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DESIGN AND TESTING OF A PROTOTYPE ELECTRODYNAMIC REGOLITH CONVEYOR FOR LUNAR ISRU

Abstract

NASA's Swamp Works Electrostatics and Surface Physics Laboratory (ESPL) is developing a 4-phase electrodynamic regolith conveyor (ERC) that could convey regolith without the risk of rotating or vibratory actuation, which could jam or require regular maintenance due to the abrasive nature of lunar regolith. Another goal of electrodynamic conveying is the reduction of conveying power, which is important considering the limited capacity of early-stage lunar power systems. The current state of the art (SOA) for lunar regolith conveying is based on recent NASA system studies for oxygen production plants. These plant designs require conveying rates around 100 kg/hr, to produce 10 mT/yr of oxygen from the regolith. To accomplish this, conventional augers and vibratory spiral conveyors have been identified as the SOA or the leading candidates due to their extensive use in the terrestrial material handling industry. At NASA KSC, the use of dynamic electric fields, generated by alternating high voltage on electrodes, has been developed as a dust mitigation solution known as the Electrodynamic Dust Shield (EDS). The EDS is being developed for lenses, solar panels, radiators, fabric and seals and is scheduled for a technology demonstration mission on the Moon in 2023. ESPL researchers have shown the ability to move thin layers (a few mm) of dust with mW of power. In Academia, researchers have shown the ability to electrodynamically convey regolith up to 1 kg/hr with a 4-phase EDS and electromagnetically convey particles that would suggest a lunar regolith conveying rate of 25 kg/hr. This paper will describe the design and testing of a prototype ERC that could scale to support transporting regolith at ISRU relevant flow rates.