NASA SBIR/STTR Technologies

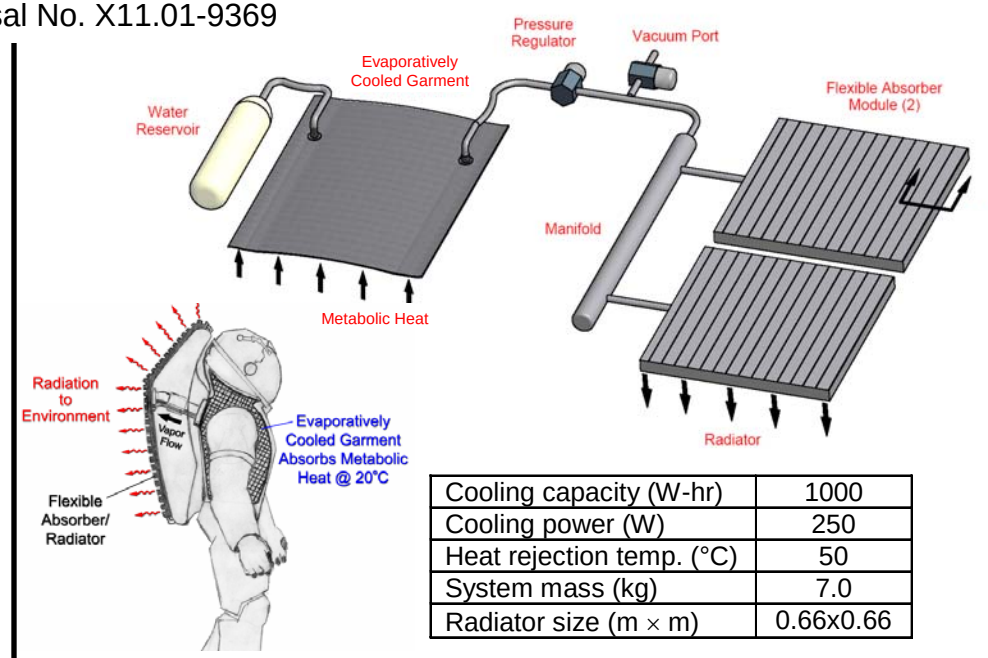
Lightweight, Flexible, and Freezable Heat Pump/Radiator for EVA Suits

PI: Dr. Michael G. Izenson/Creare Inc., Hanover, NH

Proposal No. X11.01-9369

Identification and Significance of the Innovation

- Heat pump/radiator for heat rejection from EVA suits
  - Heat rejection for Portable Life Support System (PLSS)
  - Based on LiCl/water absorption heat pump
  - Batch mode, regenerative process
- Significant benefits for future EVA suits
  - Heat pump action reduces radiator size and weight
  - Proven freeze-tolerance and light weight
  - Flexible, rugged materials
  - Evaporatively-cooled garment eliminates liquid circulating loop
- Builds on established absorption cooling process
  - High cooling density, completely regenerable
- Innovation: Rugged, flexible structure suitable for EVA
  - Compact absorber conforms to PLSS for enhanced mobility



Cooling capacity (W-hr)	1000
Cooling power (W)	250
Heat rejection temp. (°C)	50
System mass (kg)	7.0
Radiator size (m × m)	0.66x0.66

Technical Objectives and Work Plan

- Safe and effective EVA operation
  - Rugged and lightweight system
  - Freeze tolerant, eliminates liquid pump for high reliability
- Thermal control suitable for space exploration
  - Eliminates use of consumables, conserves valuable water
  - Maintains clean EVA environment
  - Easily regenerable with low-temperature heat
  - Materials can be repaired in space
- Phase I work plan
  - Optimize materials for space exploration
  - Develop fabrication methods for flexible absorber/radiator
  - Demonstrate performance
  - Design the Phase II prototype

NASA and Non-NASA Applications

- NASA application: Lunar and planetary exploration
  - Simplifies PLSS, increases reliability, reduces size and mass
  - Extended duration with routine EVA
  - Conserves valuable water by eliminating venting
- NASA application: Construction of scientific instruments
  - Maintains clean EVA environment
- Non-NASA applications
  - Medical: Portable refrigeration units for mild therapeutic hypothermia
  - Homeland security: Cooling for Level A HAZMAT suits SCBA for firefighting and rescue
  - Civilian diving