IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advances in Space-based Communication Systems and Services, Part 3 (3)

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THE PRETTY CUBESAT SYSTEM REDUNDANCY CONCEPT

Abstract

PRETTY is a 3U Earth Observation CubeSat, estimated to be launched in early 2023. The first scientific payload is a passive reflectometer system for measuring ice and sea heights by comparing the time delay between a directly captured GNSS signal to its reflected counterpart from the Earth surface. The second payload is a dosimeter system that measures radiation levels in orbit to estimate the impact of cosmic radiation on the customer-off-the-shelf (COTS) components used in PRETTY and the payload units that are developed by the Graz University of Technology.
Small satellite systems such as CubeSats or other microsatellites, in particular, are subject to significant constraints, mainly due to the limited available space and budget. Nevertheless, it is essential to design these systems with a focus on reliability. To achieve that and maximise the scientific output for such a small science mission, it is necessary to implement fail-safe mechanisms and redundant systems, wherever possible, meeting size, energy, or budget constraints.
In this paper, the PRETTY system design is described focusing on the implemented systems' redundancy concept. One of the key design-elements is the interconnection of the individual satellite components via redundant buses. Furthermore, a redundant connection between satellite and ground is ensured via VHF and S-band communication chains On the payload side, fail-tolerance is increased by the redundant implementation of the payload processing unit. The core functionality of the On-Board Computer (OBC) can be implemented on the Attitude Determination and Control System (ADCS) computer or the payload processing unit, enabling cold redundancy for critical OBC functionality.