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EXPERIMENTAL INVESTIGATION OF CARBON NANOTUBE DUST MITIGATION SYSTEM FOR HABITAT STRUCTURES

Abstract

NASA's new 2018 Strategic Plan lists, as one of its core strategic objectives, the goal of extending human presence into cis-lunar space and the lunar surface [1]. The European Space Agency (ESA) has also announced interest to set up permanent human outpost on the Moon. Such activities necessitate robust space habitats and spacesuits, for the anticipated long duration, rigorous surface operations on the lunar surface. Lunar dust has proved to cause abrasion, thermal problems, wear and tear of materials exposed to the environments, making it a major challenge for surface operations, as witnessed during the Apollo missions. It is therefore imperative that we overcome the challenges posed by the lunar environment and protect hardware deployed on the moon from the dust contamination and degradation.

This research study is an extension of utilizing the SPacesuit Integrated carbon nanotube Dust Ejection/Removal system (SPIcDER) technology to lunar habitat structures. SPIcDER technology that was originally developed for spacesuit dust cleaning was shown to be compatible with state-of-the-art habitat concepts in a previous study [2]. The concept is extendable from spacesuits to flexible/inflatable/deployable habitat structures due to their similar construction techniques: pressurized structures, outerlayer materials, irregular contours of flexible material and several layers of insulation. The usage of Carbon nanotube (CNT) flexible fibers as electrodes in the SPIcDER system makes it uniquely suited for flexible and deployable structures, where the surfaces have irregular contours and/or various curvatures

This paper reports on the experimental investigation of applying the SPIcDER system to inflatable habitat structures. A study was conducted using SPIcDER prototypes on the Inflatable Lunar Mars Habitat module build by University of North Dakota. Results from the experiments are provided in this paper.

[1] NASA 2018 Strategic Plan, NASA, 2018,(accessed 08.20.2018).

[2] K. K.Manyapu, P. de León, L. Peltz, Extending the Utilization of Dust Protection Systems using Carbon Nanotube embedded materials for Lunar Habitats for Exploration Missions, 69th IAC , Bremen, Germany, 1-5 October