**Similar Fluids as a Means to Experimentally Predict the Performance of Two-Phase Flow Systems at Reduced and Microgravity**

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## ABSTRACT

Extraterrestrial habitats are an emerging research topic, mostly because of the desire to establish human bases on the Moon and the Mars. These habitats will be supported, among others, by thermal systems, many of which ideally use two-phase systems. Examples are refrigeration cycles, pumped two-phase loops, Rankine power-cycles or distillation for waste water recovery. The performance prediction is very important but two-phase systems in microgravity or reduced gravity are poorly understood and the testing opportunities are scarce and expensive. One research approach is to select a fluid for terrestrial testing such that another fluid at reduced gravity will be approximated, a process mostly relying on selected dimensionless numbers. This research field has received some attention during the design of the International Space Station, but a large-scale approach to finding similar fluids has not been presented. This paper groups fluids that are similar according to different requirement-sets and at different gravity levels. Researchers that design buildings for reduced gravity can use these results to consider similarity studies in their terrestrial experiments.

**Keywords:** extraterrestrial habitats, scaling, similarity, two-phase flow, two-phase systems