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LAUNCH OF A 3 UNIT CUBESAT WITH INTEGRATED PROPULSION SYSTEM: D-SAT QUALIFICATION, ACCEPTANCE AND TRANSPORTATION LOGISTICS.

Abstract

During the last 40 years of space activities, the orbiting artificial objects mass increases quite steadily at a rate of 145 metric tons every year. To stop the systematic increase of non-operative satellites and guarantee a safer and sustainable access to orbit, combined remediation and mitigation measures are under development. As a preventive debris removal solution, D-Orbit developed a dedicated decommissioning device for satellites based on solid rocket motor technology to be installed on the satellite prior to launch.

In the path towards this disruptive technology, D-Orbit has designed and manufactured a 3-Unit Cubesat with installed a miniaturized decommissioning device. The nanosatellite will be released into LEO orbit in the second half of 2016 and will be the first satellite to be actively de-orbited in a quick, safe, reliable and controlled way. This particular mission, called D-SAT, is the first example of a Cubesat adopting a solid propellant motor thus implying, as threated for the first time ever, major challenges on the program. The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 711193.

In order to identify, collect and understand the applicable requirements, and identify the best integration, test campaigns and transportation logistics, an extensive work was done in closed collaboration between the nanosatellite owner, D-Orbit, the solid rocket motor manufacturer, Bayern Chemie, and the Launch Service Provider, Tyvak International. First of all, the Electro Explosive Subsystem (EES) and the solid rocket motor were individually qualified. These qualification test programs were based on major safety standards, as the European Cooperation for Space Standardization (ECSS), the Military Standard (MIL-STD-1576) and the Eastern-Western Range (EWR 127-1), the SMC-S-016 and related standards. Secondly the satellite Qualification Model was tested in an inert configuration, to optimize the program scheduling and minimize costs. Finally, the satellite Flight Model went through the acceptance test program, which was identified cleverly merging ground handling, transportation, safety, launcher and Cubesat International Standard requirements.

This paper expands and deeply discusses these topics, with the aim to describe challenges encountered, provide the Cubesat community with useful indications on the processes to be implemented, and ultimately help and encourage future nanosatellite missions using propulsive systems.