

IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
Utilization & Exploitation of Human Spaceflight Systems (3)

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PREPARING FOR HUMAN MISSIONS TO MARS: THE ROLE OF ISS AND ARTEMIS AS
ANALOGS FOR RESEARCH AND TECHNOLOGY TESTING

Abstract

The hazards of spaceflight to the human system are present in in varying degrees on different spaceflight platforms: altered gravity, isolation and confinement, distance from Earth, radiation, and hostile closed environments. A strategic view of the fidelity of hazards experienced on different platforms can shape the testing plans for human research and technology demonstration related to crew health and performance.

Working across the international partnership, the International Space Station (ISS) is planning periods of modified operations to improve the fidelity of Mars simulations. To understand transit durations as an independent variable, a series of 1-year, 6-month and 30-45 day missions are being planned on ISS. Standard measurements across ISS missions of different durations, lunar missions and ground analogs offers the opportunity to distinguish different hazards and their effects in the context of the relevance to future mission concepts. The ISS partnership is planning for additional test cases that are aligned with Mars mission plans. (1) Evaluating crew performance capabilities when transitioning to gravity after long durations in microgravity representative of a Mars transit. (2) Simulating crew medical care under Mars-like autonomous operations. (3) Identification and testing of operations under communications delay and autonomy expected for Mars missions and the linked effects on behavioral health and performance of the crew.

Artemis missions serve as a valuable analog for Mars surface operations, with partial gravity and deep space radiation hazards, but with crewmembers that are probably more physically capable than their counterparts would be after a Mars transit. Getting unobtrusive data from early Artemis missions, and knowledge gained from operational experience as Artemis operations develop can improve engineering design, medical requirements and countermeasures, and ultimately ensure mission success on Mars.

This paper will discuss the linkage between the latest Mars architectures with the plans and capabilities for ISS and Artemis to provide operationally relevant tests of crew health and performance. By

using human spaceflight platforms as well as ground simulation in an integrated way, the international community can improve exploration readiness, develop countermeasures and reduce risks of future human space missions.