



Advanced Microgravity Heat Pipe Characterization for Stirling Cryocoolers

Problem Statement

- Cryocooler heat rejection at an intermediate temperature for grooved water heat-pipes.
- This flight will provide the correct microgravity environment for the intermediate testing of the cryocooler cooling subsystem for the VASIMR engine.
- Potential users include NASA, USAF, and satellite manufacturers.

Technology Development Team

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Proposed Flight Experiment

Experiment Readiness:

- The low temperature heat pipe cooling solution for the VASIMR cryocoolers is at ~TRL 3, though some subcomponents are at TRL 4-5.

Test Vehicles:

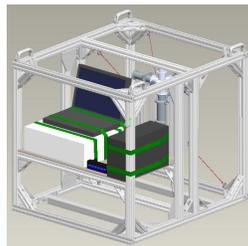
- Parabolic airplane, though human-tended suborbital spacecraft are desired for future testing.

Test Environment:

- Various subcomponents and related systems have been tested as part of the 2009, 2010, 2011 NASA FAST microgravity flight campaigns. Microgravity flights are requested for 2012, though our experiment can take advantage of 1/6g and 1/3g gravity levels.

Test Apparatus Description:

- The test apparatus will include a main experiment box 1m x 1m x 1m (flown before, picture below), and a 0.03m³ tethered box (not shown) on a 6ft tether. Tethered box stowed during take-off and landing.



Technology Maturation

- 200 W heat removal at an initial temperature of 30-40 C, in a relevant vibration environment.
- Technology maturation steps include heat flow characterization, subsystem performance measurement, initial engineering design, and then engineering prototype by 2013-2014.
- 2014-2015 to get to TRL 6 for this subsystem.

Objective of Proposed Experiment

- Measure performance of low-temp heat pipes, heat flow, sensitivity to vibration, startup time and q vs. T .
- Offer initial design solution for microgravity low-temperature heat pipe solution for cryocooler devices for the VASIMR engines.