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LEXICON, A LUNAR DUST MITIGATION SYSTEM FOR ISRU ACTIVITIES AS AN EXPERIMENT FOR THE ASCLEPIOS II ANALOG MISSION

Abstract

During In-situ Resources Utilization (ISRU) activities on the Moon, the lack of atmosphere and the low gravity might cause the creation of large dust conglomerates. Processes like drilling or water extraction can eject and disperse large amounts of particles, representing various threats for future astronauts' health. Lunar habitats' fundamental systems (i.e. power production, life support plants, thermal regulation systems, etc) and machines could also be affected by the dust deposition process, causing several long-lasting issues such as damaging sensors, shadowing and clogging the machines. Due to the growth of the ISRU activities during the lunar missions planned in the next decade, associated dust pollution and dispersion shall be considered as a major concern for any kind of operation. One of the most promising solutions to this issue is represented by the enclosure of ISRU machines in closed environments to be placed in the neighborhood of the lunar habitats, allowing dust to be captivated and collected for potential re-use in other applications.

In this paper, we outline the design of a flexible and scalable architecture to confine, separate and

collect the lunar dust produced in a closed and controlled environment. The design aims to improve the filtering solutions already adopted in the Apollo mission by reducing the required maintenance and increasing the number of possible applications. The system is based on a closed-cycle, involving an inert fluid coupled with a cyclone filter to collect the dust produced inside a dome accommodating the ISRU machine (i.e. driller, excavator, etc). The scalability of the system is allowed by 3D printing almost all the components and assembling them in- situ, thus avoiding the transportation of bulky materials. These characteristics lead to a filtering system suitable for a wide range of dome volumes, i.e. from a few cubic centimeters to cubic meters. The design presented in this work is focused on the operation of drilling machines in a closed environment, with the possibility to extend to other applications (i.e. astronaut suit cleaning).