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ASSEMBLY, TESTING, QUALIFICATION AND PLANNED OPERATIONS OF THE LEDSAT
CUBESAT MISSION

Abstract

The upcoming decades of Low Earth Orbit (LEO) operations will require the satellites to be more easily trackable for an improved sustainability of the environment and for keeping the operations of all satellites safe while mitigating the debris impact risks. In this perspective, the implementation of autonomously illuminating payloads, such as LED (Light Emitting Diodes) -based boards, can improve the optical trackability of small satellites at ground, greatly easing their identification and orbit determination. The LEDSAT mission, conceived by Sapienza University of Rome and University of Michigan, is aimed at testing a LED-based payload on-board a nano-satellite for ground-based identification and tracking. The satellite is part of the ESA Fly Your Satellite! Programme and of the Italian Space Agency (ASI) IKUNS Programme. The spacecraft equips 140 LEDs on three different colors, red, green and blue, with boards on every side of the satellite and identical color boards mounted on opposite faces. The CubeSat mission is aimed at demonstrating the effectiveness of the described payload for orbit determination, attitude reconstruction and for testing an innovative method of light-based back-up low data rate data down link. If successful, the LEDSAT investigation could suggest the implementation of similar LED-based payloads on-board all small satellite platforms for a faster identification and an improved tracking. Furthermore,

new concepts of fully autonomous self-illuminating payloads can be conceived for larger satellites or rocket upper stages, to be used in case of a loss of control of the spacecraft or at end of life of the rocket bodies. LEDSAT has been assembled in 2020. The functional tests have taken place between July and October 2020, assuring the perfect adherence of the satellite to the requirements. The environmental qualification, involving vibration and thermal-vacuum testing, has been carried out at Sapienza University of Rome in December 2020 and it confirmed the survivability of the spacecraft in representative flight environmental conditions. The spacecraft is scheduled to be launched in June-July 2021 and the preliminary results from the spacecraft flight will be produced from the observations during the first months of operations. A network of optical observatories is ready to acquire optical data from the passes of LEDSAT on its Sun-Synchronous Orbit during its early operations. This paper will report the assembly, the functional and environmental qualification of the LEDSAT 1U CubeSat, with particular focus on its architecture and on the scheduled operations and observations of the LED-based payload.