University of Colorado at Boulder

AEROSPACE ENGINEERING SCIENCES

Seminar

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Robust and Sustainable ECLSS: Enabling Novel Architectures for Crewed Spacecraft and Habitats

Human exploration of space beyond our Earth-moon system will require robust and sustainable Environmental Control and Life Support Systems (ECLSS) for future spacecraft and habitats. Over the past two decades, advanced ECLSS technologies have been developed for ISS. One of these, the active thermal control system, uses a dual-loop, two-fluid architecture to reject heat loads from the station to space. This system works quite well, but uses ammonia that poses an ever-present toxicity hazard to the crew should a leak occur. Further, because the ammonia-based external fluid loop operates at temperatures below the freeze point of water, there is the additional hazard of freezing water within the interchange heat exchanger.

In this talk, I will describe a lightweight water-based heat exchanger able to tolerate freeze and thaw without structural damage. Designs have survived hundreds of cycles without failure and have potential for application to crewed spacecraft, spacesuits and cubesats. Most recently, experiments were conducted to assess the influence of gravity on the freeze-thaw processes occurring within the heat exchanger. Altering the orientation of the heat exchanger in 1g has provided insight into the effect of gravity on the ice formation process. The onset of freeze was delayed when the water flow was directed downward relative to horizontal and upward flow conditions. Building upon this work, I plan to apply freeze-tolerant thermal control architectures to high-power cubesats, explore non-toxic, high performance refrigerants (fluids with the heat capacity of water and freeze point of ammonia) and investigate flexible solid-state thermal control architectures for spacesuits.

Monday, September 26, 2016
12:00 noon
DLC Collaboratory

Brown Bag with cookies, beverages provided!