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Small Spacecraft for Deep-Space Exploration (8)

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DEEP SPACE NETWORK OBSERVATIONS DURING CISLUNAR AND DEEP SPACE CUBESATS
SUPPORT

Abstract

After numerous successful deployments in the near-Earth environment, CubeSats are now increasingly venturing into deep space at much further distances, including two CubeSats that operated successfully during a Mars flyby several years ago. CubeSat success rate to date in cislunar and deep space, however, has been mixed. With notable limitations in their volume, mass, and power, many challenges arise for CubeSats in deep space, especially for their attitude control, power management, and communications systems. Transmitter power and antenna sizes for SmallSats are smaller than those of traditional deep space missions, constraining the link budget. This in turn challenges the ground stations to make up the G/T deficiency on the spacecraft elements in the end-to-end link budget.

The Deep Space Network (DSN) has played an integral role for these cubesat missions and has gained experience in recent years with supporting various missions going back to Mars Cube One, and most notably, the suite of CubeSat secondary payloads on the Artemis-1 mission. This experience has led to a set of observations and lessons that are shared with the CubeSat and telecommunications communities in the categories of engineering design and testing as well as operational procedures, resource scheduling, and spectrum utilization.

The DSN support experience with Cislunar and deep space CubeSats and resulting lessons learned will benefit funding agencies, engineers, scientists, and operations teams in the planning and design of future missions.