

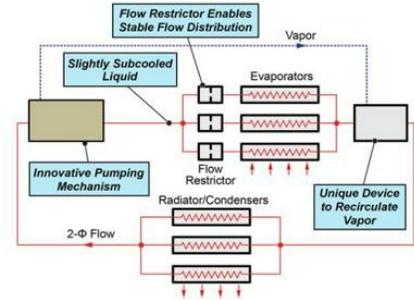
# A Robust Two-Phase Pumped Loop With Multiple Evaporators and Multiple Radiators, Phase II Project

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



## ABSTRACT

NASA's future remote sensing science missions require advanced thermal management technologies to provide effective cooling for multiple instruments and reject heat through multiple radiators. To meet this need, we propose to develop a reconfigurable two-phase pumped loop that can accommodate a complex network of evaporators and multiple radiators. The pumped loop has two performance features: (1) reliable refrigerant circulation with a mechanical pump even when the refrigerant flow exiting the radiators is a two-phase flow with significant vapor quality, and (2) reliable flow distribution among evaporators to minimize flow maldistribution due to heat load variation. These features are achieved by a combination of an innovative loop configuration and Create's proven enabling components. In Phase I, we proved the feasibility of reliable refrigerant circulation through building and testing a proof-of-concept two-phase pumped loop with key features, optimizing the pumped loop design, and predicting its performance. In Phase II, we will build and test an integrated pumped loop with multiple evaporators and heat sinks, optimize the pumped loop components and operating parameters, demonstrate its steady state and transient performance in representative thermal environments, and deliver it to NASA JPL for further performance evaluation.

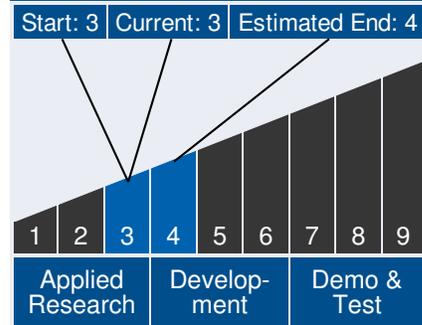


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## Technology Maturity



## Management Team

### Program Executives:

- Joseph Grant
- Laguduva Kubendran

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## ANTICIPATED BENEFITS

### To NASA funded missions:

Potential NASA Commercial Applications: The proposed thermal control technology will be ideal for remote sensing science instruments in future missions. It will maintain a constant instrument temperature under widely varied heat loads and environmental temperatures. More specifically, the technology will be uniquely suitable for a Surface Water and Ocean Topography (SWOT) mission that aims to survey Earth's surface water and map ocean surface height with greater detail than

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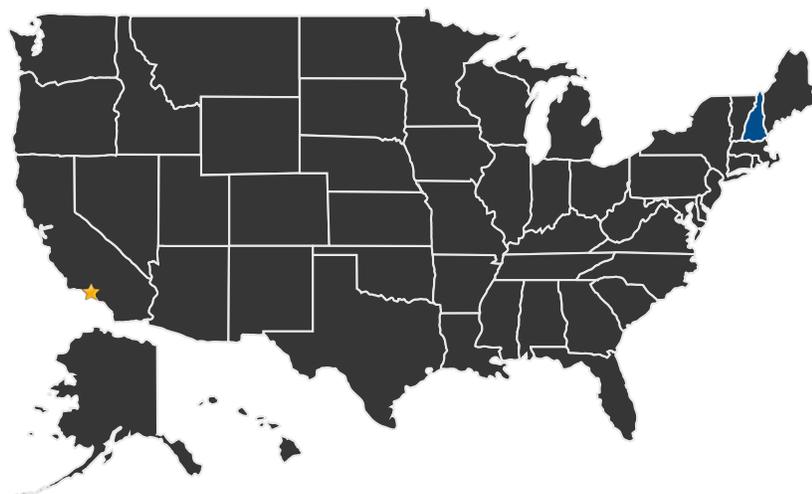


previously recorded. The two-phase pumped loop is also ideal for maintaining a uniform temperature in waveguide manifold and its temperature stability. The thermal control technology can also be used in future spacecraft with applications that include space telescopes, satellites, and exploration vehicles on Mars, the Moon, asteroid exploration, and high-altitude air balloons. The Phase II pumped loop prototype will be delivered to NASA JPL to allow NASA engineers to assess the unique capability of Create's robust pumped loop and its potential for further science mission.

### To the commercial space industry:

Potential Non-NASA Commercial Applications: The reliable pumped loop technology also has applications to advance two-phase thermal control systems in commercial and military satellites and aircraft, as well as high power electronics systems.

### U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States  
With Work

★ Lead Center:  
Jet Propulsion Laboratory

#### Management Team (cont.)

**Program Manager:**

- Carlos Torrez

**Principal Investigator:**

- Weibo Chen

#### 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)
      - └ Two-Phase Pumped Loop System (TA 14.2.3.2)

**Secondary Technology Area:**

- Thermal Management Systems (TA 14)
  - └ Thermal Control Systems (TA 14.2)
    - └ Heat Transport (TA 14.2.2)

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## Other Organizations Performing Work:

- Create, LLC (Hanover, NH)

## PROJECT LIBRARY

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### Presentations

- Briefing Chart
  - (<http://techport.nasa.gov:80/file/18179>)

## DETAILS FOR TECHNOLOGY 1

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### Technology Title

A Robust Two-Phase Pumped Loop With Multiple Evaporators and Multiple Radiators