

Two-Phase Heat Transport Systems for Aerospace Thermal Control Applications

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Since the transport capability of the classical heat pipe was foreseen not to be able to meet the high power and dedicated temperature requirements of modern and future spacecraft, the aerospace community started (already more than a decade ago) to investigate more powerful alternative systems.

The operation of these alternatives, being the Capillary Pumped Loop (CPL), the miniature, reversible and ramified Loop Heat Pipe (LHP), some Vapour Pressure Driven Heat Transfer Devices (VPDHTD) and the Mechanically Pumped Two-Phase Loop (MPTPL) are discussed in detail. Some research highlights will be presented. Controllability aspects and the issues of thermal-gravitational thermal modelling and scaling will be discussed, including the fundamental differences between liquid-vapour (single component) and liquid-gas (two-component) two-phase flow and heat transfer.

Since the majority of the above systems are currently considered to have reached maturity, they are already applied in various spacecraft. Many applications in the near and far future are foreseen. This will be illustrated in a brief survey. Some of the most challenging applications will be discussed in detail.