**Observations of Heat Exchangers in a Vapor Compression Refrigeration Cycle Subjected to Microgravity**

**Leon P. M. Brendel1\*, Stephen L. Caskey2, James E. Braun1, Eckhard A. Groll1**

1Ray W. Herrick Laboratories, School of Mechanical Engineering, Purdue University

West Lafayette, 47907-2099, USA

2Air Squared, Inc., Broomfield,CO, 80212

\*brendel@purdue.edu

## ABSTRACT

Vapor compression refrigeration for spacecraft was proposed for several decades but experimental efforts have stopped in the early 2000s. This paper presents data collected from a highly instrumented vapor compression refrigerator on parabolic flights. The analysis focuses on the behavior of the heat exchangers when going through periodic zero- and hyper gravity. Four main results are presented: 1. A flow visualization study on the flow regimes at the inlet of the evaporator. 2. Small but consistent increases in the condensation temperatures in microgravity. 3. Observed pressure and charge oscillations in the evaporator during microgravity. 4. A categorization of the evaporator heat transfer rate responses to gravity changes in four groups which can be bounded by the mass flow rate and the length of the two-phase region in the heat exchanger). This dataset is among the first ones collected from a vapor compression cycle on parabolic flights and adds to the understanding of two-phase cycles exposed to varying gravity environments.

**Keywords: vapor compression cycle, refrigeration, microgravity, hyper gravity, parabolic flights**