

LUNAR SCIENCE USING PENETRATORS: OBJECTIVES AND CONCEPTS

AHRENS, C. (NASA GSFC/NPP/ORAU)
LAFLAMME, S. (Iowa State Univ.)

Penetrator technology can be used either as a single probe (or array) in a variety of lunar environments, with a custom suite of instruments pertaining to the landing site

Hazard Assessment

Non-neutral plasmas are likely to form in shadowed lunar craters, that are likely to prevent grounding of astronauts and their equipment by the local plasma. Penetrators carrying instruments to study the plasma environment, such as magnetometers and charged particle detectors, would prove valuable for hazard assessment

Science Objectives

- I) to further our understanding of the early geological evolution of the Moon
- II) to better understand the compositional properties of volatiles and regolith
- III) collect *in-situ* data for the purpose of enhancing mechanical data of the surface/sub-surface regolith
- IV) to obtain 'ground truth' geo-chemical data

Designs

- **Piggyback** penetrators would ballistically be emplaced downrange from a main lander mission and be targeted into more extreme environments (could last ~1 week and target up to ~10 km downrange from the lander)
- **Dedicated-type** penetrators could provide larger-scale science-driven explorations (lasting for several weeks – months)
- Relatively low risk and cost (i.e., 3 out of 6 can fail and still complete the primary mission).

Moon Example Target I: Orientale Mare basin

Penetrators strewn across this multi-ring basin can give insight into the mineralogy, geochemistry, and mare basalt thermodynamics for furthering multi-ring and mare basin formation and sequence models.

Moon Example Target II: Procellarum KREEP Terrane

The impact from the penetration may indeed thermalize the residual subsurface liquid, but spectrometers could have the potential opportunity to observe the vapors, like those from the LCROSS study. Gamma ray spectrometers would not only detect H and radioactive elements, but these observations could be compared to Apollo 15/16 sample collections

Instruments

Potential penetrator instruments can include dielectric probes, thermal/heat sensor probes, seismometers, spectrometers (APX, tunable diode lasers, etc.), and magnetometers. For volatiles, these instruments can assist in identifying abundance, chemical compounds, and distribution of H-bearing species.



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Interested in joining our discussions?

Please contact <Caitlin.Ahrens@nasa.gov>