NPS Form 10-900
(7-81)

United States Department of the Interior
National Park Service

National Register of Historic Places Inventory—Nomination Form

For NPS use only
received
date entered

See instructions in *How to Complete National Register Forms*
Type all entries—complete applicable sections

1. Name

historic Pioneer Deep Space Station

and/or common Pioneer Deep Space Station

2. Location

street & number Goldstone Deep Space Communications Complex ___ not for publication

city, town Fort Irwin ___ vicinity of **congressional district**

state California **code** 06 **county** San Bernardino **code** 071

3. Classification

Category	Ownership	Status	Present Use	
___ district	_X_ public	___ occupied	___ agriculture	___ museum
___ building(s)	___ private	___ unoccupied	___ commercial	___ park
_X_ structure	___ both	___ work in progress	___ educational	___ private residence
___ site	**Public Acquisition**	**Accessible**	___ entertainment	___ religious
___ object	___ in process	_X_ yes: restricted	_X_ government	___ scientific
	___ being considered	___ yes: unrestricted	___ industrial	___ transportation
		___ no	___ military	_X_ other: Inactive

4. Owner of Property

name National Aeronautics and Space Administration (NASA)

street & number

city, town Washington ___ vicinity of **state** D.C. 20546

5. Location of Legal Description

courthouse, registry of deeds, etc. National Aeronautics and Space Administration (NASA)

street & number Real Property Management Office Code NXG

city, town Washington **state** D.C. 20546

6. Representation in Existing Surveys

title None **has this property been determined eligible?** ___ yes ___ no

date ___ federal ___ state ___ county ___ local

depository for survey records

city, town **state**

7. Description

Condition		Check one	Check one
X excellent	___ deteriorated	X unaltered	X original site
___ good	___ ruins	___ altered	___ moved date _____
___ fair	___ unexposed		

Describe the present and original (if known) physical appearance

The Pioneer Station (DSS 11) was the first deep space station to be constructed in the NASA Deep Space Network. It was built in 1958 and is at the Goldstone Deep Space Communications Complex near the northeast tip of Goldstone Dry Lake approximately 45 miles northwest of Barstow, California.

The Pioneer Station antenna is a 26-meter large-diameter, polar mounted, steerable parabolic dish. The parabolic dish has a surface tolerance of approximately .125 inch and beamwith characteristics (0.1 degree) that permit efficient use of frequencies from 1 to 3 GHz. The antenna structure was designed for closed loop steering control. The 26-meter dish surface was constructed of punched aluminum panels bolted to an open steel framework mounted atop a 62 foot high tower-like polar mount steering mechanism.[1]

The Pioneer Station antenna was patterned after the radio astronomy antennas then in use by the Carnegie Institute of Washington and the University of Michigan. There were significant differences in the design, however. First, the Pioneer antenna incorporated a closed-loop device for automatically pointing the antenna at the space probe. The electrical simplicity of a steerable parabolic reflector made this a good choice for maintaining continuous contact with the spacecraft. Second, to track the space probe automatically, the antenna had to possess an electrical feed capable of utilizing the space probe signal for driving the servo-control system. Third, the antenna had to operate without failure for many continuous hours and without being impaired by wind or temperature. The single significant feature borrowed from the radio astronomy antenna was the design of the gear system that moved the antenna, which was a dual gear arrangement call an hour angle-declination mount. The axis about which the polar, or hour angle gear wheel rotated was parallel to the polar axis of the Earth and pointed precisely, at Polaris, the North Star. This axis provided antenna movement in an East-West direction. The declination gear wheel rotated about an axis parallel to the Earth's equator (perpendicular to the polar axis) and enabled the antenna to move North-South. The gear wheels could be moved either separately or together. Because spacecraft move much like a celestial object in space after traveling several thousand miles from the Earth, it was natural to choose a mount that would steer the antenna from one horizon to the other at a sidereal rate, thus simplifying the mechanical complexity. All of these features were successfully incorporated into the Pioneer Station antenna.[2]

At the present time the Pioneer Station antenna is mothballed and in a standby status. Over the years it has become technologically obsolete and other NASA tracking stations now carry the burden of communicating with the various active space probes.

