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MOONLIGHT NAVIGATION SERVICE - HOW TO LAND ON PEAKS OF ETERNAL LIGHT

Abstract

The interest in Moon exploration has substantially grown in the latest years, positioning the Moon as an attractive testbed to develop the required technologies and capabilities for human Deep Space exploration. In past decades, lunar missions have almost entirely relied on Direct-to-Earth (DTE) communications, whilst using ranging radiometric measurements from Earth for navigation. The growing trend in the number of missions to the Moon is creating demand for the deployment of a lunar communications and navigations infrastructure to support the international community. This in turn can act as a catalyst for additional public and private world-wide cis-lunar initiatives. The European Space Agency's vision represented in the Moonlight initiative, is to stimulate the creation and development of lunar communications and navigation services, to be delivered by private partner, that will support the next generation of institutional and private Lunar Exploration Missions, including enhancing the performance of those missions currently under definition. Landing on the Moon has been successfully performed

since the initial phase of the lunar exploration, both with human and robotic missions. However, recent failures have shown that landing on the Earth natural satellite is no easy task and that accurate landing within 50 metres or even 10 metres from the target location is today considered almost impossible. The limitation of the current technology does not allow to explore directly specific areas of interest. For example landing close to a permanently shadowed areas, without risk of landing in the shadow and thus losing the mission or landing on peaks of eternal light. Finally, landing on the far side is currently very risky and difficult, requiring dedicated lunar infrastructure for each mission (e.g. Chang'e 4 mission), thus potentially precluding the access to the lunar far side for future missions. The Moonlight navigation service aims to improve significantly the landing accuracy, potentially enabling landing on peaks of eternal light or landing in very specific locations while at the same time saving propellant mass and shortening the duration from launch to landing. The paper will describe the potential concept of operations for the navigation service and how future missions could take benefits of Moonlight navigation service, assess the performances achievable on a specific mission profile representative of a lunar lander mission and describe the high-level user terminal, including its preliminary size, mass and power profile.