The Mars Global Surveyor Ka-band Link Experiment: Experimental Results

D. Morabito, S. Butman, J. Border, A. Del Castillo,
A. Mittskus, M. Speranza, V. Vilnrotter,
and J. Weese
Jet Propulsion Laboratory
California Institute of Technology

W. Adams, A. McMechen, and R. Davis
Lockheed Martin
Denver, Colorado

Several telecommunications studies have shown that by utilizing K_a-band (31.8 to 32.3 GHz) frequencies over X-band (8.40 to 8.45 GHz) frequencies on a spacecraft-to-ground communications link, a potential advantage of approximately 5 dB (factor of 3 improvement) can be realized for equivalent spacecraft radio system configurations. The increased advantage comes from increased antenna gain at the shorter wavelengths and can be used to increase data volume, decrease transmission time, decrease transmitter power on the spacecraft, decrease spacecraft antenna size, or allow for a smaller antenna on the ground. However, the advantage can be reduced by higher atmospheric noise, decreased ground station antenna efficiency, and weather susceptibility at K_a-band.

The Mars Global Surveyor (MGS) spacecraft, launched November 7, 1996, carries a flight experiment designed to demonstrate and characterize the performance of Ka-Band (32 GHz) deep space communications. This Ka-Band Link Experiment (KaBLE-II) is sponsored by JPL's Telecommunications and Mission Operations Directorate Technology Program. Acquisition of MGS X-band and Ka-band data began in December, 1996 while MGS's High Gain Antenna was not yet earth pointed. The Ka-band equipment is functioning and signal level data are being acquired on a regular basis using a 34-meter R&D antenna located at Goldstone, California.

MGS arrives and will be captured into Mars orbit in September 1997. Mapping will start in March 1998 after the orbit has been trimmed to a lower and more circular orbit via aerobraking. The mission will continue beyond the year 2000.

This paper will present and discuss MGS KaBLE-II Ka-band and X-band communication link performance data.