MARTIAN SURFACE ROUGHNESS USING 75-CM BISTATIC SURFACE ECHOES RECEIVED BY MARS ODYSSEY. H. M. Gunnarsdottir[1], I. R. Linscott[1], J. L. Callas[2], G. L. Tyler[1], M. D. Cousins[3], [1]Stanford University, 350 Serra Mall #325, Stanford, CA 94305, hrefna@stanford.edu, [2]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, John.L.Callas@jpl.nasa.gov, [3]SRI International, 333 Ravenswood Avenue, Menlo Park, CA 94025, michael.cousins@sri.com.

Between August and December 2005, we conducted 76 oblique-incidence scattering experiments using the SRI 46-m antenna in the Stanford foothills to illuminate Mars for 20 min. periods with an unmodulated 75 cm-λ, circularly polarized wave. The direct signal and a Martian surface echo, which are separated by Doppler frequency, were received simultaneously by the one-bit receiver on board the Mars Odyssey spacecraft. Out of 46 experiments with high signal-to-noise ratios, 27 were in the northern hemisphere, while 19 were in the southern hemisphere.

The surface echoes are characterized by both fluctuating amplitude and varying spectral width, which correspond roughly to the surface reflectivity and roughness, respectively. Analysis of the data is based on quasi-specular scattering theory, but interpretation of the echoes is complicated by Odyssey's reception of only the right-circular polarized (RCP) wave component, and by the high incidence angles involved ($\phi > 60$ deg.), for which the scattering theory is not well developed.

Our analysis of the echoes makes use of MOLA topographic maps at a resolution of 128 points per deg. of longitude and latitude, to model the scattering surface in three dimensions along the specular track. We can account for most of the small scale echo amplitude fluctuations by the variation in number of surface-model facets tilted to produce a specular reflection towards Odyssey, indicating that MOLA scale topography is sufficient to capture an important scattering mechanism at this wavelength.

We use the topographic information and echo width to obtain a measure of the small scale surface roughness along each specular point track by finding the maximum tilt angle away from a perfectly mirroring surface facet which contributes significantly to the echo. This roughness measure is compared to rms surface slope estimates derived by fitting the data to Hagfors' scattering model.

Comparison of scattering from the northern hemisphere with the southern hemisphere reveals a strong correspondence to the smoothness both MOLA and visual images find at high northern latitudes.