HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Astronaut Training, Accommodation, and Operations in Space (5)

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DESIGN AND ESTABLISHMENT OF AN ANALOG PLANETARY HABITAT FACILITY TO SERVE AS A BASIS FOR HUMAN MACHINE INTERFACE STUDIES

Abstract

Expanding human presence beyond low-earth-orbit is an essential step in the development, utilization, and understanding of the solar system. Inevitably, robotic systems will lay the foundation of these human tended mission. As such, while several analog crewed habitat studies are being conducted across North America and Europe a facility located in the high desert of the Antelope Valley of Los Angeles County offers unique research opportunities. As per space policy (Global Exploration Roadmap), the next anticipated manned deep space mission will be to an asteroid followed by Mars. Training for such hostile environments under variable planetary conditions with robotic systems requires proximity to the robotic systems to be used, as well as the engineers and programmers responsible for them. A habitat and robotic test site in the deserted terrain north of the NASA Jet Propulsion Laboratory will ultimately operate as a base for crewed analog habitat studies using JPL developed mission hardware. This hardware will includes rovers, robots, mining devices, geologic sampling tools, gloves; planetary surveillance aircrafts, helicopters, balloons and more. The terrain resembles proposed manned mission targets, and given its proximity to JPL, the VISIONA (Virtual In Situ and Operations Node/Analogue) will provide access to experts required for test and verification of the human-machine interface. Virtual reality devices will be used for Extra Vehicular Activity (EVA) preparation and mission planning. The facility focuses on sustainable metabolic needs for the crew and plants, in addition to power and environmental control requirements. Semi-closed loop life support systems (LSS) will be employed, with emphasis on attaining a fully closed loop environment control and LSS within 5 years. The habitat will also be used to study microbial and plant behavior in closed environments with grown food and recycled water used in crew's diet. Waste will be processed using low energy, semi-closed loop techniques. Mission planners will study the psychological implications of long duration space missions analyzing sleep patterns, stress cycles, and crew behavior in isolated environments. The crew will conduct specific tasks with imbedded flight control teams providing communications, operations and high fidelity simulations. Ground operations and mission planning will be studied simultaneously in close proximity. The entire system will be designed for autonomy minimizing interference and maximizing the effects of isolation. An optimized human-machine

environment will improve mission success rates and help prepare a new generation of space-farers for the long journey beyond low earth orbit.