

“Powering the Lunar Surface: Managing Dust, Extreme Environments, and Power Needs”

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Power availability remains one of the primary constraints for lunar surface science. This talk reviews power requirements from previously flown instruments to help prepare future payloads for upcoming CLPS opportunities and highlights the testing and environmental-simulation capabilities at NASA JSC that enable reliable lunar payload development. It also outlines the power needs, environmental challenges, and emerging technologies required to support sustained human and robotic operations on the lunar surface as part of NASA’s Moon-to-Mars strategy. Key challenges include variable solar illumination at polar and equatorial regions, extreme thermal environments, and dust-driven degradation that limit current surface power systems.

The science data needed for resource identification and landing site planning will allow for the successful preparation of crewed Artemis activities and long-term presence. Building on recent missions, current test infrastructure, and emerging power-technology pathways, this presentation equips industry, academia, and government teams with the information needed to design robust lunar payloads, reduce development risk, and fully leverage the increasing cadence of CLPS missions. These developments will form a critical technical foundation for long-duration lunar presence and future Mars exploration.

Artificial Intelligence (AI) Usage Disclosure

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