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# AUTONOMOUS ILLUMINATION PAYLOADS FOR SPACE TRAFFIC MANAGEMENT: THE PLANNED OPERATIONS OF THE LEDSAT DEMONSTRATION MISSION

**Abstract**

The increasing congestion in the LEO environment requires a more precise and reliable tracking of all the in-orbit objects to prevent the increase of collision risks and new debris creation. In the perspective of the new generation Space Traffic Management tasks, the utilization of Light Emitting Diode-based payloads for small satellite platforms would greatly increase the optical trackability of small satellites throughout their life cycle for the benefit of all the users of orbital technologies. The LEDSAT mission has been conceived by Sapienza University of Rome and University of Michigan for demonstrating a LED-based payload for ground-based optical tracking. The satellite project is participating in the ESA Fly Your Satellite! Programme and it is supported by ASI (Italian Space Agency) within the IKUNS Programme. The spacecraft is equipped with 140 LEDs in three different colors, mounted on all the external faces of the CubeSat. The satellite will perform optimized flashing patterns for maximizing the acquirable orbital and attitude information that can be extracted from optical observations. Furthermore, the satellite will demonstrate how such kind of payloads could greatly help identifying small satellites

through identifier flashing patterns soon after launch, with particular regards to cluster launches that often do not allow a precise identification of the spacecraft for the first days upon deployment. Finally, the satellite will demonstrate an innovative, low data rate, light-based back-up communication method to be used by future satellites experiencing a failure of the transceiving systems. If successful, the LED payloads designed implemented on LEDSAT could be transferred to many other satellite missions to improve their trackability and to mitigate the risks of in-orbit collisions. LEDSAT has been assembled and qualified through functional and environmental testing throughout 2020. The spacecraft will be launched in July 2021, allowing the first observations and operations to be conducted between summer and early fall 2021. This paper will report the planned operations of LEDSAT in the perspective of a future broader usage of LED-based payloads for optical tracking and STM tasks. After a brief description of the satellite design and a short report on the Assembly, Integration and Verification activities, the satellite planned operations will be described with a preliminary report of the first conducted observations, if available. Extensions of the LED-based payload design concept will be provided at the end of the paper for application to other small satellite or larger satellite missions.