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NEXT GENERATION SUIT DESIGNS, TAKING LESSONS FROM CURRENT ANALOGUE SUIT DESIGNS.

Abstract

With renewed interest and activity to return to the moon and Mars and other space operations, significant thought must be given to Lunar Surface Suit (LSS), Mars Surface Suit (MSS), or Space Activity Suit (SAS) designs. Factors to be considered include physical, data, and human factors issues. Specifics include mission duration requirements, availability of consumables, power, waste management, communications, data management, entertainment and other operator needs. Since the physical requirements are defined by the mission, they are minimum requirements. Data and human factors will also be considered minimum requirements, other needs are more flexible, and should be driven by the individual mission. These needs are best defined through extensive analogue testing in a relevant environment performing realistic and relevant tasks. Therefor, this author believes that analogue suits should be designed as close as practicable to their real counterparts, and real suits should be designed from the lessons learned in the use and testing of their analogues.

From 2001 until 2007, the author oversaw operations at the Mars Desert Research Station (MDRS) and Flashline Mars Arctic Research Station (FMARS), Observing simulations using primitive analogue suits, and gathering data on suit functionality from the perspective of the experienced field scientists and engineers who use them. Since then, the author has been working with the OpenLuna and Kepler Shipyards suit development team in the design and developing a LSS that will meet or exceed their own, and NASA requirements.

Examination of existing analogue usage suggests that the following features should also be included in both analogue and space-worthy suits; a food and water supply, carbon dioxide, liquid and solid waste disposal, in-suit communications and navigation, temperature control, remote medical access, radiation shielding, environmental protection, mobile power sources, and resource recycling. Rescue and recovery of an injured explorer or a damaged suit is required. Available to the operator will be local copies of documentation, mapping and other data resources. Entertainment will be considered to maintain morale during long transits, tedious tasks, or during emergencies. Lastly, the suit must be modular, inexpensively manufactured, easy to maintain and clean, durable enough to provide physical protection and must be able to operate in a wide variety of environments, with variable outerwear for special needs. All of the features should be extensively tested in an analogue environment before introduction into space-worthy suits, and any changes in the real suit needs should be reflected in their analogue counterparts.