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HANDS-ON STRATOSPHERIC BALLOON EXPERIMENT AS A STEPPING STONE TO THE SPACE: THE RETINA STUDENTS' EXPERIENCE

Abstract

In the context of space post-graduate students' education, applied activities are fundamental to combining academic knowledge with practical experience. Hands-on work allows in fact students to acquire the pre-requisite skills necessary to get involved in professional space-related programs. Within this framework, taking part in the design and realization of a stratospheric experiment is a formative opportunity for the students to put into practice all the technical skills and lessons learned from their university career and to apply and improve their soft skills, including teamwork and project management capabilities. The S5Lab (Sapienza Space Systems and Space Surveillance Laboratory) research group at Sapienza University of Rome actively supports and incentivizes the students' participation in various educational activities and programs. The REXUS/BEXUS program, supported by SNSA (Swedish National Space Agency), DLR (German Aerospace Center) and ESA (European Space Agency), promotes the launch of experiments designed and developed by students on board stratospheric balloons and suborbital rockets, and has seen in the past years the successful participation of three S5Lab teams, respectively in 2016, 2019 and 2023. RETINA (Real-time Experiment for Thermal management, Inertial Navigation and Attitude) is a stratospheric experiment designed and proposed by S5Lab post-graduate students that has been selected to fly in October 2024 as part of the 15th REXUS/BEXUS cycle. RETINA consists of the in-flight technology demonstration for different innovative technologies aimed at increasing their TRL (Technology Readiness Level) for future space applications. RETINA research is carried out through the testing of four different experiments, featuring the implementation of AI-based algorithms for attitude determination through Inertial Measurement Unit (IMU) data, testing of data fusion algorithms for navigation using multiple IMUs, the implementation of a miniaturized two-phase pumped loop cooling system and first in flight demonstration of a Flexible Time Triggered Ethernet network for communication between onboard devices. Being part of this project led the RETINA team to acquire a great number of lessons learned, related mainly to first experiences with space systems development, intercommunication between subsystems, resource and team management. This paper will present the design, implementation and test phases of the RETINA experiment, the main lessons learned by the students, including the educational return obtained from the project. The paper will focus on the main challenges faced and on how this type of project can be a stepping stone both for postgraduate students and for innovation in space.