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MALAPERT MOUNTAIN: AN IDEAL STAGING POINT FOR LUNAR SOUTH POLE EXPLORATION

Abstract

The Lunar South Pole has been a focal point of the recent renaissance in Lunar exploration. This is due to the presence of water ice in the permanently-shadowed craters at the pole as well the peaks of eternal light" which offer near constant sunlight around the year. Due to the fact that some of these points of interest such as Shackleton crater are located on the far side of the Moon, special communications strategies such as relay satellites are necessary. As part of a Phase 0 study on In-Situ Resource Utilisation (ISRU) for the European Space Agency (ESA), PTScientists has analysed several possible landing sites around the Lunar South Pole. One of these sites is the ridge of the Malapert crater, the so-called Malapert Mountain". It has received prior attention due to its favourable illumination conditions, i.e. more than 300 days of light, and visibility from Earth, i.e. being located on the near side of the Moon and the Earth disk being constantly visible form the top of the Malapert Mountain ridge [1]. Another important aspect is that several interesting sites on the far side, including Shackleton crater, have an unobstructed line of sight with Malapert Mountain. Based on these properties we propose a Lunar South Pole exploration mission architecture which uses Malapert Mountain as a staging point for subsequent missions to Lunar far side locations at the South Pole. A small robotic lander, e.g. PTScientists' ALINA2, would be landed at Malapert and deploy a free-space optical communications terminal. Future missions could then use this lander as a relay for communications with Earth. The major challenge in establishing a communications outpost at Malapert is the need for a high-precision landing. Due to the roughness of the mountainous terrain, the largest features with the desired properties, i.e. illumination and communications, are not larger than 100x100m. In this paper we discuss the mission architecture outlined above, provide a trade-off analysis of several Lunar South Pole landing sites, and describe our strategies for precision landings from polar selenocentric orbits.

[1]https://web.archive.org/web/20060213061216/http://www.space.com/scienceastronomy/solarsystem/moon$_mountain_0$20326.html