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PLANETARY EXPLORATION HABITAT ENERGY REQUIREMENTS AND FORECASTING

Abstract

Travel to other planetary bodies represents a major challenge to resource management. Previous manned exploration missions of long duration were resupplied with food, water, and air as required with regular resupplies. Manned missions traveling to other planetary bodies will have duration of years, with little to no possibility of resupply. Consequently, the monitoring and forecasting of resource consumption is a mission critical capability. The Hawaii Space Exploration Analog and Simulation (HI-SEAS), a long duration planetary analog simulation, has recently completed its fifth long term isolation mission gathering energy, food, and water demands for a six manned planetary habitat crew. Energy consumption data from five of the simulations are analyzed and discussed showing unique data sets for energy, food, and water demands of a six man long term planetary mission. A novel method for forecasting energy consumption will also be presented that incorporates the emotional state of the habitat crew. Gathered data show that environments can be heavily influenced by the actions of a single crew member resulting in dramatic changes in consumption, throwing forecasting models to the point of total failure. Previous work has shown that the inclusion of the daily astronaut activities and psychological state allow for higher accuracy in forecasting for longer duration. Currently psychological surveys in the form of Positive and Negative Affect Schedule (PANAS), and a generalized artificial neural-modulation method are used to incorporate emotional response into machine learning forecasting methods. Using these lessons and developments, a large scale smart habitat control and forecasting system will be proposed that will monitor, control, and forecast habitat resources for manned missions. This new system will require the incorporation of psychological and physiological data from crew members, crew activities, and schedule.