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QUALIFICATION TEST CAMPAIGN OF BARIDI-SANA FLIGHT MODEL, AN INNOVATIVE TWO-PHASE FLOW COOLING SYSTEM FOR SPACE APPLICATIONS

Abstract

In the modern vision of miniaturization of Space Systems and Spacecrafts, the increasing use of high-power devices, spanning from communication systems to scientific devices, led to an increase of thermal loads to be managed due to the smaller dimensions of the instrumentations. Thus, active cooling systems, based on the utilization of two-phase flows, assume a strategic importance, for their capabilities of manage more power-demanding scenarios. In this new vision of Space missions, the research and development activity carried out by the United Nations Office for Outer Space Affairs (UNOOSA), has assumed a great importance, allowing researchers to share knowledge and new technologies. In this frame, Baridi Sana, a joint progamme between Sapienza University of Rome and Machakos University, supported by the Italian Space Agency (ASI) and the Kenya Space Agency (KSA), with the collaboration of ENEA, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, was selected as one of nine scientific projects planned for the China Space Station (CSS) in 2022. The Project aims to carry on board of the CSS a new, innovative, two phases flow cooling system for Space Systems, to be tested in Microgravity conditions. Such a system is intended to meet the new requirements asked to the new generation of Space Systems and Spacecrafts, of reducing weights and costs, as well as to get a longer operating life and high performances, immersing in the new reality of miniaturization of the space systems themselves. In this study, the ground experimental qualification phase of Baridi-Sana Flight Model, is reported. The system has been tested under different mass flow rate conditions, from 10 kg/h up to a maximum of 40 kg/h, and with a thermal power to be dissipated up to 200 W at a pressure up to 1.75 bar. The results showed a good performance with an increase in the convective heat transfer coefficient at higher mass flow rates and pressures.