NASA SBIR/STTR Technologies

X3.04-9990 - A Multi-Environment Thermal Control System With Freeze-Tolerant Radiator

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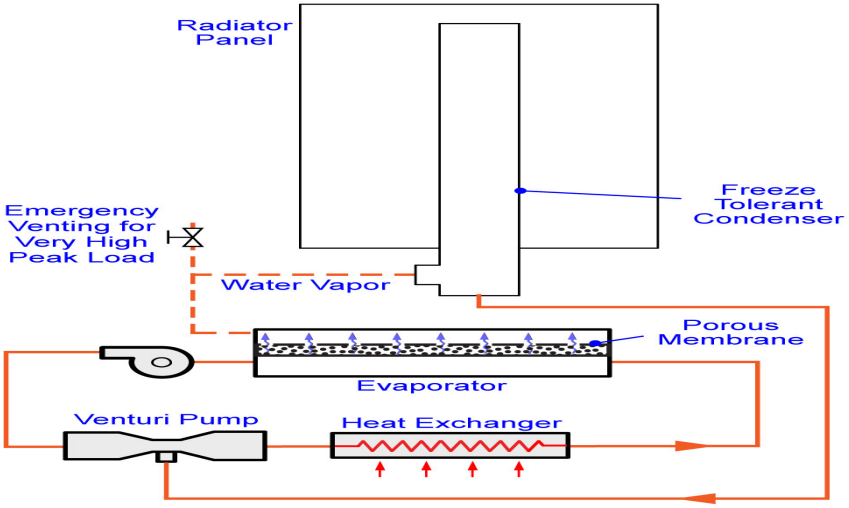
Identification and Significance of Innovation

- A compact, lightweight thermal control system for extreme thermal environments
  * Constant cabin and equipment temperatures
  * Single pumped loop with liquid flow for lightweight and simple integration
  * Suitable for long missions as well as ascent and descent stages
  * Low power consumption
  * No consumables
- A freeze-tolerant radiator with self-regulating thermal conductance to ambient environment
  * Eliminate active control for the heat rejection system
- Benign working fluid that is compatible with aluminum heat exchangers and pipes.



Estimated TRL at beginning and end of contract: (Begin: 3 End: 4)

Technical Objectives and Work Plan

Technical Objectives
- Develop a TCS to maintain a constant cabin temperature under widely varied heat loads and environmental temperatures
- Show the performance benefits of the freeze-tolerant TCS with self-regulating thermal conductance

Work Plan
- Phase I
  * Demonstrate the TCS's freeze-tolerant and variable thermal conductance characteristics
  * Produce an optimal TCS system design and its predicted performance data
  * Optimize corrosion inhibiting and biocide additives for working fluid
- Phase II
  * Build and demonstrate a prototype TCS for a specific space mission

NASA Applications

- Thermal control systems for future manned spacecraft, rovers, and habitats
- Thermal control systems for satellites and exploration rovers
- Lunar, Mars, and asteroid exploration

Non-NASA Applications

- Commercial and military satellites
- Terrestrial electronic cooling systems

Firm Contacts

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NON-PROPRIETARY DATA