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Author: Ms. Aimee Carvey
University of Manitoba, Canada, carveya@myumanitoba.ca

Dr. Philip Ferguson
University of Manitoba, Canada, Philip.Ferguson@umanitoba.ca

EVALUATING THE FEASIBILITY OF SMART RADIATOR DEVICE (SRD) THROUGH SIMULATED SMALL SATELLITE MISSIONS

Abstract

This paper presents the simulation results of a new Smart Radiator Device (SRD) applied in small satellite missions. We compared the simulations implementing SRDs to identical simulations using conventional radiator materials in order to evaluate the performance improvements that the tiles provide. The SRD delivers improved thermal control over conventional radiator materials as it exhibits temperature-variable emissivity. At a temperature of approximately 25 degrees Celsius, the SRD's emissivity transitions from low to high, which allows for increased control of radiated heat in low and high temperature situations. Thermal control has always been an important aspect of satellite design, and with smaller spacecraft becoming more common, the need for more accurate thermal control methods that can fit within small dimensions is very important. SRDs fit well within this field as their variable emissivity property increases control of radiation without adding design complexity or weight. The most important benefits that this provides to small satellites are decreases in required bias heater power and reductions in overall satellite temperature swings on orbit. In order to quantify the power savings and reductions in temperature variations that the SRDs can provide, we used NX Space Systems Thermal to perform simulations of a small spacecraft using SRDs in orbit. We also performed identical orbital simulations of the same spacecraft using traditional thermal control methods, and compared the two sets of results. This comparison showed that for certain small satellite configurations and duty cycles, SRDs are able to eliminate the need for bias heaters and reduce temperature swings by 15 degrees Celsius compared to conventional radiators.