NASA SBIR/STTR Technologies

Phase I Proposal No. 09-X7.02-9282;
A Two-Phase Cooling Loop for Fission Surface Power Waster Heat Transport
Contract No. NNX10CD37P

PI: Jay C. Rozzi, Ph.D., Creare Inc., Hanover, NH

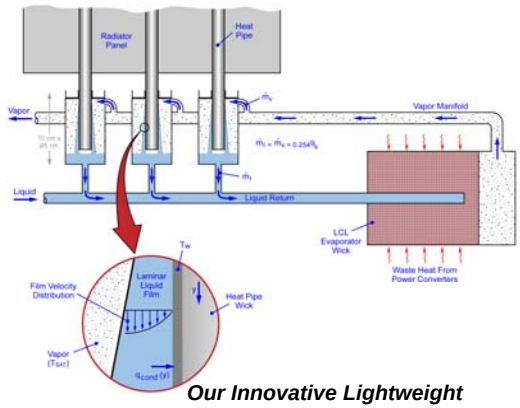
Identification and Significance of Innovation

Current space-based Fission Surface Power (FSP) Systems consist of waste heat transport systems based on heavy, pressurized water cooling loops, increasing launch weight and cost

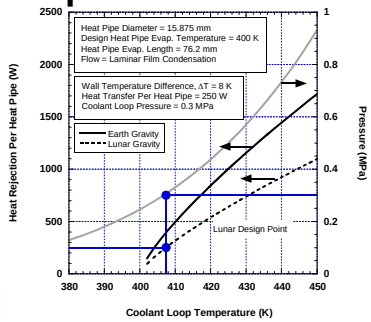
Our innovation is a Lightweight Cooling Loop (LCL) that is comprised of a two-phase water loop and a capillary pumped liquid return. Using our approach, we demonstrated feasibility during Phase I by designing, fabricating, and testing a proof-of-concept LCL.

We have estimated that our LCL will reduce the cooling loop system mass by 46% compared to the current approach along with a reduced system volume.

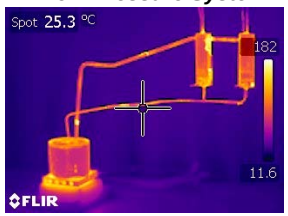
Expected TRL Range at the end of Contract:3 - 6



Our Innovative Lightweight Cooling Loop (LCL)



Low-Pressure System



Temperature Uniformity

Key Technical Achievements During Phase I

Designed and fabricated the proof-of-concept LCL system for our feasibility demonstrations. This included an LCL evaporator and two condenser modules.

Experimentally validated the high heat transfer coefficients associated with condensation resulting in a compact, lightweight LCL.

Confirmed the design point performance of the proof-of-concept LCL system. We confirmed that the measured temperature difference was within the predicted value (~4 K) for a condenser module heat load of 250 W.

Developed a large scale design for a 35 kW power cell demonstrating that our LCL approach will reduce the mass of the WHTS by 46% compared to the current single-phase liquid water approach currently being considered by NASA.

NASA Applications

Fission Surface Power (FSP) Systems to support In-Situ Resource Utilization (ISRU) for Mars robotic and manned missions

Non-NASA Applications

Large scale computing facilities, radar, aerospace, large scale power systems, and energy recovery applications

Firm Contacts

Jay C. Rozzi, Ph.D.
Creare Inc., Hanover, NH 03755
603-640-2367; jcr@creare.com

NON-PROPRIETARY DATA