VISIBLE-NEAR INFRARED IMAGING SPECTROMETER DATA OF EXPLOSION CRATERS.

T.G. Farr , Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA

In a continuing study to capture a realistic terrain applicable to studies of cratering processes and landing hazards on Mars, we have obtained new high resolution visible-near infrared images of several explosion craters at the Nevada Test Site. We used the Airborne Visible-Infrared Imaging Spectrometer (AVIRIS) to obtain images in 224 spectral bands from 0.4-2.5 μm [1]. The main craters that were imaged were Sedan, Scooter, Schooner, Buggy, and Danny Boy [2].

The 390 m diameter Sedan crater, located on Yucca Flat, is the largest and freshest explosion crater on Earth that was formed under conditions similar to hypervelocity impact cratering. As such, it is effectively pristine, having been formed in 1962 as a result of the detonation of a 104 kiloton thermonuclear device, buried at the appropriate equivalent depth of burst required to make a "simple" crater [2]. Sedan was formed in alluvium of mixed lithology [3] and subsequently studied using a variety of field-based methods. Nearby secondary craters were also formed at the time and were also imaged by AVIRIS. Adjacent to Sedan and also in alluvium is Scooter, about 90 m in diameter and formed by a high-explosive event. Schooner (240 m) and Danny Boy (80 m, Fig. 1) craters were also important targets for AVIRIS as they were excavated in hard welded tuff and basaltic andesite, respectively [3, 4]. This variation in targets will allow the study of ejecta patterns, compositional modifications due to the explosions, and the role of craters as subsurface probes.

In addition to the visible-near IR imaging spectrometer data, high resolution lidar DEMs [5] and thermal IR imaging spectrometer data [6,7,8] were acquired recently for the craters. These data sets will provide constraints for studies of crater formation and modification and for models of landing hazards and rover trafficability on Mars [9]. Other planned studies include ejecta size-frequency distribution, correlation of ejecta size and composition, and comparison of these results with similar measurements of Mars.

The data sets and derived data products will be made available to the science community upon release by DOE.

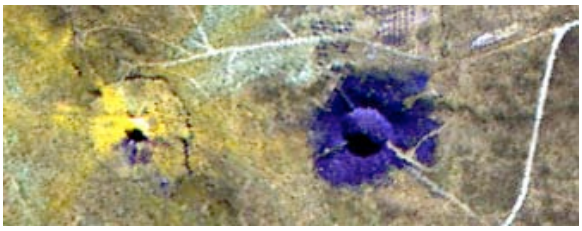

Fig. 1: AVIRIS image of Buckboard 12 (left) and Danny Boy (80 m dia.) on Buckboard Mesa. Buckboard 12 penetrated a zone of oxidized basaltic scoria while Danny Boy excavated mostly unmodified massive basaltic andesite. Compare with thermal IR data in [6, 7]. North up.

References: [1] http://aviris.jpl.nasa.gov/ [2] DOE (2000) DOE/NV-209-Rev 15. [3] Slate, JL et al. (1999) USGS OFR 99-554-A. [4] Moore, HJ (1977), J. Res. US Geol. Surv., v. 5, p. 719. [5] Farr, TG et al. (2004) LPSC35, abs. #2146. [6] Kirkland et al., (2004), LPSC35, abs. #1846. [7] Kirkland et al., (2005a), LPSC36. [8] Kirkland et al., (2005b), LPSC36. [9] Golombek, MP et al. (2003) *J. Geophys. Res.*, v. 108, doi: 10.1029/2002JE002035.

Acknowledgements: We thank the staff of the Nevada Test Site for permissions to fly our sites. Laurel Kirkland (LPI) and Brian Allen (NTS) made a field trip to the craters possible. The research described in this report was carried out at the Jet Propulsion Laboratory under contract with the National Aeronautics and Space Administration.