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LEVERAGING NOVEL PEEK ADDITIVE MANUFACTURING TECHNIQUES FOR A VIABLE MICRO LUNAR ROVER STRUCTURE

Abstract

Lunar rovers have traditionally been manufactured using precision machined metal components that employ metallic fasteners for assembly. The high thermal conductivity and emissivity of most metals paired with the lunar surface temperature variation of -200C to 100C during the night and day respectively poses a severe problem for maintaining core thermal temperatures within acceptable bounds during the lunar night. Manufacturing the rover structure from polyetheretherketone (PEEK) using advanced fused deposition manufacturing (FDM) techniques allows a significant reduction of thermal pathways through metallic components and fasteners, while also bringing advantages such as repairability, reduction of failure pathways, and compact integration of sub-system components. This paper presents a modular prototype design that can be entirely printed on a commercially available PEEK capable 3D printer in only four pieces, utilizing novel joining mechanisms inspired by traditional wood joinery techniques. The chassis body takes advantage of the 3D printing process by including most of the sub-system mounting points and locating features directly into the 3D printed structure, eliminating the need for metallic fasteners and time-consuming assembly. Additionally, the structure can be easily optimized for structural stiffness and low mass, both of which are key performance metrics for lunar payloads. Ultimately, the PEEKbot will take advantage of the many benefits brought forward by 3D printing technology and will hopefully pave the way for future development in this field.