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6S CUBESAT: A STUDENT-MADE IOD MISSION FOR CHARACTERIZATION OF PEROVSKITE SOLAR CELLS AND STRUCTURAL BATTERY

Abstract

The 6S CubeSat mission is the flagship project of the university student association PoliSpace which

aims to design, manufacture, and operate the first student-made 1U CubeSat of Politecnico di Milano. Moreover, since January 2023, the project has been part of the pilot edition of ESA's "Fly Your Satellite! Design Booster" program aiming to support selected teams through the consolidation of the design by arranging regular reviews with ESA experts.

Looking at potential improvements in space technology and its transfer, 6S CubeSat was developed as a technological demonstrator of two payloads focused on in-orbit power production and storage; Volta structural battery and PErovskite Solar Cells Analyzer (PESCA). The former is a game-changing concept that combines both form and function, aiming to significantly reduce weight and complexity in satellite design. The latter, instead, will manage the testing of Perovskite solar cells, which promise high efficiency, high power-to-mass ratio, low production cost, and excellent resistance to radiation, making them a good alternative to Silicon-based Solar Cells, both for terrestrial and in-space applications. Furthermore, a derived goal from PESCA is to develop and validate an open-source, affordable, and highly effective solar cells testing platform built in-house. Along with 6S' second in-house component, the CubeSat structure, these two present the main challenges of the CubeSat construction and qualification.

Students from BSc, MSc, and PhD careers are organized in teams that include Attitude and Orbit Control System (AOCS), Electrical Power System (EPS), Mission Analysis (MA), On-Board Data Handling and Flight Software (OBDH&FSW), Thermal Control System (TCS), Telemetry and Telecommand (TMTC), System Engineers (SE), and Structural (STR) teams that translate the theoretical background provided by the university courses of diverse backgrounds to the application of standard practices in space mission design. This also involves the adoption of ECSS and SAVOIR standards and practices of Model Based System Engineering (MBSE), targeting a high academic return for the students involved.

The paper aims to present the technological and educational mission objectives. Additionally, it will provide a complete overview of the mission baseline by detailing the technical design choices and relevant results achieved by the teams cooperating in the project.