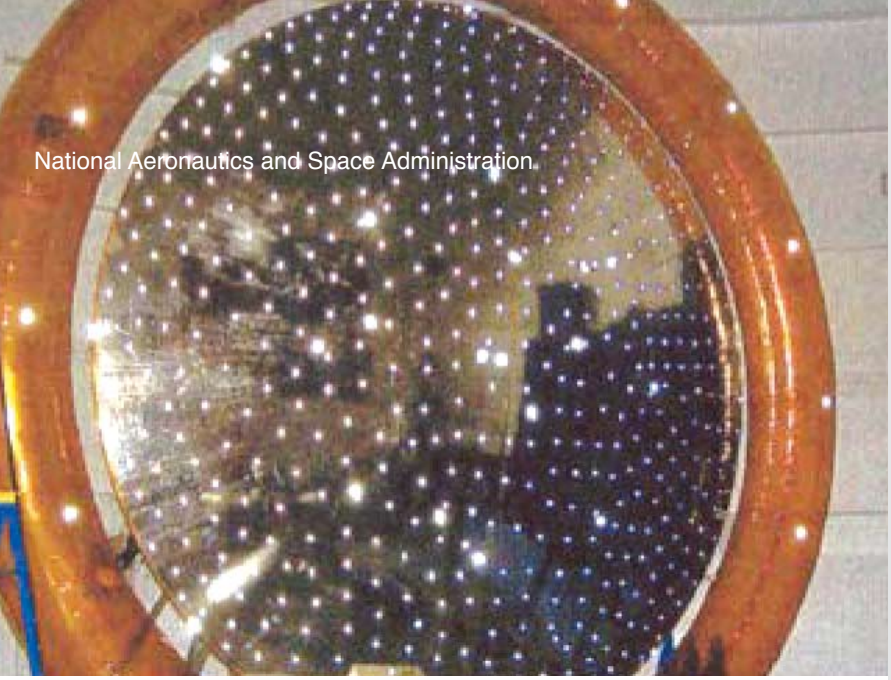

NASA Langley's
Thermally Driven Miniature Piston Actuator

A high-displacement and high-force actuator

NASA Langley has developed a new linear actuator from liquid crystalline elastomer material. The feedback-controlled flexible actuator is the first actuator that is based on a polymer that can produce high displacement and high force. The compact actuator can produce bidirectional response for hundreds of cycles. NASA Langley developed the new actuator for controlling the position of optical components. It may also serve as an alternative to solenoid or hydraulic valves for certain applications.

Benefits

- High displacement and high force in a compact actuator design
- Bidirectional response for hundreds of cycles

partnership opportunity

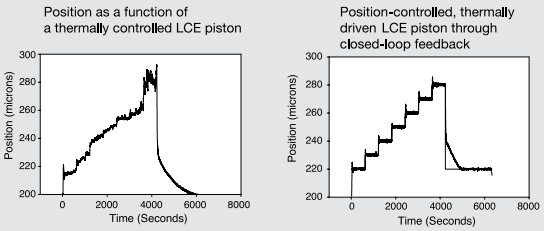

Figure 1. The two graphs show the actuator displacement in response to the corresponding heating over a one-hour time span

Applications

The technology offers wide-ranging market applications, including:

- Aerospace – actuators for optics control
- Industrial applications – control of precision optics, or certain antenna applications, but final authority
- Undersea oil production – for opening/closing valves without using hydraulic
- Shock absorbers – due to excellent damping properties
- General – alternative when solenoid valves cannot be used, such as in:
  - magnetic resonance imagers where the copper wires used in the solenoid present a problem
  - miniature actuators that need to produce large displacement (¼ inch) and force (50 lbf) rapidly

The Technology

NASA Langley has developed a miniature linear piston actuator composed of a thermally active shape-changing material as the core ingredient inside a cylinder made of a stiff hollow tube with two moveable caps/plungers on the top and bottom. A heater with a thermal sensor is attached to the outer surface of the cylinder. When the actuator is position-controlled, a position sensor such as a laser range finder is used to monitor the position of the end caps and provide the required feedback to a proportional-integral-derivative (PID) controller.

NASA has tested the valve and demonstrated position control with critical damping behavior with a viscoelastic actuator. The closed-loop feedback compensates for disturbances, such as thermal lag, creep, and environmental changes. The two graphs show the actuator displacement in response the corresponding heating over a one-hour time span.

NASA has performed initial testing and is seeking a partner to further develop and commercialize the technology. Two patent applications have been filed for the technology.

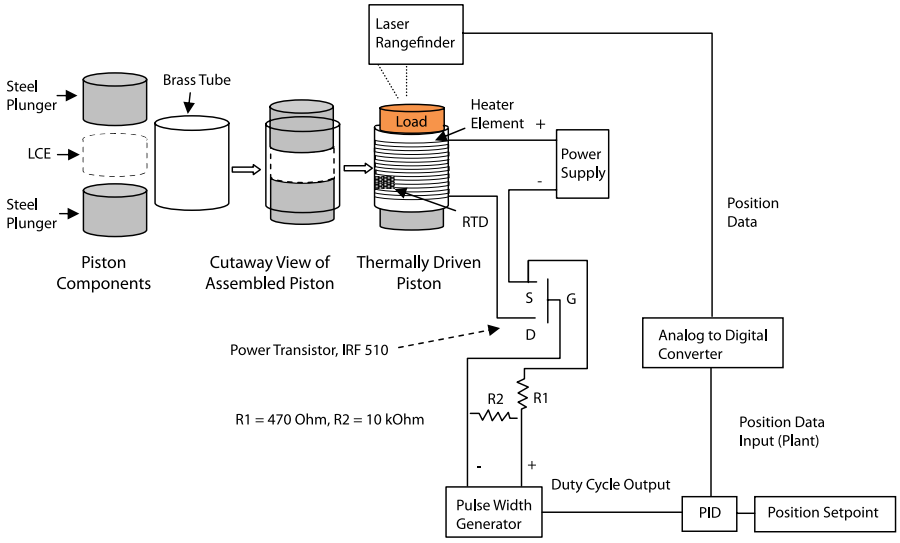

Figure 2. Schematic drawing of the piston actuator

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:

The Technology Gateway

National Aeronautics and Space Administration

Langley Research Center
Mail Stop 218
Hampton, VA 23681
757.864.1178
LARC-DL-technologygateway@mail.nasa.gov
technologygateway.nasa.gov

www.nasa.gov

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