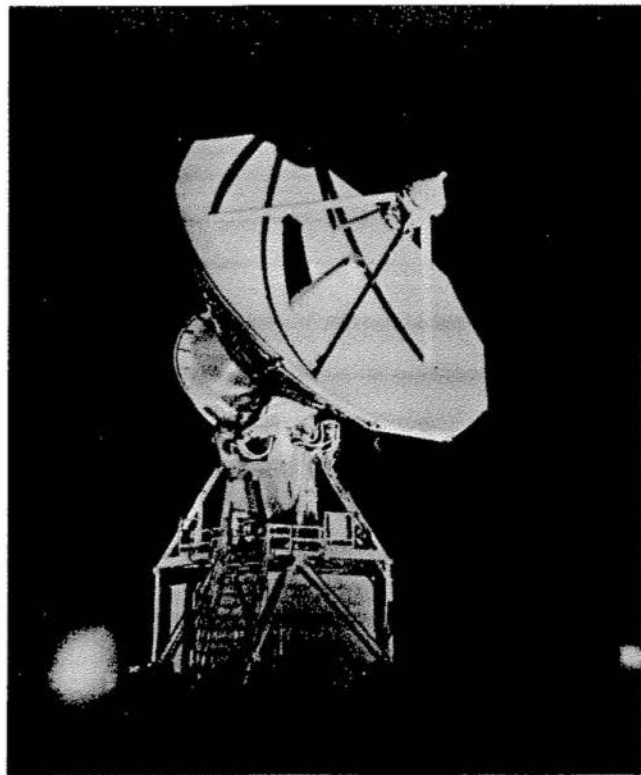
**Antenna Control Console**



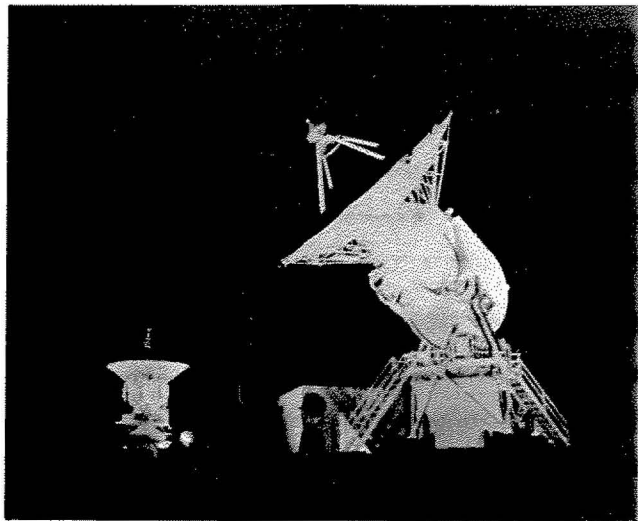
## UNIFIED S-BAND ANTENNA

The antenna is thirty feet in diameter and has a surface which is a true parabola and is accurate to a few hundredths of an inch. The dimensions and accuracy of the antenna, usually referred to as a "dish," result in a beamwidth of approximately one degree, with the ability to measure extremely fine angles. The antenna mounting is of the X-Y type to enable spacecraft tracking through or near the zenith.

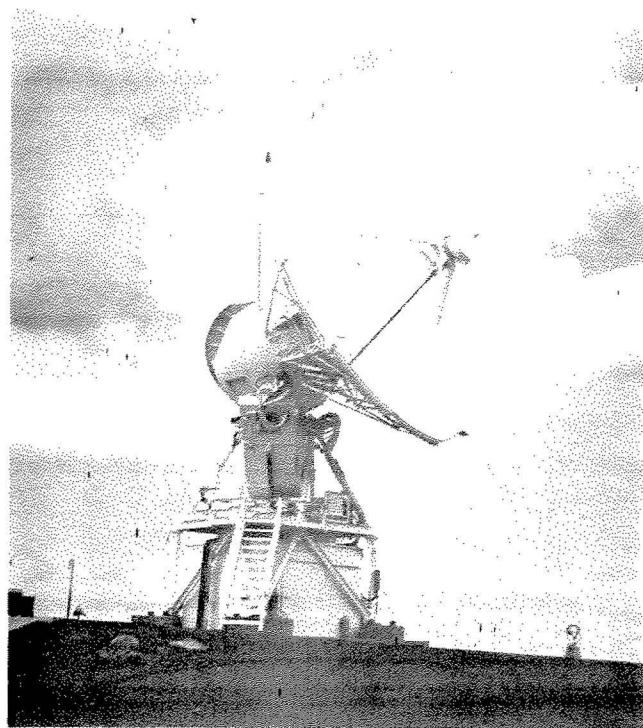
The antenna is driven by hydraulic motors to achieve smooth operation. The antenna feed system is of the Cassegrain type, similar to reflecting telescopes. This allows the feed supporting system to be reduced in length by half, decreasing inertia to allow more precise tracking. In operation, the antenna is controlled by receivers, resulting in completely automatic tracking.



