Paper ID: 87683
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IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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MOONLIGHT COMMUNICATION & NAVIGATION SERVICES AND APPLICATIONS

Abstract

Moon exploration is now emerging as the next global strategic priority in space exploration and the latest developments are expected to further support highly ambitious government and commercial missions. The European Space Agency's (ESA) Moonlight programme is delivering a dedicated infrastructure of satellites around Moon providing Communication and Navigation capabilities and services that will unlock the potential of the future Lunar missions, enabling more data through high rate low latency communication in S- and Ka-band, as well as high accurate landing and navigation (PVT/PNT) capabilities. This will enable more science per mission and also create opportunity for new missions with less onboard complexity and resources.

In the spirit of economic sustainability, the Moonlight programme relies on a public-private partnership model, involving the private sector to play a prominent role in developing and operating the system as well as providing Communication and Navigation services on and around the Moon through a commercial service provider. As a first step, the commercial partnership project Lunar Pathfinder (LP) between ESA and Surrey Satellite Technology Ltd is currently in development and will be a showcase of initial service delivery for Cislunar Communication and demonstration of Navigation technologies. LP is scheduled to be launched not earlier than end-2025 as a rideshare on the NASA CLPS CS3 mission and will deliver communication relay services to ESA, NASA and commercial missions. In a next step and the main part of Moonlight programme, the Lunar Communications and Navigation System (LCNS) will bring a

complete suite of both services, targeting Initial Operational Capabilities not earlier then 2027 and Full Operational Capabilities not earlier than 2030.

Moonlight services are to be provided not only to ESA but to any other public or private customer entity worldwide. Here NASA, ESA and JAXA working together consolidating the LunaNet Interoperability Specification to enable a standardised service interface from different providers to the end-user. Furthermore, ESA is in discussion with other agencies to make Moonlight services available to them as part of inter-agencies barter agreements, in particular NASA in the context of the ARTEMIS programme. This paper describes the full suite of Moonlight Communication (real-time non real-time, low high data rate, nominal critical) and Navigation Services (one two-way-ranging, time dissemination, PVT post processing), their step-wise deployment as well as the overall status of the programme and initial use cases for lunar economy applications.