

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
Space Vehicles – Mechanical/Thermal/Fluidic Systems (7)

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MICRO-PUMPED COOLING LOOP TO STANDARDIZE MICRO-SAT THERMAL CONTROL

**Abstract**

With the miniaturization of space-borne sensors, more powerful payloads are anticipated to be used in small satellites. Therefore, new thermal concepts are required to cope with the increasing thermal dissipation and address the short development time available between customer demand and launch. Compared to standard spacecraft thermal design three requirements become design drivers:

- Design flexibility for late orbit parameter changes
- Short development and Manufacturing, Assembly and Integration time
- Heat switch function to reduce heater power during eclipses

This paper presents a new thermal control concept to standardize small satellites with power dissipation problems. First an inventory is made of the micro-satellite size for which thermal problems can arise. Subsequently it is explained why a heat switch function should be a key part of a micro-satellite thermal concept. Two NLR thermal concepts are introduced with the focus on the micro-pumped cooling loop. This new thermal design concept is a small pumped loop. The heart of the system is the multi-parallel micro-pump as developed by the Netherlands aerospace centre (NLR). This pump concept provides a low mass pumped solution with high reliability. The article describes the concept of the loop and the pump in detail. Then, the advantages and drawbacks of the system are elucidated by comparison with conventional thermal design solutions with focus on the above mentioned design drivers. The paper concludes with the development status, the further development plan of the micro-pumped loop and expected market demands for which the micro-pumped loop is a suitable solution.