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TELECOMMUNICATION FOR LUNAH-MAP MISSION: LESSONS LEARNED IN DESIGN,
DEVELOPMENT, INTEGRATION, AND OPERATION OF A CUBESAT TELECOMMUNICATION
SYSTEM FOR AN INTERPLANETARY MISSION

Abstract

The Lunar Polar Hydrogen Mapper (LunaH-Map) mission was developed by Arizona State University, Jet Propulsion Laboratory, and other partners over the course of multiple years since its selection during the SIMPLEX proposal call in 2015. The mission goal was to test and validate an innovative neutron spectrometer instrument by taking measures around the Moon. The LunaH-Map mission was launched on Artemis 1 on November 16th 2022. The mission signal was nominally acquired, although issues with the propulsion system did not allow to fully complete the mission and inject the spacecraft into the correct trajectory. Despite the malfunctioning, the mission was still successful as the instrument was validated during a lunar flyby, and the other subsystems performed mostly nominally. Specifically, the telecommunication subsystem performed nominally until the end of the mission which was declared in May 2023. The subsystem was comprised of an Iris radio, an SSPA, an LNA, and two sets of transmitting and receiving low gain patch antennas (LGA) placed on opposite sides of the spacecraft to maximize coverage. The ground receivers for the mission were the 34-m Deep Space Network Stations located in Goldstone, Canberra, and Madrid, plus the new Deep Space Station (DSS)-17, which is a 21-m dish located in Morehead (Kentucky) and managed by Morehead State University. The paper describes in detail lessons learned in regard to the design, development, integration, and operation of the telecommunication subsystem: details of the telecommunication link analysis, components testing together with operational challenges, and results are discussed.