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Human Exploration of the Moon and Cislunar Space (1)

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COMMON POWER AND ENERGY STORAGE SOLUTIONS TO SUPPORT LUNAR AND MARS
SURFACE EXPLORATION MISSIONS

Abstract

Future human exploration missions on the moon and Mars will require a new generation of power sources to sustain crew members and leverage in-situ resources. Long-duration human missions to the lunar and Martian surface will likely include large-scale landers, crew habitats, pressurized rovers, and in-situ propellant production plants. The power demands for these surface elements, whether on the moon or Mars, will be similar starting with robotic precursor missions in the multi-kilowatt range scaling to 10s of kilowatts as the crew presence expands and local propellant production is established. While the power requirements may be similar, the vastly different environments on the two surfaces present unique challenges for power generation and storage systems. Candidate technologies to satisfy the surface power needs include deployable solar arrays, regenerative fuel cells, and small fission reactors. This paper presents strategies for power system architectures with elements that can be used on the moon and are extensible to Mars with features that make them resilient to either environment.