**Title:** Flow Boiling in Microgap Coolers—Suborbital Flight Results

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**Topic Area:** Active Thermal

**Abstract:** Flow Boiling in Microgap Coolers (FBMC) is a thermal management technique that provides embedded, on-site heat removal for power dense electronic components and systems. The dielectric coolant undergoes liquid-to-vapor phase change as it passes through channels integrated within or between devices. By facilitating direct contact between the coolant and heat-generating devices and relying on phase change, the system provides tight temperature control, hot spot mitigation, very high heat transfer coefficients, and low pumping power. Ground tests demonstrated removal of high heat fluxes (up to 500 kW/m2), very high coefficients of performance (up to 40 W of heat transferred per W of pumping power), and consistent performance across five evaporator orientations under the appropriate conditions. As a follow-on study and to better assess the role of gravity on such two-phase systems, the FBMC payload was developed and flown twice aboard the Blue Origin New Shepard space vehicle in January and May 2019. Each flight exposed the payload to weightlessness (150 seconds below 0.01 g) and shorter periods of high-g during ascent (up to 3 g) and descent (up to 5 g). The flow boiling performance was consistent independent of the acceleration levels, which provides confidence that such systems will provide consistent performance when tested on the ground, orbiting or traveling through weightlessness, and operating on the surface of the Moon, Mars, and other planetary bodies. Details of the flight results, payload development, flight environment, and planned future testing will be presented.