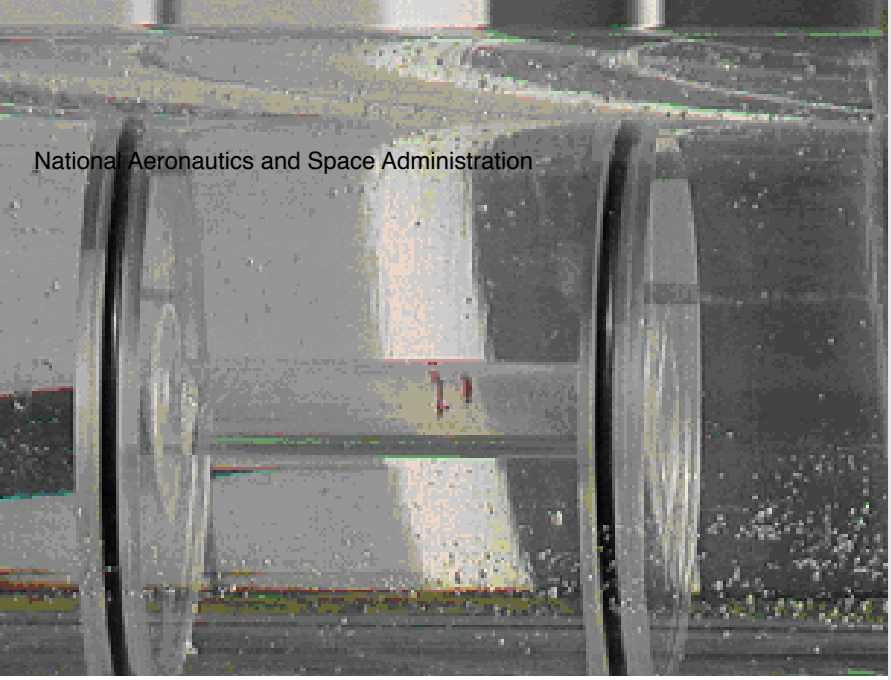

NASA Langley's
Free Piston Space Radiator
Low mass and efficient heat dissipation design

NASA Langley Research Center's free-piston technology offers an efficient heat dissipation design that enables a rapid return rate of fluid supply in an open-loop heat pipe using a low mass piston. The design can be used with many different working fluids to operate at a variety of temperatures. The innovation is applicable to a wide range of sizes, including extremely long tube lengths, while maintaining efficiency. NASA is seeking development partners and potential licensees.

Benefits

- Efficient return of fluid supply in an open-loop heat pipe
- Versatile fluids and temperatures
- Low mass to power ratio
- Scalable to wide range of sizes
- Potential use in large tube lengths without loss of efficiency
- Weight and cost minimized due to simplicity of device

partnership opportunity

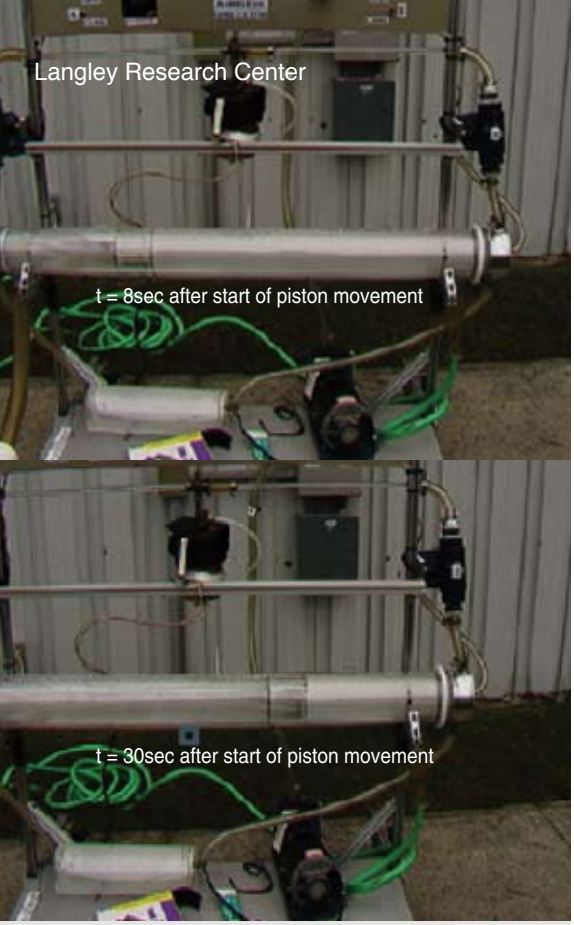

Figure 1: Experimental setup with the piston at two different locations. The piston starts to the left and travels to the right as shown.

The Technology

NASA Langley developed the free-piston technology to create a heat dissipation design for the Space Solar Power Program. The value of the technology to NASA is for use in large power systems that will require efficient design on permanent stations on the moon (and eventually Mars).

The innovation is a piston action that returns the liquid evaporated from the heat source from either end of the radiator tube. The space radiator is a variation of an open-loop heat pipe, but with a unique added feature—a freestanding piston scraper. When a valve is closed on either side of the piston, the continued condensation will create a pressure drop on that side, pulling the piston in that direction. The piston moves through the pipe due to a differential in pressure. The free-piston scraper compacts all of the condensed fluid film to the end of the pipe. The valve is opened and fluid is returned to the evaporator. By alternating the opening of valve ends, the radiator operates continuously.

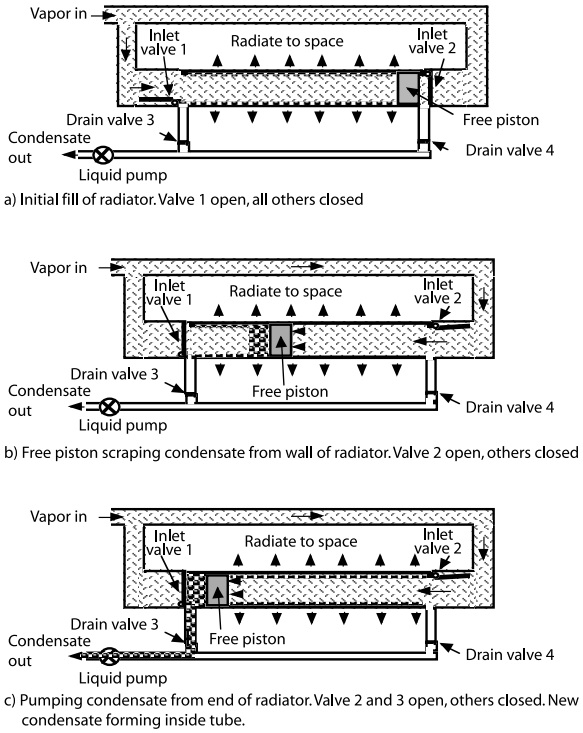

Figure 2: Sequence of operations for open-loop heat pipe with free-piston scraper

Applications

- Commercial aerospace – large power systems that will require efficient heat dissipation

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

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Vol 1, Issue 32
NP-2008-04-77-LaRC

LAR-17468