8. Significance

Period	Areas of Significance—Check and justify below				
___ prehistoric	___ archeology-prehistoric	___ community planning	___ landscape architecture	___ religion	
___ 1400–1499	___ archeology-historic	___ conservation	___ law	___ science	
___ 1500–1599	___ agriculture	___ economics	___ literature	___ sculpture	
___ 1600–1699	___ architecture	___ education	___ military	___ social/ humanitarian	
___ 1700–1799	___ art	X engineering	___ music	___ theater	
___ 1800–1899	___ commerce	___ exploration/settlement	___ philosophy	___ transportation	
X 1900–	X communications	___ industry	___ politics/government	X other (specify) Space Exploration	
		___ invention			

Specific dates 1958-1978 **Builder/Architect** U.S. Army

Statement of Significance (in one paragraph)

The Pioneer Station antenna was the first antenna to support the National Aeronautics and Space Administration's unmanned exploration of deep space. It was the prototype antenna for the entire Deep Space Network and had many of its design features incorporated into later improved antennas. During the course of its operational life the Pioneer Deep Space Station antenna tracked a variety of NASA missions including projects--Pioneer, Echo, Ranger, Lunar Orbiter, Surveyor, Apollo, Helios, Mariner, Viking and Voyager.

When NASA assigned responsibility to the Jet Propulsion Laboratory (JPL) for the unmanned exploration of the moon and planets in our solar system, the problems implicit in the assignment were awesome. Aside from designing and fabricating the spacecraft itself, JPL had to solve the many problems in extending the arts of telecommunications and tracking. While research in sophisticated techniques of space age telecommunications had been going on since 1954, there was little experience in dealing with the practical problems of tracking a spacecraft traveling far from Earth, maintaining communication contact, and capturing radio waves generated from the far reaches of space. The problem was to design and build a space broadcasting and receiving station here on Earth.[3]

Prior to the Space Act of 1958 construction began on the Pioneer Station antenna as an Army project under JPL. After the creation of NASA the Pioneer Station antenna became the first deep space tracking station in the NASA deep space communications network. In deciding where to build the Pioneer Station two stipulations were that the location had to be far from man-made electrical and commercial radio and television interference and that the terrain be of a natural bowl shape.[4]

A suitable site was found in the heart of the Mojave Desert in California, at Fort Irwin, about 45 miles from the town of Barstow. It was at this site that JPL built the Pioneer Station antenna which eventually grew into the Goldstone Deep Space Communications Complex. At the present time the Goldstone Complex consists of four Deep Space Stations (DSSs)--Pioneer (DSS 11), Echo (DSS 12), Venus (DSS 13) and Mars (DSS 14). These stations are named for the projects in which they first participated.[5]

To provide continous 24-hour coverage for space probes, NASA also established two overseas tracking stations in the Deep Space Network. These stations are in Canberra, Australia, and in Madrid, Spain, and are spaced approximately 120 degrees apart so that spacecraft are always in view of at least one tracking station.

9. Major Bibliographical References

10. Geographical Data

Acreage of nominated property Less than 1 acre

Quadrangle name Goldstone Lake **Quadrangle scale** 1:62,500

UMT References

	Zone	Easting	Northing		Zone	Easting	Northing
A	11	513060	3916025	B			
C				D			
E				F			
G				H			

Verbal boundary description and justification

The boundary of the Pioneer Deep Space Station Antenna includes only the Antenna and the base upon which it is now physically located.

List all states and counties for properties overlapping state or county boundaries

state	code	county	code
state	code	county	code

11. Form Prepared By

name/title Harry A. Butowsky

organization National Park Service **date** May 15, 1984

street & number Division of History **telephone** (202) 343-8168

city or town Washington, D.C. 20240 **state**

12. State Historic Preservation Officer Certification

The evaluated significance of this property within the state is:

___ national ___ state ___ local

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

State Historic Preservation Officer signature

title **date**

For NPS use only

I hereby certify that this property is included in the National Register

date

Keeper of the National Register

Attest: **date**

Chief of Registration

The Pioneer Station antenna represents the first generation of 26-meter antennas that enabled NASA to solve the technical problems of tracking deep space probes. Although it has now been superseded by newer and more efficient antennas it was the first, the prototype for the entire system. Features incorporated into the latest generation of 64-meter antennas that enable NASA to track Pioneer and Voyager Spacecraft to the very edge of the Solar System and beyond were first developed and proven at the Pioneer Station. In recognition of the importance of the Pioneer station to the Deep Space Network, and to the people who worked there, NASA dedicated a plaque to the station in 1978 recognizing its role and contribution to the continuing mission of NASA in the exploration of space.

