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STRATEGIES DEVELOPED TO ESTABLISH A NANOSATELLITE THERMAL TESTING PLAN FOR THE SC-ODIN STUDENT PROJECT

Abstract

Space Concordia's Spacecraft division was one of the 15 selected teams to participate to the Canadian CubeSat project. Through this mission, the team will develop, build, and operate Space Concordia's Orbital Dust Imaging Nanosatellite (SC-ODIN), with the goal of measuring aerosol particle properties using an RGB imager, and produce meaningful Earth observation data.

Aboard a spacecraft, the thermal environment is managed by a thermal control system, to ensure the viability of individual critical components as well as the nanosatellite, as a whole. The thermal subsystem team needs to understand the mission requirements, as well as analytically model the spacecraft in the environment it will operate. The results from this thermal analysis are essential since they allow the team to notice thermal design problems and ultimately, find appropriate solutions in the early phases of the project. However, thermal management only via analytical tools is not enough to ensure the spacecraft's reliability during its entire mission. The CubeSat needs to go through a series of validation and qualification tests, before confidently ensure its operation in space. As the thermal lead working within the SC-ODIN design team, developing and presenting a thermal testing plan that is feasible in terms of budget, time, and resources is key. Indeed, since CubeSat student teams are considered more of a great learning experience than priority missions, it is essential for the thermal subsystem to discuss and establish a testing profile that will allow them to reveal thermal design challenges, otherwise not notable, without compromising the overall progress of the project.

This paper aims to provide nanosatellite team projects with practical strategies to develop a tailored testing plan, that will allow them to validate their design as well as qualify their flight model, while taking into consideration their limitations. By presenting different approaches and challenges encountered when establishing SC-ODIN's thermal testing plan, that comprises a full-stack 1 cycle thermal balance test, CubeSat student teams will gain valuable tools to help them work towards obtaining experimental results and validate their thermal analytical model. Such approaches include, but are not limited to, the understanding of the different types of results obtained by both thermal balance and thermal cycling tests and how to chose which test to perform, sub-unit level testing to target specific subsystems that present a greater risk to the mission, in addition to the advantages of 1 cycle versus multi-cycle profile tests.