

Human Mars Surface Mission Nuclear Power Considerations

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Abstract

A key decision facing Mars mission designers is how to power a crewed surface field station. Unlike the solar-powered Mars Exploration Rovers (MER) that could retreat to a very low power state during a Martian dust storm, human Mars surface missions are estimated to need at least 15 kilowatts of electrical (kWe) power simply to maintain critical life support and spacecraft functions. “Hotel” loads alone for a pressurized crew rover approach two kWe; driving requires another five kWe—well beyond what the Curiosity rover’s Radioisotope Power System (RPS) was designed to deliver. Full operation of a four-crew Mars field station is estimated at about 40 kWe. Clearly, a crewed Mars field station will require a substantial and reliable power source, beyond the scale of robotic mission experience. This paper explores the applications for both fission and RPS nuclear options for Mars.