Footnotes

1. N. A. Renzetti, ed., A History of the Deep Space Network From Inception to January 1, 1969 Technical Report 32-1533 (Pasadena, California: Jet Propulsion Laboratory, 1971), Vol. 1., pp. 10-11.

2. Ibid., 13.

3. Goldstone DSCC (Pasadena, California: Jet Propulsion Laboratory, 1979), p. 6.

4. Ibid.

5. Ibid.

Bibliography

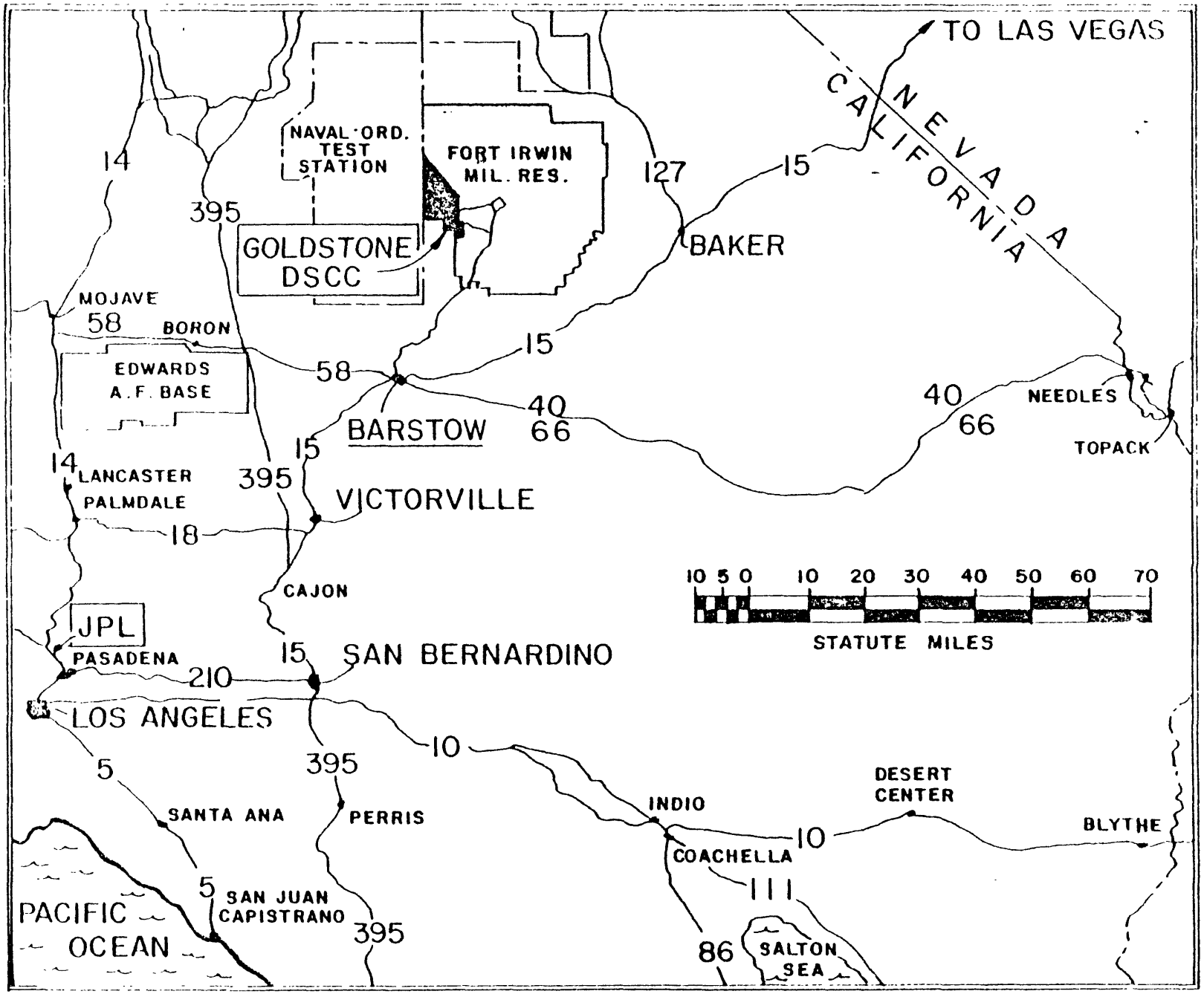
Corliss, William R. A History of the Deep Space Network. Washington, D.C.: National Aeronautics and Space Administration, 1976.

