GOLDSTONE RADAR OBSERVATIONS OF MARS: THE 1986 OPPOSITION

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Radar echoes from the planet Mars were obtained on 27 S-band (wavelength=12.5 cm) and 2 X-band (wavelength = 3.5 cm) tracks using the Goldstone Solar System Radar. These observations took advantage of the favorable 1986 opposition since the earth-Mars distance was 0.40 AU at opposition (the smallest earth-Mars distance since the 1971 and 1973 oppositions) and radar echo strength is proportional to inverse-fourth-power to the distance to the target. Another equally favorable opposition occurs in 1988; these favorable geometries do not reoccur until the next century.

The coverages of the 1986 Goldstone radar observations are summarized in Table 1 and Figure 1; which show the daily start and end point of each observation. The observations were conducted via the cw-spectra techniques described by Harmon et al. (1982 and 1985). A continuous tone was transmitted at Mars and the radar echo was sampled to obtain a Doppler-spread spectrum. Each received event was separated into polarized (opposite sense circular, OC) and depolarized (same sense circular, SC) periods. Also, a minute or two of noise was recorded in each transmit-receive cycle. The total echo time was the round-trip travel-time which was varied from about seven minutes near opposition to over twelve minutes for last runs in October. Thus, about one-third of the total track was devoted to actual echo recording.

The coverage on Mars as shown in Table 1 started at 8^{o} S, travelled toward the equator to 3^{o} S during August, and then migrated south to 14^{o} S for the last run in October. These are new areas for earth-based radars. The data analysis is just getting underway. However, our volatile real-time spectra displays often showed features similar to those observed by Harmon et al. (1982 and 1985).

There was one successful ranging run on 17 October 1986 (the last track). The ground track for this run was similar to the cw observation of 15 October 1986, the Southern-most track in Figure 1. This ranging run had a resolution of 2 microseconds and should yield surface heights accurate to 300 meters.

References:

J. K. Harmon, D. B Campbell, and S. J. Ostro (1982), Dual-Polarization Radar Observations of Mars: Tharsis and Environs, Icarus, 52, 171-187.

J. K. Harmon and S. J. Ostro (1985), Mars: Dual-Polarization Radar Observations with Extended Coverage, Icarus, 62, 110-128.

DOY	DAY-ID	IUTC	LUTC	FREQ				
169	860618	833	1102	S-BAND	LON-LAT =	95.	131.	9- 7S
170	860619	1117	1255	S-BAND	LON-LAT =	126.	150.	9- 0S
174	860623	633	955	S-BAND	LON-LAT =	21.	70.	8-30S
175	860624	619	1225	S-BAND	LON-LAT =	8.	98.	8-22S
177	860626	611	1053	S-BAND	LON-LAT =	349.	57.	8- 5S
186	860705	946	1148	S-BAND	LON-LAT =	321.	351.	6-40S
187	860706	637	1121	S-BAND	LON-LAT =	266.	335.	6-31S
195	860714	452	801	S-BAND	LON-LAT =	169.	215.	5-16S
196	860715	530	930	S-BAND	LON-LAT =	170.	228.	5- 7S
198	860717	430	950	S-BAND	LON-LAT =	137.	215.	4-50S
201	860720	429	959	S-BAND	LON-LAT =	111.	191.	4-26S
202	860721	434	824	S-BAND	LON-LAT =	103.	159.	4-18S
205	860724	410	850	S-BAND	LON-LAT =	70.	139.	3-58S
209	860728	346	807	S-BAND	LON-LAT =	29.	92.	3-36S
216	860804	319	752	S-BAND	LON-LAT =	320.	26.	3-12S
219	860807	302	826	S-BAND	LON-LAT =	288.	7.	3- 8S
221	860809	304	727	S-BAND	LON-LAT =	271.	335.	3- 8S
228	860816	223	626	S-BAND	LON-LAT =	197.	256.	3-21S
237	860825	445	653	S-BAND	LON-LAT =	149.	180.	4- 6S
241	860829	139	704	S-BAND	LON-LAT =	66.	145.	4-35S
244	860901	303	558	S-BAND	LON-LAT =	59.	101.	5- 0S
246	860903	249	634	S-BAND	LON-LAT =	37.	92.	5-19S
250	860907	239	630	S-BAND	LON-LAT =	357.	53.	5-58S
255	860912	430	627	X-BAND	LON-LAT =	337.	5.	6-54S
259	860916	211	643	S-BAND	LON-LAT =	265.	331.	7-41S
260	860917	225	626	X-BAND	LON-LAT =	259.	318.	7-53S
276	861003	420	523	S-BAND	LON-LAT =	135.	150.	11-28S
281	861008	335	600	S-BAND	LON-LAT =	76.	111.	12-40S
285	861012	2335	546	S-BAND	LON-LAT =	329.	59.	13-50S

Table 1: Goldstone Radar Observations of Mars: 1986

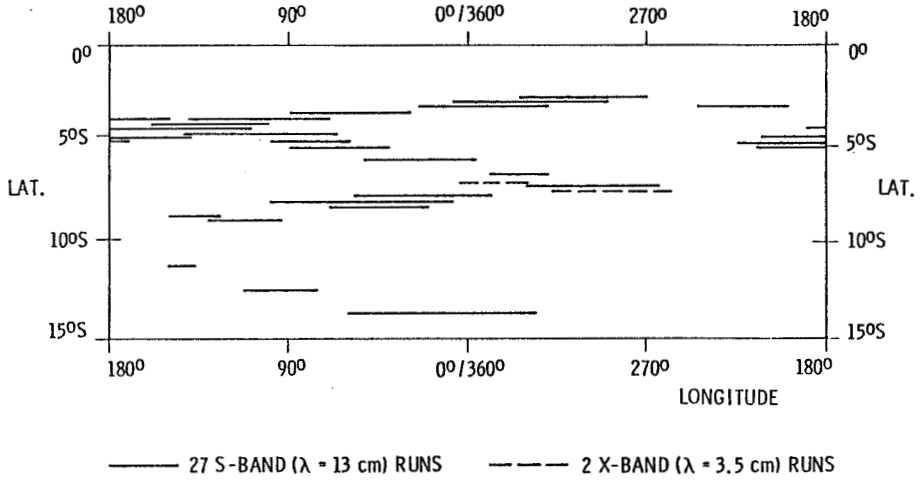

Figure 1: Latitude-Longitude Coverages of 1986 Goldstone Radar Observations of Mars