**MSFN 30-Foot Diameter Antenna**



**X-Axis**



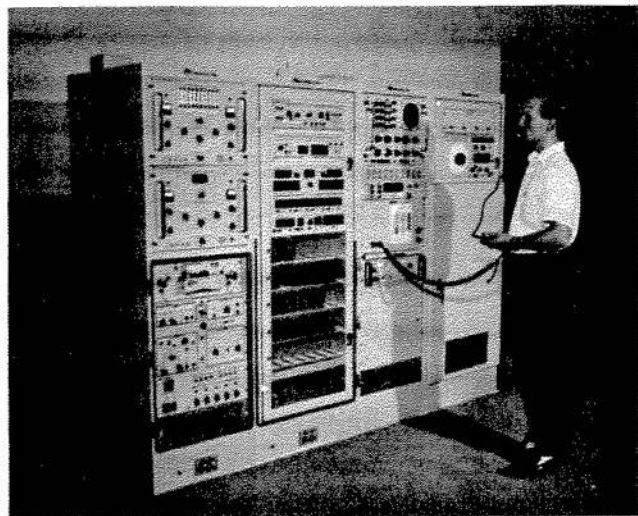
**Y-Axis**

**UNIFIED S-BAND ANTENNA**

## THE TELEMETRY SYSTEM

The telemetry system accepts and decodes spacecraft pulse-code-modulated telemetry data that has been acquired directly by the unified S-band system. In the case of near-earth orbits, it may also accept data from the VHF acquisition aid Teltrac system. This equipment has the capability of simultaneously processing downlink telemetry data from any three distinct and separate vehicles within the Apollo mission profile (Command and Service Modules, Lunar Excursion Module, or any of the three stages of the Saturn launch vehicle).

Upon receiving the telemetry data, the demodulation system prepares and conditions the incoming stream of digital data and breaks it down into words or specific spacecraft parameters. It then distributes these words with the use of instructions from its internal magnetic memory for display, monitoring, and/or real time computer processing and transmission to Mission Control at the Manned Spacecraft Center in Houston.



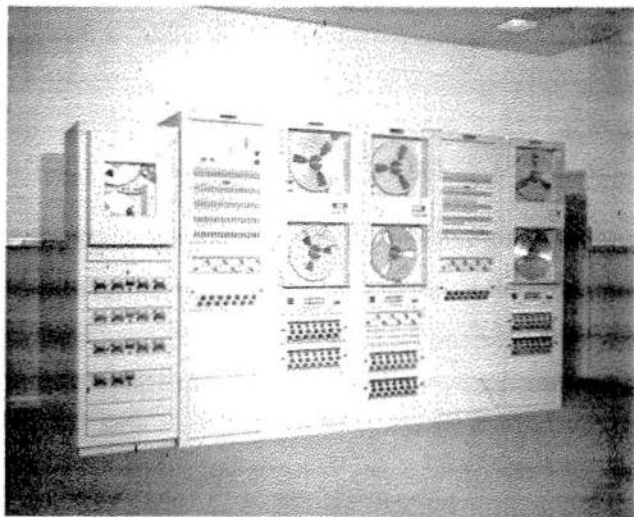
**The Telemetry System**

## DATA RECORDING SYSTEM

The station uses a complex of magnetic tape recorders to make permanent records of all received telemetry data, television video, and communications with the spacecraft. Simultaneous recording of critical station data (such as tracking receiver signal strengths (AGC), all in-house intercom circuits, as well as communications with the Manned Spacecraft Center) provides records of station evaluation of a particular mission if required.

This system consists of several wideband recorders (capable of recording signal frequencies from DC to 1.5 MHz) for telemetry and spacecraft data. There are also special purpose narrow-band and audio recorders for voice and low frequency data.

All recorders simultaneously record data on 14 separate tracks of one-inch wide tapes.



