

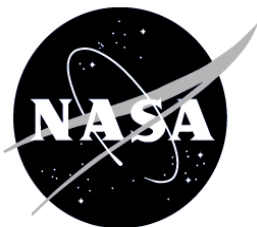
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Technical Support Package

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Quick-Response Thermal Actuator for Use as a Heat Switch

NASA Tech Briefs
NPO-46679



National Aeronautics and
Space Administration

Technical Support Package
for
QUICK-RESPONSE THERMAL ACTUATOR FOR USE AS A HEAT SWITCH

NPO-46679

NASA Tech Briefs

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Quick-Response Thermal Actuator for use as a Heat Switch

Juan Cepeda-Rizo, 10/22/08

The device uses waste heat that flows through the plunger pedestal into the heat pipe and out towards the paraffin wax to cause actuation of the plunger due to phase change of the wax from solid to liquid. For use as a heat switch on a spacecraft, multiples of these devices may be permanently attached to a radiator via the plunger, and the body attached to a rigid structure. The device will then push off the radiator, disengaging it from the spacecraft bus, during a safe mode orbital maneuver if the radiator should face the sun. The device could be mounted as a pull device as well, pulling the radiator closer to the thermal bus to increase the thermal conductance between bus and radiator.

Thermal actuators of this kind are somewhat common, except that this device uses a heat pipe as a plunger, so this is an improvement idea. Most other devices require heat transfer through the wax chamber body, not through the plunger itself. This device will have three distinct advantages over other versions: 1.) Fast actuation due to quick heat transfer from the outside into the paraffin chamber. 2.) Large stroke and stroke velocity. Heat is delivered directly to the interface with the paraffin wax, thus providing instant actuation without having to first conduct through the entire wax thickness. 3.) The heat pipe allows for mass savings as there is no need for thick metallic sections for conducting heat into the paraffin wax chamber.

Actuation stroke could be designed to be large and quick enough to be used as an energy harvesting device, converting waste heat into mechanical energy.

Some preliminary tests have been performed on a prototype and some promising data acquired.

Thermal Actuator with Heat Pipe Plunger

