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# A SIMPLIFIED OPS-SAT THERMAL MODEL TO DEFINE THERMAL FDIR STRATEGIES

**Abstract**

OPS-SAT is a 3U Cubesat acting as a powerful platform to demonstrate novel software experiments in space, planned to be launched in the second quarter of 2019. The satellite has a high power production of up to 32 Watts and a total of 10 payload devices, some of which consume a lot of power. Due to the satellite's passive thermal design and its surface almost fully covered with solar panels, there is limited surface area left which can be adjusted in terms of thermal emissivity and thus help to regulate the thermal behaviour. During nominal operations, the Satellite's core payload, the Satellite Experimental Processing Platform (SEPP) alone uses up to 12 Watts and during an S-band ground station pass, the power consumption can exceed 25 Watts. To understand the thermal behaviour of OPS-SAT and its payload devices, we create simplified thermal models for the most power consuming payloads and validate the model against vacuum tests. First, a steady-state model will be used to determine the maximum temperature of a payload for a variety of typical use cases. The transient thermal behaviour is determined by extending the steady-state model, taking into account thermal capacity and conductivity for each payload device alone and in combination with a thermally representative mockup of the satellite. This allows estimation of heating and cooling phases during sunlight and eclipse and for different combinations of active payloads. The first iteration of the steady-state model for OPS-SAT's core payload show around 10% deviation between simulated steady-state temperature and measured temperature under vacuum conditions. We will use the measurements to fine-tune the model parameters and to build up a comprehensive thermal model of the satellite step by step. The results will be used to determine thermal strategies and thresholds for the OPS-SAT FDIR in order to keep the satellite safe during nominal and experimental operations.