

Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment (CAPSTONE)

Advanced Space has partnered with NASA to develop and build the Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment (CAPSTONE) mission which will serve as a pathfinder for Near Rectilinear Halo Orbit (NHRO) operations around the Moon. The NHRO, (Perilune = 3,200 km; Apolune = 70,000 km) will be the intended orbit for the NASA's Gateway lunar orbital platform, as such the CAPSTONE mission will validate simulations and confirm operational planning for Gateway while also validating performance of navigation and station-keeping for future operations. Thus, this mission will provide operational experience to NASA, commercial, and international missions for operations in a demanding orbital regime.

CAPSTONE will fly 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 cross-link 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 is contracted to launch with Rocket Lab and will be launched in early 2021. Upon launch, the spacecraft will traverse a highly efficient transfer taking approximately three months to enter a primary demonstration phase in an NRHO for six months followed by a twelve month technology enhancement operations phase.

The CAPSTONE Project is led by Advanced Space, LLC of Boulder Colorado. Spacecraft development and mission operations will be conducted by Tyvak Nanosatellite Systems of Irvine, California. Noted objectives for the CAPSTONE mission will be to demonstrate the accessibility of NHROs, validate key operational concepts in the NHRO environment, lay a foundation for commercial support of future lunar operations and accelerate the availability of peer-to-peer navigation capabilities provided by the Cislunar Autonomous Positioning System (CAPS).

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. The CAPSTONE Mission and project status will be presented.