NORMAL INCIDENCE RADAR OBSERVATIONS OF THE "STEALTH" SOUTH THARSIS REGION, R.F. Jurgens[1], M.A. Slade[1], and S.H. Zisk[2], [1]Jet Propulsion Laboratory, Pasadena, CA 91109, [2]University of Hawaii, Honolulu, HI 96822

We made high resolution ranging observations covering the "stealth" region south-west of Tharsis during the period 12-15 December 1990 using the Goldstone radar facility at 3.54 cm wavelength. These complement observations made in 1988 by Muhleman et. al. using the Goldstone/VLA imaging system[1]. The latitude of the tracks is approximately -11^{o} and each crosses portions of Syria Planum where the echo indicates very smooth topography (almost an impulse like response at one point) as seen in Figure 1. Each figure shows spectra for successive range slices separated by 3.0 us (one half of the range resolution). The line plot to the side is the range-power profile, i.e., the integrated energy in each spectrum which is indicative of the regional scattering properties. The positive frequency side of the spectra is westward, i.e., reversed from the normal manner of viewing Mars. Preliminary model fitting indicates that the Hagfor's C parameter is in the order of 30000 yielding an RMS roughness of 0.33^{o}.

Figure 2 shows a typical region further west. The regularity of the spectral edges is indicative of minimal large scale topography while the shape of the range power plot requires considerable roughness on smaller scale sizes. Figure 3 shows the transition into the "stealth" region. Note that the right (westward side) is absent of echo. Figure 4 shows a region south-west of Arsia Mons that is presumably all "stealth" material. The region appears to be both lowly-reflecting and very rough on all scale sizes that contribute to quasi-specular scattering. The indistinct spectral edges indicate rough topography in the 100m scale size, and the scattering law is characteristic of Hagfor's C parameters near 10 or roughly 18^{o} RMS. The displacement of the echo from the center line is caused by the descending westward slope. Unfortunately, further and more detailed analyses capable of revealing accurate measures of the Fresnel reflection coefficient and Hagfor's C parameter require the redevelopment of computer programs similar to those of Downs, Reichley and Green [2].

The absence of energy reflected in the same sense circular polarization as observed by Muhleman et. al.[1] would appear to indicate that the region is devoid of roughness components smaller than the wavelength as well as any sub-surface volume scattering. The existence of extensive larger scale roughness is not inconsistent with studies by Schaber [3] using using earlier 12.5 cm radar data and Viking imaging which shows eolian mantling over rough lava flows. It is also possible that the eolian mantle is partially transparent, and that the rough underlying lava is being viewed by this radar experiment. A video animation of this track has been prepared as part of the Mars radar exhibit.

REFERENCES: [1] Muhleman, D.O., Butler, B., Grossman, A.W., Slade, M., and Jurgens, R.F., (1989) Fourth International Conference on Mars, Jan. 10-13, Tucson, Arizona (abstract). [2] Downs, G.S., Reichley, P.E., and Green, R.R., (1975), Icarus, 26, 273-312. [3] Schaber, G.S., (1980) Icarus, 42, 159-184.

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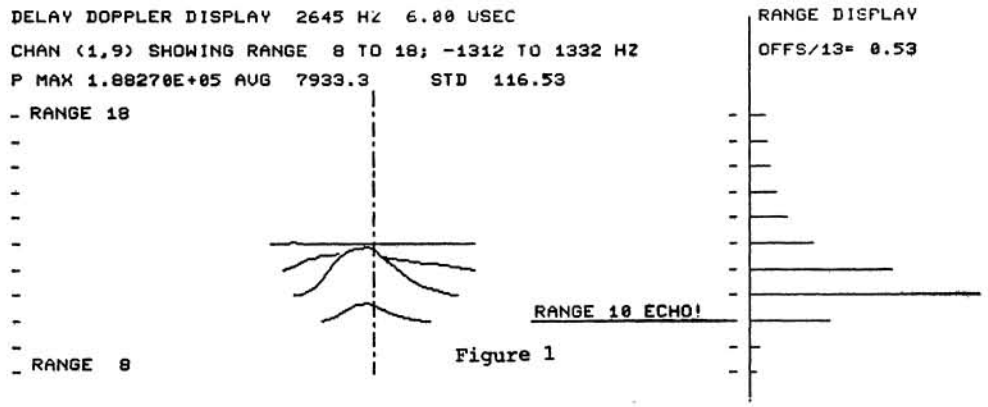

