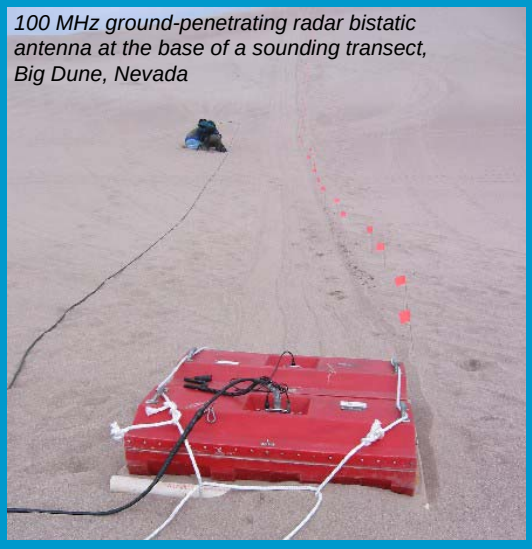
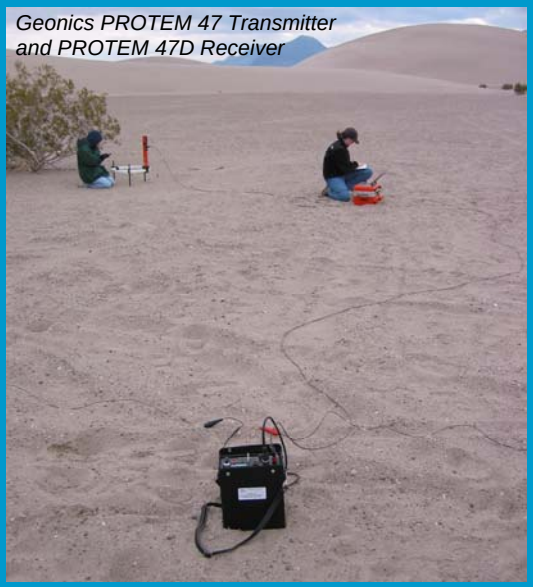
# Ground-Penetrating Radar Investigations of Terrestrial Analogs to the Martian Crust



*100 MHz ground-penetrating radar bistatic antenna at the base of a sounding transect, Big Dune, Nevada*

*Multiple Low Frequency radar antenna (16–80 MHz)*



*Geonics PROTEM 47 Transmitter and PROTEM 47D Receiver*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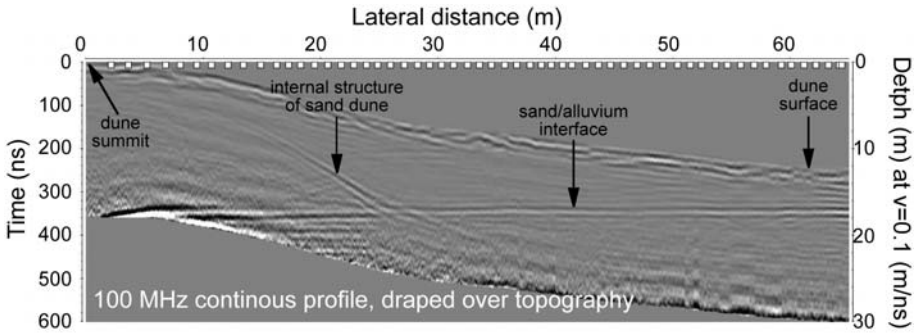
| **Sponsor:** | SwRI® Advisory Committee for Research |
| **Principal Investigator:** | Cynthia L. Dinwiddie |
| **Inclusive Dates:** | 1/2004 to 5/2004 |

## *Program Brief*

**Statement of Problem:** The Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) aboard the European Space Agency's Mars Express spacecraft began acquiring the first global data set of Martian subsurface radar data in June 2005. Because no MARSIS prototype was ever field tested and only limited ground-penetrating radar investigations of the Earth have been made within its low frequency range, interpretation of MARSIS data is uncertain.

**Approach and Accomplishments:** A team of geoscientists and geophysicists from Southwest Research Institute and the Lunar and Planetary Institute conducted transient electromagnetic and ground-penetrating radar investigations of three well-characterized terrestrial analog sites in the desert southwest. The frequencies selected were similar to those proposed for Mars studies: (1) sand dunes overlying alluvium, (2) an alluvium-basalt-alluvium sequence, and (3) alluvium with a shallow water table. Transient electromagnetic soundings were performed to measure ground conductivity and estimate absorptive losses. Radar identified the contact between sand dune and alluvium. Elevated ground conductivity within fines at the second site precluded identification of the basalt/alluvium contacts; however, transient electromagnetics indicate that the shallow water table site may be a good target for future radar investigations.




**Client Benefits:** Terrestrial analogs to Mars provide an opportunity to collect low frequency radar data from well-characterized sites so that uncertainties may be minimized when interpreting Mars radar data. This project laid the necessary foundation for development of two winning NASA Mars Fundamental Research grant proposals in 2004. Staff experience gained through this and a subsequent internal research and development project led to the submission of a GPR instrument proposal on the Mars Scout II *Zephyr*.


**Publication:** Heggy, E., S.M. Clifford, R.E. Grimm, C.L. Dinwiddie, J.A. Stamatakos, and S.H. Gonzalez (2006), Low-frequency radar sounding investigations of the North Amargosa Desert, Nevada: A potential analog of conductive subsurface environments on Mars, *J. Geophys. Res.*, *111*, E06S03, doi:10.1029/2005JE002523