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ESA YPSAT: A YOUNG PROFESSIONALS-LED EXPERIMENTAL SPACECRAFT FOR THE INAUGURAL FLIGHT OF ARIANE 6

Abstract

Is there a better way to teach the new space generation how to imagine, plan and build a space mission than by letting them do it on their own? This paper focusses on the development of the Young Professional Satellite (YPSat) carried by Ariane 6 on its maiden flight, capturing each key launch phase, and built entirely by the young professional community of the European Space Agency (ESA).

Throughout its approximately 3-hour-long operating life, YPSat remains attached to the upper stage of the launcher and operates fully autonomously up until upper stage re-entry. YPSat's primary objective is to acquire imagery of the fairing separation, the CubeSat deployment, and in-orbit views of Earth and space, keeping parts of the Ariane 6 upper stage in the foreground. Imaging fairing separation requires

a unique solution to trigger the imaging that was designed, assembled, and tested in house, the YPSat Wake-up-System (WUS). Another innovative solution implemented is the use of a Phase Change Material (PCM) for thermal control, a substance which melts as the internal temperature of the satellite increases and, through this, absorbs the thermal energy, allowing the spacecraft to stay within its operational temperature range.

As additional payloads, YPSat incorporates technology from European partners to expand its capabilities beyond image acquisition. The spacecraft measures Earth's magnetic field along the launch trajectory using a streamlined version of the OSCAR-QUBE experiment, previously flown aboard the International Space Station. It further houses an amateur radio unit from the Spanish amateur satellite radio organisation, AMSAT-EA, which allows ham radio enthusiasts to establish a radio connection with the spacecraft.

The mission has brought together the New Space generation from all backgrounds allowing to have each specialty and subsystem of YPSat developed entirely by ESA young professionals. YPSat, in turn, has allowed young professionals to communicate, coordinate and learn from ESA's top management, experts, suppliers and launch team. This paper provides a comprehensive overview of the overall YPSat mission architecture – including mission concept of operations, technical spacecraft design on system and subsystem level, interface design with Ariane 6 upper stage, as well as description of the mission's ground segment elements. The project has been created in the hope that YPSat's multicultural team composition, low budget, and short development, can inspire students and young professionals globally to be bold and dare to start a space project of their own.