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Theoretical and Experimental Investigation of Lunar and Martian Regolith Simulant Dynamic Response to Rocket Plume Impingement JOHN BRANDENBURG, Orbital Technologies Corporation, ROBERT BEHRINGER[1], ABRAHAM CLARKE, Duke University, ORBITEC COLLABORATION, DUKE UNIVERSITY COLLABORATION — An investigation of rocket plume impingement on the regolith of the Moon and Mars is being conducted both theoretically and experimentally. Experimental results (1)and data from the Apollo landings inspired a theoretical model at ORBITEC : the ABL (Ablating Boundary Layer) model that assumes that regolith erosion and entrainment occurs in the thin boundary layer. The resulting crater streamlines itself with curve formed by extremization of the Lagrangian : $L = (Z')^2 + Z^2$ where Z(r) and Z(r)' are a depth variable and its radial derivative respectively. The actual depth profile z (r) in this model is derived from the formula $z = \mathrm{Log}(1 + Z/Z_o)$ where Z_o is a constant. For light soils the model reduces to $z \sim Z/Z_o$ and cantenary profiles result, exponential density profiles (2) give conoidal craters. (1) Experimental tests of the ABL model performed at Duke have shown good agreement. Further theoretical modeling and experimental data will be presented. (1) Metzger P., Lane, J., Immer C. and Clements, S. '6^{th} International Conference on Case Histories in Geotechnicla Engineeering , Arlinton VA August 11-16, 2008. (2) Bresson L. M., Moran C. J., and Assoline, S. Soil Sci. Soc. of Am. Jou, 2004, vol. 68, 4, pp. 1169-1176.

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