Description of the Deep Space Network Operational Capabilities as of January 1, 1966 Technical Memorandum No. 33-255. Pasadena, California: Jet Propulsion Laboratory, July 1, 1966.

Directory of Goldstone DSCC Buildings and Supporting Facilities. Seventh Edition, August 1979.

Goldstone DSCC. Pasadena, California: Jet Propulsion Laboratory, 1979.

Renzetti, N.A. ed. A History of the Deep Space Network Technical Report 32-1533, Vol. 1. Pasadena, California: Jet Propulsion Laboratory, 1971.

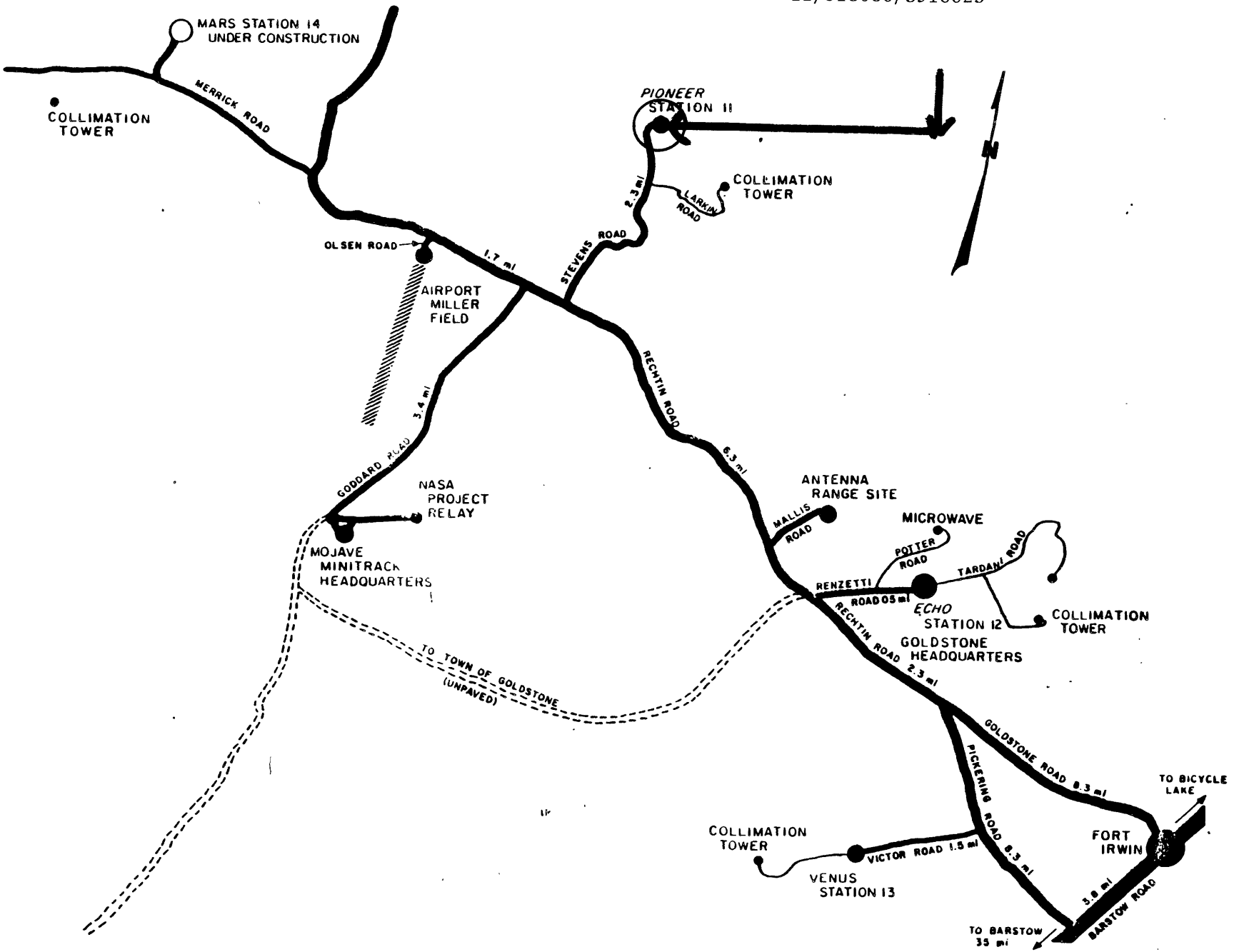


GEOGRAPHIC RELATIONSHIP OF GOLDSTONE TO JPL, PASADENA

Source: Directory of Goldstone DSCC Buildings and Support Facilities, No page number.

