

Lunar Exploration (2)
Lunar Exploration (1) (1)

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AN ANALYSIS OF CUBESAT DEPLOYMENT TO LUNAR ORBIT BY PLANETARY
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Abstract

For several years, Planetary Transportation Systems GmbH (PTS) has been developing a lunar lander, the *Autonomous Landing and Navigation Module* (ALINA). This lander will unlock new mission concepts as it offers the capability to precisely deploy scientific payloads to both the Moon's surface and into a set of versatile lunar orbits. During a phase 0 study into In-Situ Resource Utilisation for the European Space Agency, PTS analysed several commercially and scientifically interesting landing sites around the lunar south pole, for example at Malapert Mountain [1].

As part of this lunar south pole mission concept, the PTS Mission Operations department has developed various mission concepts that include the deployment of a commercial CubeSat or similar payloads into highly-desirable lunar orbits. ALINA utilises a tried and tested, robust transfer strategy that allows for flexible launch dates, based on a desired lunar landing date (local solar time). Orbits that are accessible to ALINA through the use of such a strategy include orbits such as Highly Elliptical Orbits (HEOs), Polar Orbits (POs) and Circularly Retrograde Orbits (CROs). The accompanying Δv budget for each scenario is included. Alongside these mission concepts, in-depth analyses into the operational characteristics of each deployment orbit is presented including: accessibility, occultations, surface communications and Earth line-of-sight, etc.

Finally, an investigation into the feasibility of deploying a CubeSat into a more peculiar class of orbits, such as longterm stable Frozen Orbits (FOs), is presented.

This paper demonstrates various commercially interesting mission concepts that will help unleash the potential for cheaper, smaller missions to the Moon for national space agencies, international academia and industry partners.

- L. Steindorf, et al. (2019), "Malapert Mountain: An ideal staging point for lunar south pole exploration", proceeds of the International Astronautical Congress 2019, Washington D.C. IAC.