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ATTITUDE AND ORBIT CONTROL RESULTS OF THE GOMX-4 TANDEM CUBESAT MISSION

Abstract

This paper introduces the AOCS results obtained during the first 6 months of the GOMX-4 mission, a tandem mission with two 6U CubeSats developed by GomSpace. GOMX-4A is intended for monitoring air and sea traffic in the Arctic regions while the GOMX-4B satellite is an In-Orbit Demonstration mission by the European Space Agency demonstrating several new payloads, actuators and sensors. The mission has strict requirements on inter-satellite station keeping and pointing performance due to the inter-satellite radio link between the two satellites and optical payloads on-board.

The pointing performance of the ADCS is assessed in both satellites during the early operations phase and compared to the performance obtained after a series of on-orbit calibrations of the sensors. Given satellites are designed with redundant sensors on-board (coarse- and fine sun sensors, low- and high grade gyroscopes, low- and high grade magnetometers), what makes it possible to compare the performance of the system when using different sensor configurations. Moreover a new Star Tracker, specifically tailored for the nano-satellite industry, is utilized on-board GOMX-4B as a payload. Throughout the mission of GOMX-4B, the Star Tracker will be implemented with the ADCS to eventually improve the accuracy of the pointing performance.

Another main topic of the work done with GOMX-4 relies on the Orbit control and particularly the station-keeping of the two satellites formation. CubeSats are typically launched as secondary payloads and usually do not have the capabilities to change their orbits significantly. For that reason, differences in the injection parameters of the satellites will lead to an unwanted and potentially problematic drift along-track over time.

To control the relative distance between the satellites and mitigate the initial drift, a mix of drag management and propulsion is used. The difference in the exposed surface area between the two satellites makes it possible to control the decay rate and can eventually be used for station keeping. A cold gas thruster system on-board GOMX-4B is used to perform a rapid change in the difference between the satellites orbital semi-major axis. This second part of the paper will describe how these two approaches can be combined to control the relative distance evolution with a limited amount of propellant. Throughout the GOMX-4 mission a number of propulsion maneuvers will be scheduled to reach certain reference distances and perform tests with the experimental inter-satellite radio link.