Paper ID: 35574
interactive

IAA/IAF SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

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HOW MEASUREMENTS FROM HYPOGRAVITY LOCOMOTION STUDIES CAN INFORM THE ARCHITECTURAL DESIGN OF PLANETARY HABITATS

Abstract

How high do we jump on the Moon? Should we build architecture with steps or should we support different ways of moving, e.g. climbing? The reduced gravity will lead to a loss of muscular mass and stiffness of the legs, negatively affecting a person's balance: Yes, we can climb, but we can also easily lose our balance and trip up against the surrounding architecture. To avoid all of this, we need to better understand and address the human walking behavior and balance on the Moon and Mars in the design already.

There are a number of studies already on simulation of hypogravity locomotion, but how we can use results from hypogravity simulation studies in order to inform the architectural design of lunar or martian habitats? This paper addresses how measurements from hypogravity locomotion studies can inform the architectural design of planetary habitats. To better understand the walking behavior, one key factor to consider that is addressed here for the first time is the effect of deconditioning and the countermeasures applied to the subject to decrease the deconditioning. Once these factors are under control, the data needed for defining the interior design are kinematic variables of joints or body segments, such as speed, step extent, direction of movement, sight line, variation of altitude, typology of walk, and balance.

Finally, the ideal research methodology is here presented, which investigates how to measure kinematic variables of joints or body segments that impact an astronaut's balance and gait structure in order to apply the results to the design of Moon and Mars architectures.