Closed-Loop, Non-Venting Thermal Control for Mars EVA Suits, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

NASA seeks new thermal control technology for EVA suits on Mars. The system must be closed-loop and non-venting, have negligible impact on the Martian environment, and be capable of operating under Mars surface conditions. We propose to develop a space evaporator/absorber/radiator (SEAR) system with innovative features that will enable operation on Mars. The system uses a regenerable water absorption cooling system that rejects heat entirely by radiation. The key innovation needed for operation on Mars is an enhanced absorption process that enables thermal radiation at increased temperatures. In Phase I we will prove the feasibility of our approach through thermal/fluid/mechanical analysis and assessment of design trade-offs, proof-of-concept experiments, and design of a prototype SEAR for Mars. In Phase II we will build a prototype system and demonstrate its operation under conditions that simulate the Martian surface.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: The Mars SEAR will enable EVA on Mars without venting water, which is critical both for preserving the Martian environment and for conserving valuable life-support resources. The enhanced water absorption technology can be used to boost performance of SEAR thermal management systems for EVA suits in any environment. The enhanced SEAR technology can also be used to provide thermal storage on spacecraft or rovers that operate in variable thermal environments.

To the commercial space industry:

Potential Non-NASA Commercial Applications: The SEAR technology can be used by the commercial space industry for space suit thermal control. The basic technology we propose to enhance absorption cooling has a wide range of terrestrial applications as part of high-value analytical instruments used for

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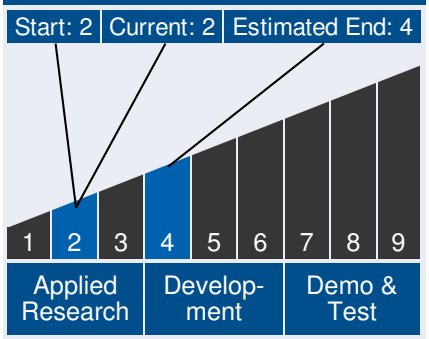
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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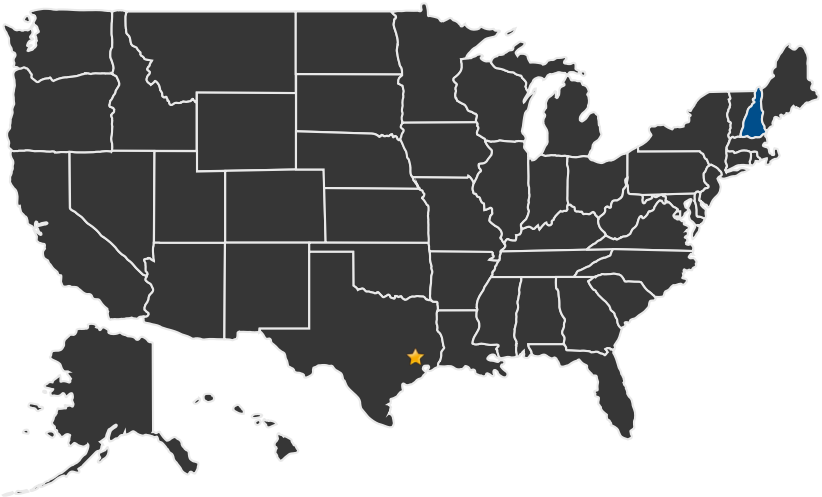
atmospheric sampling and analysis.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Johnson Space Center

Other Organizations Performing Work:

- Creare, LLC (Hanover, NH)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23278)

Management Team *(cont.)*

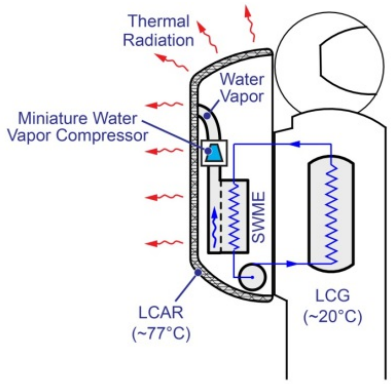
Principal Investigator:

- Michael Izenson

Technology Areas

Primary Technology Area:
Thermal Management Systems (TA 14)
└ Thermal Control Systems (TA 14.2)
  └ Heat Rejection and Energy Storage (TA 14.2.3)

IMAGE GALLERY



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DETAILS FOR TECHNOLOGY 1

Technology Title

Closed-Loop, Non-Venting Thermal Control for Mars EVA Suits, Phase I

Potential Applications

The Mars SEAR will enable EVA on Mars without venting water, which is critical both for preserving the Martian environment and for conserving valuable life-support resources. The enhanced water absorption technology can be used to boost performance of SEAR thermal management systems for EVA suits in any environment. The enhanced SEAR technology can also be used to provide thermal storage on spacecraft or rovers that operate in variable thermal environments.