

## Darkness Visible: Instrumentation and Thermal Design to Access the Hidden Moon

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### Abstract:

In poetic language, people often talk about “The Dark Side of the Moon,” while their astronomical meaning is the “Far Side of the Moon.” In this workshop, we are literally discussing the dark Moon – the entire Moon during the 14-day lunar night at the equator, and the regions of eternal darkness in polar craters which may be rich in volatiles for use as resources, and as a valuable record of the Moon’s history. The dark Moon has been hidden for most of the history of spaceflight, as no human missions and few robotic missions have persisted through even one lunar night, and no missions whatsoever have landed in the permanently-shadowed regions. In this poster, we discuss “Night” mission concepts, previously developed by the authors with NASA funding, that remain directly relevant to NASA robotic and human science and exploration of the Moon - a long-lived (> 6 y) lunar geophysical network [1] and a Discovery-class mission for the in-situ investigation of volatiles in the lunar polar cold traps [2].

We also discuss Ball instrument and thermal technology enabling survival, situational awareness, and operations in the dark Moon, including low-light and thermal cameras, flash lidars, advanced multi-layer insulation (MLI)[3], and phase-change material “hockey pucks” that can damp out thermal transients to help moving platforms scuttle through dark regions for 24 h or so on their way between illuminated area such as “the peaks of eternal light” near the lunar south pole, without expending precious stored electrical power for heat.

### References:

[1] NLSI Lunar Science Conference (2008) abstract 2058, Weinberg, Neal, et al.

[2] NLSI (2008) abstract 2142, Elphic, Weinberg, et al.

[3] Commercial and Government Responsive Access to Space Technology Exchange (CRASTE)(2016): An Overview of Next Generation Multilayer Insulation. Gary Mills BATC