IAF SPACE POWER SYMPOSIUM (C3)
Space Power System for Ambitious Missions (4)

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MARS HABITAT POWER OPTIMIZATION, RESULTS AND DEVELOPMENT

Abstract

Preparation for long-duration space missions includes ground-based mission analogs. One of these analog experiments, the Hawaii Space Exploration Analog and Simulation (HI-SEAS) studies conditions for a Martian surface crew with constraints on crew isolation, asynchronous communication and self-sufficient power generation. These restrictions require greater crew independence and reliance on local decision-making about resource allocation under variable weather conditions.

Habitat power data was collected during the fifth HI-SEAS mission and a model was developed for daily power consumption based on performance of the photovoltaic array and crew scheduled activities. Using a combinatorial optimization approach and the modeFRONTIER software platform, this power consumption model was optimized for minimal disruption to planned activities with respect to varying power generation. Optimization methods, results and decision parameters are presented here. In addition, an agent-based model application is discussed to add fidelity to the decision parameters. Modular agents could improve the simulation model by better representing trends across multiple analog experiments like changes in resource architecture and crew member composition. The optimization methodology is applicable to future mission planning and in-mission decision making for a variety of space applications.