Figure 1

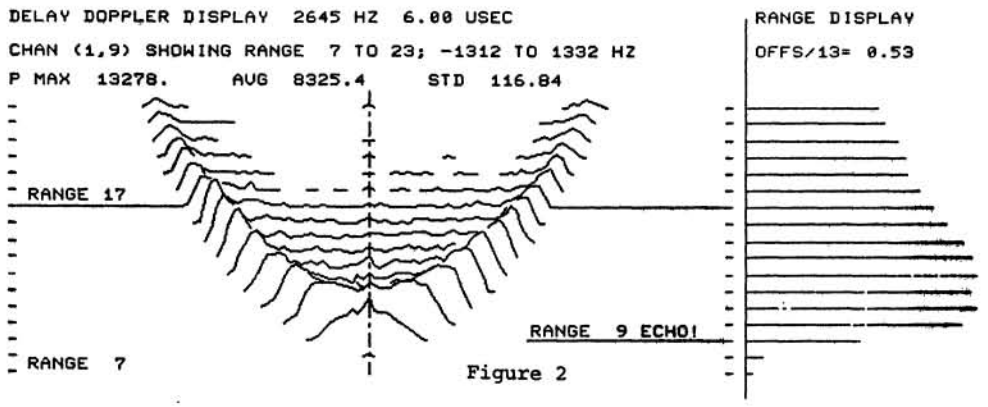

Figure 2

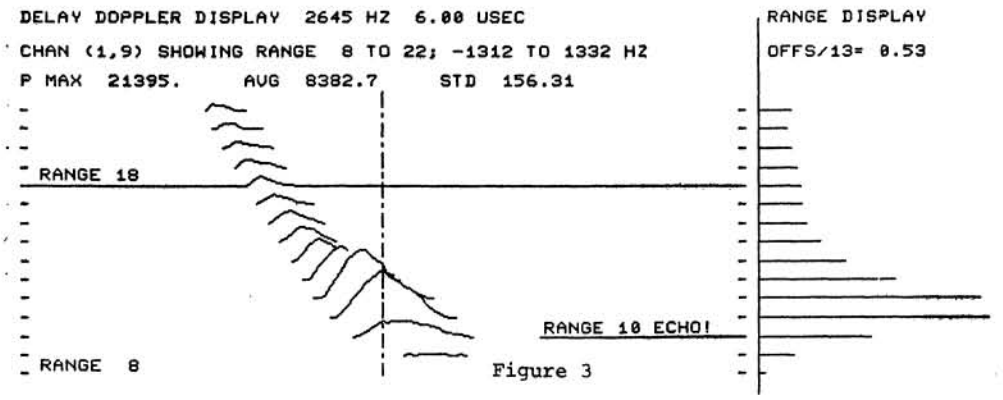

Figure 3

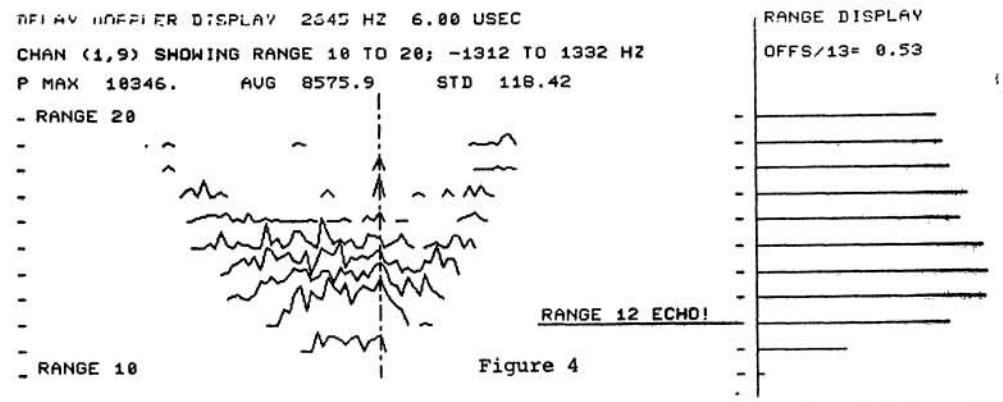

Figure 4

Delay-Doppler radar echoes observed on 14 December 1990. UT times are: 06:01:52, 06:22:10, 06:42:28 and 07:21:27 respectively corresponeing to Longitudes 109, 114, 119 and 128.