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LEAPS: LUNAR EXPEDITION TO ASCERTAIN PHILOLAUS SKYLIGHTS

Abstract

Introduction: In the recent years, numerous concepts studies have been conducted to help accommodate astronauts on the hostile Lunar surface. Indeed, this interest has been fueled by NASA's Artemis mission. The astronauts will face many challenges, the most prominent ones being the harsh temperature variations and radiation exposure. A potential solution to mitigate this problem would be to establish a settlement in a cave on the lunar surface, as the temperatures are much more accommodating and devoid of cosmic and solar radiation.

Lunar Skylights: Investigation of the Lunar Reconnaissance Orbiter (LRO) images of the Lunar surface has allowed scientists to confirm the presence of lava tubes, an underground network of interconnected caves. Meteorite impacts have occasionally dented these tubes, hereby giving entry points into them that are known as "Skylights". Potential Skylight candidates reside in the Philolaus crater. The latter being relatively close to the northern lunar pole, this could prove to be interesting as they could host a larger abundance of water-bearing volatiles, prospecting a self-sustained environment. Furthermore, the geologically young Philolaus crater could provide deeper understanding of the lunar mantle characteristics.

LEAPS mission: Much research has gone into the development of un-manned exploration tools to discover these lava tubes in greater depth. Combined with the current trend of commercial landers, this could further accelerate their development. LEAPS is a case study of such an exploration method. It aims to use state of the art technology to deploy a network of "micro-rovers" on the Lunar surface to confirm the Philolaus skylight prospects as well as fulfill various different scientific objectives with their on-board instruments.

Scientific Objectives: The LEAPS rover network is categorised into three groups of rovers, each group composed of two rovers, to achieve redundancy. The science objectives of the mission mainly rely on two different scientific instruments: LIDAR and Camera imagery; and a Ground Penetrating Radar (GPR). This diverse configuration enables to assign each group a specific set of tasks depending on their instrumentation configuration so as to collect data on both the Philolaus crater's geology and its prospective skylights