

30th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Generic Technologies for Small/Micro Platforms (6A)

Author: Mr. Ramy Kozman

Surrey Satellite Technology Ltd (SSTL), United Kingdom, rkozman@sstl.co.uk

Ms. Ashvi Illott

Surrey Satellite Technology Ltd (SSTL), United Kingdom, ailott@sstl.co.uk

Mr. Alex da Silva Curiel

Surrey Satellite Technology Ltd (SSTL), United Kingdom, acuriel@sstl.co.uk

Prof. Martin Sweeting

Surrey Satellite Technology Ltd (SSTL), United Kingdom, m.sweeting@sstl.co.uk

COMMERCIAL DATA RELAY SERVICES IN THE CIS-LUNAR ENVIRONMENT WITH LUNAR
PATHFINDER

Abstract

Many missions are planned for the cis-lunar environment in the coming decades. Traditionally, all missions would receive TCs from and send payload data/TM to Earth directly. However, missions can benefit from reduced size, weight, power and costs and increased data rates if they forgo space-Earth communications hardware and instead communicate with a nearby cis-lunar data relay orbiter.

Accordingly, SSTL have been working with ESA under the auspices of the Commercial Lunar Missions Support Services partnership agreement to provide Lunar communications and navigations services. This will be done through SSTL's Lunar Pathfinder spacecraft, a small satellite with a mass of 300 kg that will be placed in an elliptical lunar frozen orbit. Lunar Pathfinder will provide communications services to lunar missions of all types and is scheduled to launch in 2025.

Lunar Pathfinder flies two Lunar Link Transponders (LLTs) that use the CCSDS Proximity-1 protocol to communicate with users. The LLTs contain novel features, expressly developed for Lunar Pathfinder, namely new frequency bands and modulation/coding schemes, all of which have been endorsed by the relevant CCSDS working groups and are under consideration for inclusion in updated releases of Proximity-1 standards. Apart from the above, the LLT will also use Version-4 USLP transfer frames, improving interoperability with future missions.

Lunar Pathfinder will be the first time Proximity-1 is used a) around the Moon and b) to provide data services to commercial, not institutional, users. To make this a success SSTL will engage with potential users early on during the design phase of the customer spacecraft to ensure user hardware compatibility. Indeed, this is currently being done with Vulcan Wireless who are creating a compatible transceiver that will be flown on CS-3, a lunar lander that will not only use Lunar Pathfinder as a relay node, but also deliver it to lunar orbit.

Users of the Lunar Pathfinder communications service only require modest ground segment infrastructure to communicate with their spacecraft. Users connect to SSTL ground infrastructure via a VPN to transmit TCs/data, which are uploaded to Lunar Pathfinder and relayed to the spacecraft using the Proximity-1 protocol. The duplex communications channel can be used to simultaneously receive the spacecraft payload data/TM. Data rates can be optimised in line with the link performance through usage of the Variable Coding and Modulation features present in Proximity-1. Any received data is downlinked by Lunar Pathfinder to SSTL's ground infrastructure before being transferred to the user.