

Planetary Radar

R. M. Taylor

Deep Space Network Operations Section

G. S. Downs

Communications Systems Research Section

This article reports on the Radar Astronomy activities supported by the Deep Space Network during January, February and March 1980. Data were obtained at both S- and X-band and the observations were 75 percent successful.

The high-power S- and X-band radar transmitters at the Goldstone 64 meter station were used for a radar probe of Mars during January, February and March 1980, which was designed to provide range and doppler data derived from signals reflected from the Martian surface, taking advantage of the planet's nearness during opposition.

Observations were scheduled to provide eight hours of data every three to four days. Complete success would have provided two looks at each surface element and allowed measurement of a continuous topographic profile for slightly more than one full rotation of Mars.

In reality, the observations were 75 percent successful and of high quality. Complete success was not achieved, due to 1) occasional high-voltage problems in the S-band transmitter, 2) some data-acquisition hardware failures and 3) weak back-scattered power from the rougher regions of Mars.

The radar sensitivity is inversely proportional to the fourth power of the Earth-to-Mars distance. This opposition provided a minimum distance of 0.7 Astronomical Units (AU), twice the possible minimum. Hence, the radar sensitivity was about 12 dB below maximum. Nevertheless, the data quality is high enough to provide:

- (1) Topographic profiles with 8 km resolution along the latitude parallel at 23° N, thereby adding to the topographic database established at other latitudes between 1971 and 1978.
- (2) Additional scattering data for the Martian regolith, with an eye towards differentiating terrain types by remote sensing and correlating the results of the Viking on-board instrumentation.
- (3) A basis for extending the Martian ephemeris to 1982 in the event that the Viking Lander spacecraft can no longer provide ephemeris information (the same region will be observed again in 1982).