Area map of Goldstone stations

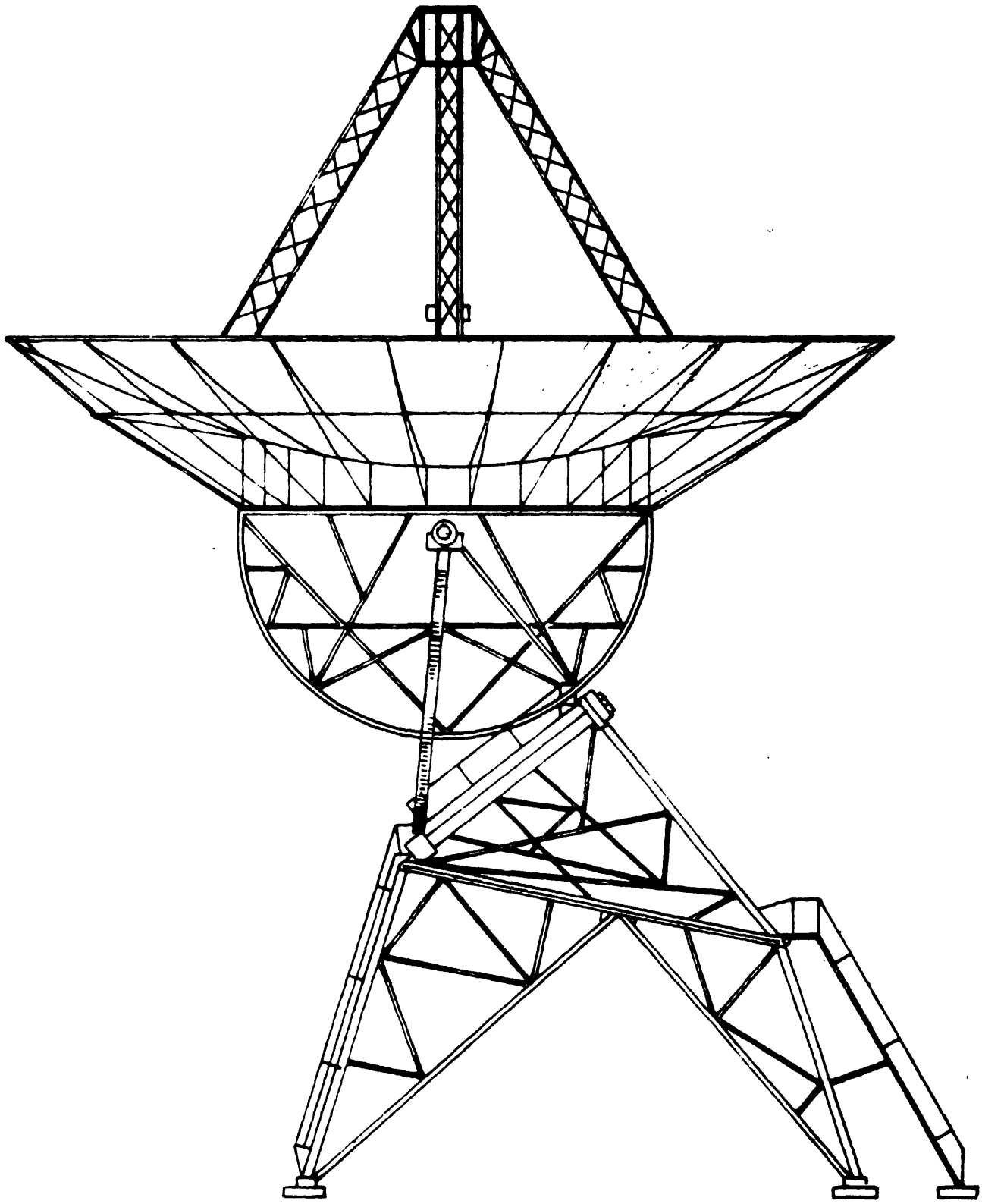
Pioneer Deep Space Station
11/513060/3916025



Source: JPL Technical Memorandum No. 33-225, p. 5.

26 METER (85')
ANTENNA, BLDG G-4
PIONEER STATION

SCALE: NONE



Source: Directory of Goldstone DSCC Buildings and Support Facilities, No page number.