

# NASA TECH BRIEF

## NASA Pasadena Office



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### Deep Space Network

A network of earth-based communications stations was begun in 1958 with the establishment of the first 85-ft antenna Deep Space Station at Goldstone in the Mojave Desert. The Deep Space Network was formally established when two additional 85-ft antenna Deep Space Stations became operational at Woomera, Australia in December 1960, and Johannesburg, South Africa in June 1961.

At present, the stations of the Deep Space Network are as follows:

<i>Designation</i>	<i>Location</i>
Pioneer	Goldstone, California
Echo	Goldstone, California
Mars	Goldstone, California
Woomera	Island Lagoon, Australia
Tidbinbilla	Canberra, Australia
Johannesburg	Johannesburg, South Africa
Robledo	Madrid, Spain
Cebreros	Madrid, Spain
Cape Kennedy	Cape Kennedy, Florida

These sites were chosen so that three prime stations would be separated by about 120 degrees in longitude and would be located between 40°N and 30°S latitude; this separation assures that at least one station would be in contact with spacecraft vehicles in deep space, despite rotation of the earth. Each station is equipped with an 85-ft steerable-dish antenna except Mars, which has a 210-ft diameter antenna designed to receive radio signals from millions of miles in space. The stations are located in natural depressions or valleys to decrease interference from local radio stations and other electromagnetic sources.

The facilities of the Deep Space Network have been incorporated in the Manned Space Flight Network in support of the Apollo program. The most significant electronics system addition to the Deep Space Network operational L-band system at 890-960 MHz is the unified S-band (USB) transmit/receive RF system (2290-2300 MHz); this single system replaces the multiple antennas and RF links previously used for the Mercury and Gemini spacecrafts and allows simultaneous modulation of voice and telemetry data on the same RF carrier used for the tracking function.

A report describing the Deep Space Network support of the Manned Space Flight Network for Apollo has been prepared. It describes the history of the development of the S-band radio system; the NASA receiver/exciter/ranging subsystem employed in the USB system was evolved in three stages from an original S-band system used early in the program for modifying the Deep Space Network for use with the Manned Space Flight Network. Synoptic details and block diagrams are given of the system characteristics at each stage in the development of the S-band system. Summaries are given of station tests and evaluations which verified the compatibilities of the various subsystems and the overall operational capability of the system and the entire network; both static and dynamic tracking tests are described. Details are given of the qualification tests made during unmanned Apollo 4, 5, and 6 flights in which all stations in the network were involved.

(continued overleaf)

**Notes:**

1. The following documentation may be obtained from:

National Technical Information Service  
Springfield, Virginia 22151  
Single document price \$3.00  
(or microfiche \$0.95)

Reference: NASA CR-12898 (N71-35304),  
A History of the Deep Space Network.

2. Requests for further information may be directed to:

Technology Utilization Officer  
NASA Pasadena Office  
4800 Oak Grove Drive  
Pasadena, California 91103  
Reference: B72-10043

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