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AOBA VELOX-IV ATTITUDE AND ORBIT CONTROL SYSTEM DESIGN FOR A LEO MISSION APPLICABLE TO A FUTURE LUNAR MISSION

Abstract

Aoba VELOX-IV is a 2U-Cubesat which will serve as a platform for technology validation towards a future lunar mission for the observation of lunar horizon glow (LHG). LHG was first spotted in 1966 and 1968 by onboard cameras on Surveyor spacecraft after the sunset from the western horizon, and Apollo astronauts reported that they had seen the horizon glow. Even though the horizon glow was highly visible in the Apollo 15 sunset, Apollo 16 showed no traces of the horizon glow, proving that it is a highly varying phenomenon. Nanyang Technological University (NTU Singapore) is collaborating with Kyushu Institute of Technology (Kyutech), to build Aoba VELOX-IV, which will be launched by Japan's national agency, the Japan Aerospace Exploration Agency (JAXA) in 2018. Though its AOCS scheme is designed to meet the requirements for a low-Earth-orbit (LEO) mission, it can be directly applicable to a lunar mission. This paper is dedicated to the description of the design and analysis of a AOCS to meet these requirements. Because of dimension restrictions, the satellite attitude is two-axis controlled. The hardware of AOCS consists on Sun sensors, gyroscope, reaction wheels and pulsed plasma thrusters (PPT). Satellite position, velocity and time will be determined by a ground station and the satellite will propagate them until the next revisit. Based on PPT thrusters, the AOCS will desaturate RW during attitude control maneuvers for the pointing towards Earth horizon in such a way that the satellite can observe sunrise and sunset. In eclipse phase, the satellite is required to know its attitude by means of Kalman filtering to observe the sunrise. The geometry configuration of PPT will allow the extension of the satellite mission lifetime while desaturation of RW and while the satellite is visible to the ground station.