RADAR REFLECTIVITY OF THE MARTIAN POLAR REGIONS. B. J. Butler, *National Radio Astronomy Observatory, Socorro, NM, (bbutler@nrao.edu)*, M. A. Slade, *Jet Propulsion Labratory, Pasadena, CA*, D. O. Muhleman, *California Institute of Technology, Pasadena, CA*.

Radar experiments provide a unique method of probing the surfaces and subsurfaces of planetary bodies. Information on surface and subsurface structures and properties can be extracted from radar data. There is a well developed history of radar investigations of the planet Mars, beginning in with the first reports of variation of scattering properties as a function of martian longitude in the mid-1960's. Because of the rapid rotation of Mars, the standard technique of delay–doppler mapping cannot be used as effectively as it is on Mercury and Venus, making it a more difficult radar target. Techniques have been developed to overcome this difficulty, including an inversion technique to combine many doppler-only (CW) experiments from different viewing geometries into a map of surface reflectivity, and new random long-code techniques. These techniques still suffer from ambiguities, however. A third technique which does not suffer from these ambiguities is the combination of the powerful Goldstone transmitter with the VLA as the receiving instrument to create a combined radar imaging instrument. We have used this combined radar instrument to image the surface of Mars in 3.5-cm radar reflectivity during the 1988, 1992/93, and 1999 oppositions. Figure 1 shows a map of radar reflectivity from the surface of Mars obtained during the 1988 opposition.

During the 1988 experiments, the residual south polar ice cap (RSPIC) was the brightest radar reflector on the planet - intrinsically brighter than even the Tharsis lava flows. This was quite an unexpected result. In contrast, during the 1992/93 experiments, the residual north polar ice cap (RNPIC) was not nearly so bright, and in fact showed no enhancement at all. This was puzzling, given the 1988 results for the RSPIC. We attributed the lack of a radar reflection enhancement to a combination of three effects: the geometry was different; the season was different; and the intrinsic scattering from the residual ice caps was different.

The 1999 experiments provided a chance to test the relative importance of these three effects, since the RNPIC would be visible in a geometry very similar to the RSPIC in 1988, and the season would also be very similar. Preliminary reduction of the data taken in 1999 shows that the RNPIC did in fact show a radar reflectivity enhancement (see Figure 2), but that it was still not as bright as the RSPIC in 1988.

Details regarding the radar reflectivity of the residual ice caps, as well as the surrounding polar layered terrains (in light of our radar reflectivity data) will be discussed.

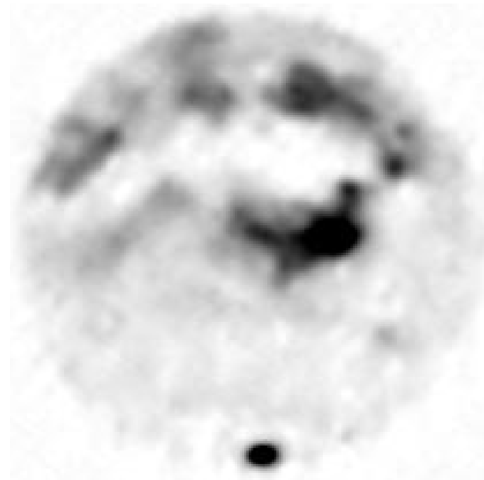

Figure 1. Snapshot image of the 3.5-cm radar reflectivity of Mars obtained in a joint Goldstone/VLA radar experiment in 1988. Darker shades are higher reflectivity. The residual south polar ice cap is the spot at the bottom. The Tharsis volcanic region is prominent in the center of the image, as is the "Stealth" region, stretching to the west of Tharsis.

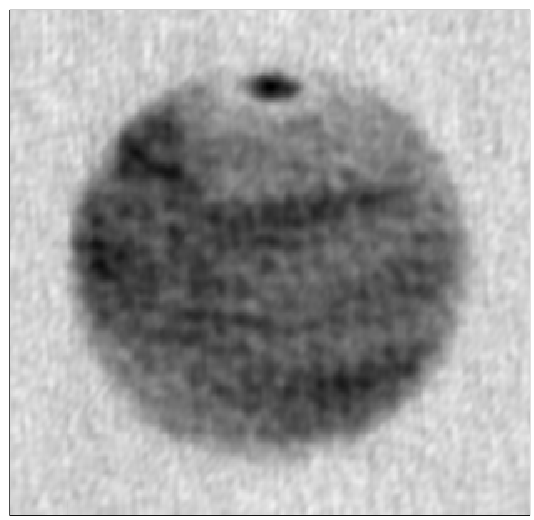

Figure 2. Averaged martian radar reflectivity in the north polar regions - data taken 24Jun1999. The spot at the top is the reflection from the north polar residual ice cap, and is surrounded by the very radar-dark sand sea.