**Data Recording System**

## **VHF TELTRAC and RF TELEMETRY SYSTEMS**

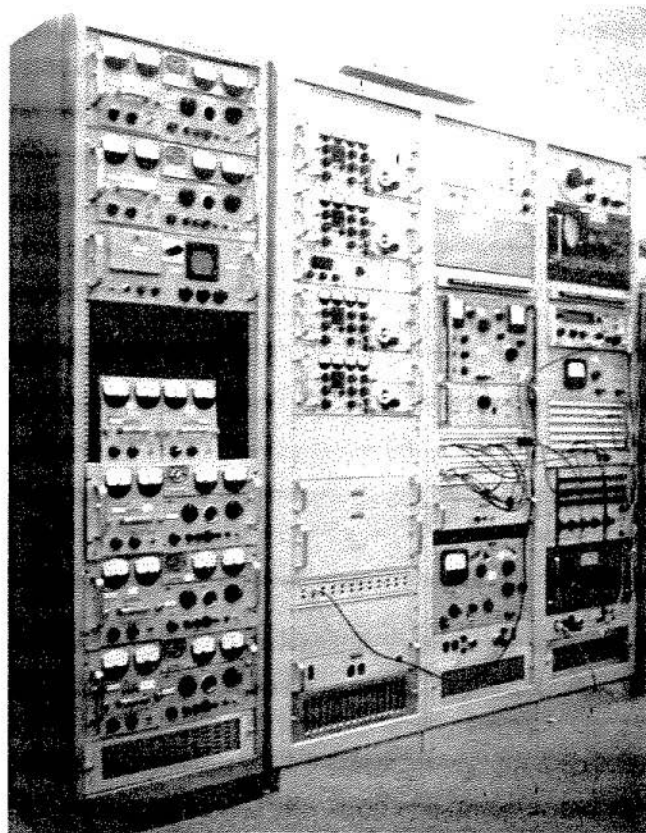
The VHF and RF telemetry systems are capable of tracking the Apollo spacecraft and associated launch vehicles. They also provide downlink RF telemetry to the PCM telemetry systems during earth orbital phases or early translunar phases of the mission.

The broad beamwidth of the Teltrac antenna system enables this equipment to readily acquire the spacecraft and to be used as an acquisition aid for the narrow beam unified S-band system by providing dynamic synchro pointing data for the 30-foot unified S-band antenna.

During initial phases of the mission, this equipment may serve as a contingency system should an equipment failure prevent receipt of usable S-band telemetry.



**Teltrac Antenna**



**RF Telemetry System**

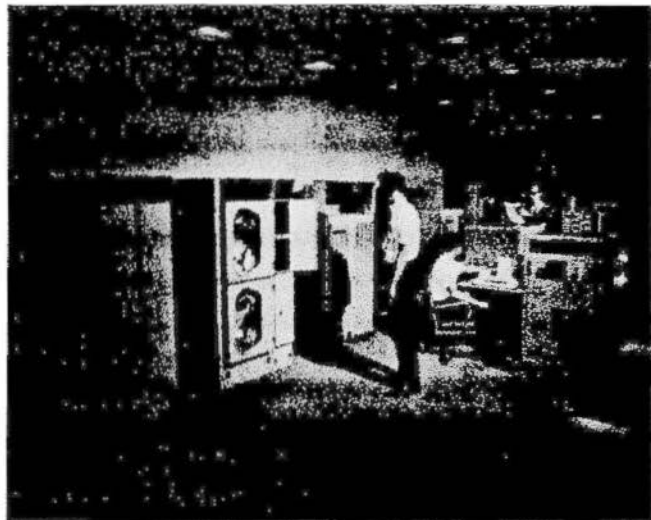
## REMOTE SITE DATA PROCESSOR AND COMPUTER SYSTEMS

The remote site data processor is the station central computer complex that accepts and stores spacecraft telemetry data from the PCM systems. It also selects and groups specific parameters for high-speed retransmission when so instructed by the real-time computer complex at the Manned Spacecraft Center in Houston, Texas. All commands to the Apollo vehicle onboard computers, such as navigation updates and orbital and glide path data, are processed by the computers and sent to the unified S-band system for transmission to the spacecraft.

The remote site data processing system consists of two Univac M642B digital computers, expanded memory units for each computer, and all associated equipments, such as keyboards, punched paper tape, input-output consoles and high-speed digital recording, and magnetic tape recovery units.

There is an additional computer (with associated equipments) which computes pointing data and

spacecraft orbital or transmitting parameters relative to the station and points the unified S-band 30-foot antenna to the predicted spacecraft position prior to acquisition. This is a high-resolution system that provides for rapid and accurate reacquisition should active spacecraft track be lost at any time during a pass.



