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PREPARING FOR PLANETARY SURFACE EXPLORATION BY MEASURING HABITAT DUST INTRUSION WITH FILTER TESTS DURING AN ANALOGUE MARS MISSION

Abstract

As humans venture deeper into space more issues correlated to operations are being discovered. While the perils of dust particles may not be widely recognized, it is one of the major issues astronauts will face on the surface of the Moon and Mars. Dust particles present a problem for both astronaut health and equipment as revealed during the Apollo era lunar surface missions. Dust particles cling to spacesuits and field gear, which upon ingress would begin circulating throughout the spacecraft or habitat. An astronaut's health is compromised by the dust particle's potential to stick to the lungs and cause respiratory illnesses. The extreme abrasiveness and granularity of the particles make it near impossible to completely shield a spacecraft or habitat from dust related damage. NASA's Glenn Research Center collaborated with Crew 188 at the Mars Desert Research Station (MDRS) in Utah to measure how much dust entered the habitat during a series of extravehicular activities (EVAs), or surface excursions. New fan-based dust filter equipment with a scrolling media was tested, collecting dust that entered the habitat in the airlock after the EVAs. An optical particle counter measured the ambient airlock particulates five times including: before the start of operations; after the crew left for EVA; in the middle of the EVA with the settled air; before the crew entered the airlock after EVA; and finally, after the crew simulated re-pressurization and suit brushing off in the airlock. Data was also collected in several of the working environment locations around MDRS and outside the habitat in the wind. Data collected from this research will help establish filter equipment for life support systems and prescribed operations for astronaut transition from a planetary surface into a desired clean habitat. Measurements may aid in updating a baseline expected dust load for a surface habitat and further facilitate the mitigation of astronaut's exposure to dust particles on the surface of celestial bodies.