# SOIL ANALYSIS MICRO-MISSION CONCEPTS DERIVED FROM THE MSP '01 MARS ENVIRONMENTAL COMPATIBILITY ASSESSMENT (MECA)

M. H. Hecht[1], T. P. Meloy[2], M. S. Anderson[1], M. G. Buehler[1], M. A. Frant[3], S. M. Grannan[1], S. D. Fuerstenau[1], H. U. Keller[4], W. J. Markiewicz[4], J. Marshall[5], W. T. Pike[1], W. W. Schubert[1], and P. Smith[6]

*1. Jet Propulsion Laboratory, 4800 Oak Grove Dr., Pasadena, CA 91109 USA*
*2. W. Virginia University, 338 COMER, P.O. Box 6070, Morgantown, WV 26506 USA*
*3. Orion Research, Inc., 131 Westchester Rd., Newton, MA 02158 USA*
*4. Max Planck Institut fur Aeronomie, Max-Planck-Str. 2, 37189 Katlenburg-Lindau, Germany*
*5. SETI Institute NASA ARC, M/S 239-12, Moffett Field, CA 94035-1000 USA*
*6. University of Arizona, Lunar and Planetary Laboratory, Tucson AZ 85721 USA*
*7. Univ. of Neuchâtel, P.O. Box 3 CH-2007, Neuchâtel, Switzerland*

The Mars Environmental Compatibility Assessment (MECA) will evaluate the Martian environment for soil and dust-related hazards to human exploration as part of the Mars Surveyor Program 2001 Lander. The integrated MECA payload contains a wet-chemistry laboratory, a microscopy station, an electrometer to characterize the electrostatic environment, and arrays of material patches to study abrasion and adhesion.

Heritage will be all-important for low cost micro-missions, and adaptations of instruments developed for the Pathfinder, '98 and '01 Landers should be strong contenders for '03 flights. This talk has three objectives: (1) Familiarize the audience with MECA instrument capabilities; (2) present concepts for stand-alone and/or mobile versions of MECA instruments; and (3) broaden the context of the MECA instruments from human exploration to a comprehensive scientific survey of Mars. Due to time limitations, emphasis will be on the chemistry and microscopy experiments.

Ion-selective electrodes and related sensors in MECA's wet-chemistry laboratory will evaluate total dissolved solids, redox potential, pH, and the concentration of many soluble ions and gases in wet Martian soil. These electrodes can detect potentially dangerous heavy-metal ions, emitted pathogenic gases, and the soil's corrosive potential, and experiments will include cyclic voltammetry and anodic stripping. For experiments beyond 2001, enhancements could allow multiple use of the cells (for mobile experiments) and reagent addition (for quantitative mineralogical and exobiological analysis).

MECA's microscopy station combines optical and atomic-force microscopy (AFM) in an actively focused, controlled illumination environment to image particles from millimeters to nanometers in size. Careful selection of substrates allows controlled experiments in adhesion, abrasion, hardness, aggregation, magnetic and other properties. Special tools allow primitive manipulation (brushing and scraping) of samples. Soil particle properties including size, shape, color, hardness, adhesive potential (electrostatic and magnetic), will be determined using an array of sample

receptacles and collection substrates. The simple, rugged atomic-force microscope will image in the submicron size range and has the capability of performing a particle-by-particle analysis of the dust and soil. Future implementations might enhance the optical microscopy with spectroscopy, or incorporate advanced AFM techniques for thermogravimetric and chemical analysis.