# Pioneers 6-9 Mission Support

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*During July and August 1972, the DSN supported a radial experiment requiring signals of Pioneers 9 and 10 simultaneously. The Pioneer principal investigators plan to establish the distribution of fields and particle gradients. The DSN demonstrated a Mark III-system-type station software which can transmit Pioneers 6, 7, 8, and 9 telemetry data by high-speed data lines.*

During this reporting period, the DSN supported a radial experiment of Pioneers 9 and 10. On August 6, 1972, the distance between the Sun and Pioneer 9 was approximately 120 million km, and Pioneer 10 was already speeding away from the Sun, having a 240-million-km Sun range. The DSN started to furnish Pioneer 9 support in mid-July 1972, and an average of seven tracking passes have been provided weekly. During the same time, Pioneer 10 support was continuous. The Pioneer 9 spacecraft was tracked most of the time by DSS 11 at Goldstone and DSS 51 in South Africa. Some tracking passes were provided by DSS 41 in Woomera, Australia.

The support of the Pioneer 9 and 10 radial experiment was a continuation of the DSN's effort to make possible simultaneous observations by two spacecraft separated by a large heliocentric radial distance. The Pioneer principal investigators plan to determine the parameters of the solar wind and magnetic field in situations where the two spacecraft under surveillance are aligned on the same solar radial. The significance of this experiment was also magnified by the fact that the sun was quite active during the radial configuration, and therefore the interplanetary medium was more complex. More background information on the Pioneer radial and spiral opportunities was given in Ref. 1.

The Pioneer 6 spacecraft is still within the threshold range of the 26-m antenna stations. The DSN stations in Spain, South Africa, and Australia tracked an average of five passes per week for the Pioneer 6 mission. Pioneers 7 and 8 can be tracked only from the 64-m antenna station at Goldstone, California. Because of the heavy loading of this single advanced facility, Pioneers 7 and 8 were tracked for only a few passes.

The DSN continued to improve the network's effectiveness by attempting to support all unmanned missions in the DSN Mark III-type configuration. The engineers of DSS 62 in Madrid have recently developed a new station software which has already been demonstrated, making possible the support of Pioneer 6, 7, 8, and 9 missions in the same standard, multimission-type configuration as designed for the current and future unmanned planetary and interplanetary missions. This software has a capability to use the standard subcarrier demodulators, symbol synchronizers, and sequential decoders for the demodulation of the Pioneer signals. The on-site telemetry and command processor generates high-speed data blocks very similar to the ones used by Pioneer 10, records a digital magnetic tape called the Original Data Record, and also generates a teletype output which can transmit Pioneer 6, 7, 8, and 9 telemetry frames and a short status monitoring frame. The DSN entered negotiations with the Pioneer Project to make possible operations on the second-generation Pioneers with this demonstrated software.

The JPL Mission Control and Computing Center started engineering planning for a proposed configuration making the demonstrated station software compatible with a flight project operational capability. After such a capability is implemented, the DSN plans to deactivate the Ground Operations Equipment (GOE). This equipment has been in service since the Pioneer 6 launch in December 1965. GOEs are still operational at DSSs 12 and 14 at Goldstone, California, and at DSS 51 in South Africa. The demonstrated on-site software subsystem will improve telemetry threshold support capabilities by approximately 1 dB using the latest state-of-the-art demodulation equipment.

## Reference

1. Siegmeth, A. J., "Pioneer Mission Support," in *The Deep Space Network Progress Report*, Technical Report 32-1526, Vol. X, pp. 10–13. Jet Propulsion Laboratory, Pasadena, Calif., Aug. 15, 1972.