Remote Site Data Processor

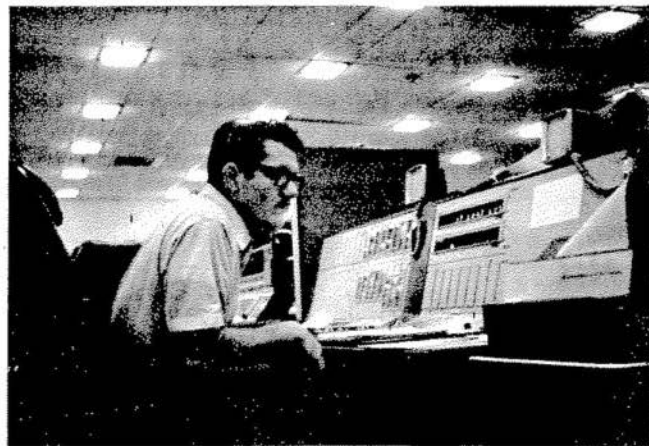
## STATION COMMUNICATIONS SYSTEM

The communications system consists of teletype communications and a SCAMA (Switching, Conferencing, and Monitoring Arrangement) for both exterior voice and data communications, and an interior telephone system for administrative purposes during missions and testings.

This system is generally used for passing and receiving information between the Goddard Space Flight Center, the Apollo Control Center in Houston, Texas, and the other tracking stations of the network. Therefore, this system, along with the powerhouse, is manned twenty-four hours a day.

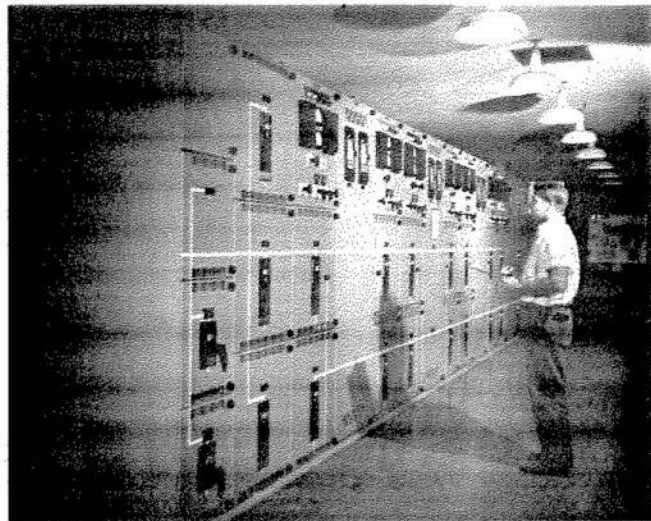
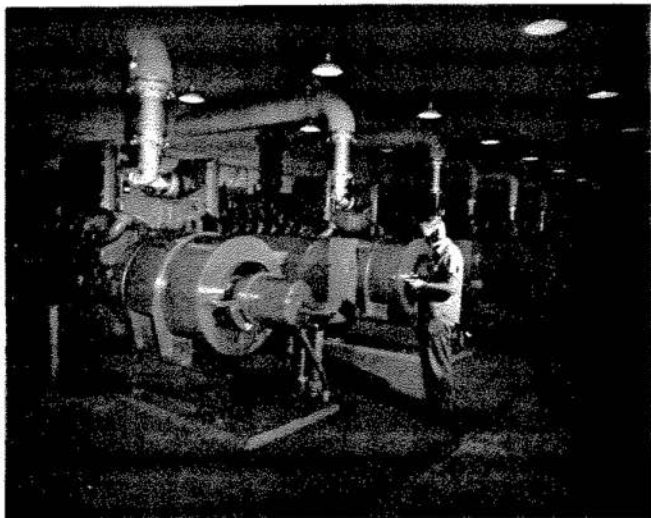


**Communications Center**

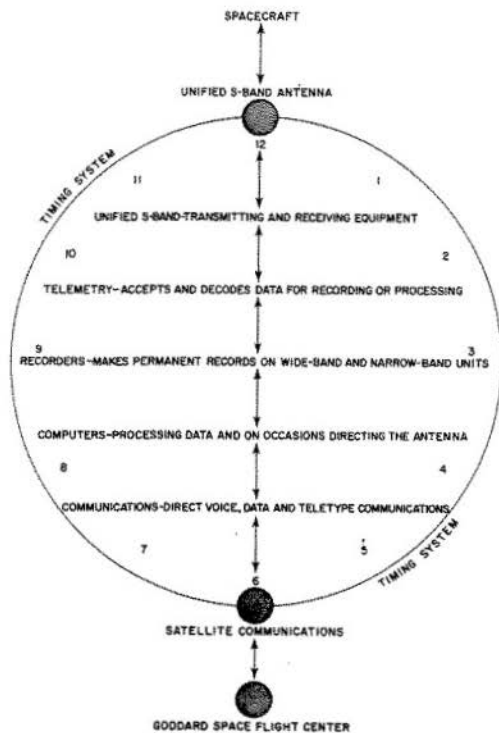


**Maintenance and Operation Console**





**THE POWERHOUSE**



**Outlined Site Operations System**