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CAPSTONE MISSION LAUNCH AND OPERATIONS

Abstract

Advanced Space and NASA have partnered to develop and launch the Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment (CAPSTONE) mission which is serving as a pathfinder for Near Rectilinear Halo Orbit (NRHO) operations around the Moon. The NRHO is the intended orbit for the NASA's Gateway lunar orbital platform – as such the CAPSTONE mission is validating simulations and confirming operational planning for Gateway while also validating performance of navigation and stationkeeping for future operations. This low-cost, high-value mission has demonstrated an efficient low-energy orbital transfer to the Moon and an insertion into the NRHO. It is now demonstrating the operations within the NRHO that ultimately will demonstrate a risk-reducing validation of key exploration operations and technologies required for the future success of NASA's lunar exploration plans, including the planned human return to the lunar surface. This paper and presentation will include the current mission status leading up to launch, the operations underway, and lessons learned to date in order to inform future CubeSat pathfinders in support of national exploration and scientific objectives.

CAPSTONE is a 12U cubesat developed, integrated, and tested by Tyvak Nanosatellite Systems carrying a payload communications system capable of cross-link ranging with the Lunar Reconnaissance Orbiter (LRO), a dedicated payload flight computer for software demonstration, and a camera. The crosslink ranging and software demonstration will provide critical demonstration of the Cislunar Autonomous Positioning System (CAPS) to enable peer-to-peer navigation for future lunar missions. CAPSTONE was launched on a Rocket Lab Electron launch vehicle with a Photon upper stage. The paper will describe the results of the launch and subsequent flight to the Moon.

The CAPSTONE mission is funded through NASA's Small Spacecraft Technology Program (SSTP), which is one of several programs in NASA's Space Technology Mission Directorate. SSTP is chartered to develop and demonstrate technologies to enhance and expand the capabilities of small spacecraft with a particular focus on enabling new mission architectures through the use of small spacecraft, expanding the reach of small spacecraft to new destinations, and augmenting future missions with supporting small spacecraft.