the use of potential leak-inducing valve body penetrations.

One implementation of this technology is a high-pressure, high-flow-rate rupture valve that is self-rupturing, which is advantageous for high-pressure applications such as gas isolation valves. Once initiated, this technology is self-energizing and requires low force compared to current pyrotechnic-based burst disk hermetic valves.

This is a novel design for producing a single-use, self-rupturing, hermetically sealed valve for isolation of pressurized gas and/or liquids. This design can also be applied for single-use disposable valves for chemical instruments. A welded foil diaphragm is fully supported by two mated surfaces that are machined to micron accuracies using EDM. To open the valve, one of the surfaces is moved relative to the other to (a) remove the support creating an unsupported diaphragm that ruptures due to over pressure, and/or (b) produce tension in the diaphragm and rupture it.

This work was done by Curtis E. Tucker Jr. and Stewart Sherrit of Caltech for NASA's Jet Propulsion Laboratory. ***F****Further information is contained in a TSP (see page 1).* *NPO-47497*

Explosive Bolt Dual-Initiated From One Side

Lyndon B. Johnson Space Center, Houston, Texas

An explosive bolt has been developed that has a one-sided dual initiation train all the way down to the pyro charge for high reliability, while still allowing the other side of the bolt to remain in place after actuation to act as a thermal seal in an extremely high-temperature environment. This lightweight separation device separates at a single fracture plane, and has as much redundancy/reliability as possible. The initiation train comes into the explosive bolt from one side.

This work was done by Eric Snow of Lockheed Martin for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809. MSC-24843-1

Two-Stage Winch for Kites and Tethered Balloons or Blimps

Goddard Space Flight Center, Greenbelt, Maryland

A winch system provides a method for launch and recovery capabilities for kites and tethered blimps or balloons. Low power consumption is a key objective, as well as low weight for portability. This is accomplished by decoupling the tether-line storage and winding/unwinding functions, and providing tailored and efficient mechanisms for each. The components of this system include rotational power input devices such as electric motors or other apparatus, line winding/unwinding reel(s), line storage reel(s), and independent drive trains.

Power is applied to the wind/unwind reels to transport the tether line. Power is also applied to a line storage reel, from either the wind/unwind power source, the wind/unwind reel itself, or separate power source. The speeds of the two reels are synchronized, but not dependent on each other. This is accomplished via clutch mechanisms, variable transmissions, or independent motor controls. The speed of the storage reel is modulated as the effective diameter of the reel changes with line accumulation.

This work was done by Ted Miles and Geoff Bland of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). *GSC-16014-1*

Dampers for Stationary Labyrinth Seals

Spring and/or shot dampers are incorporated as integral parts of seals.

Marshall Space Flight Center, Alabama

Vibration dampers have been invented that are incorporated as components within the stationary labyrinth seal assembly. These dampers are intended to supplement other vibration-suppressing features of labyrinth seals in order to reduce the incidence of high-cycle-fatigue failures, which have been known to occur in the severe vibratory environments of jet engines and turbopumps in which labyrinth seals are typically used. A vibration damper of this type includes several leaf springs and/or a number of metallic particles (shot) all held in an annular seal cavity by a retaining ring. The leaf springs are made of a spring steel alloy chosen, in conjunction with design parameters, to maintain sufficient preload to ensure effectiveness of damping at desired operating temperatures. The cavity is vented via a small radial gap between the retaining ring and seal housing. The damping mechanism is complex. In the case of leaf springs, the mechanism is mainly friction in the slippage between the seal housing and individual dampers. In the case of a damper that contains shot, the damping mechanism includes contributions from friction between individual particles, friction between particles and cavity walls, and dissipation of kinetic energy of impact.

The basic concept of particle/shot vibration dampers has been published previously; what is new here is the use of such dampers to suppress traveling-wave vibrations in labyrinth seals. Damping effectiveness depends on many parameters, including, but not limited to, coefficient of friction, mode shape, and frequency and amplitude of vibrational modes. In tests, preloads of the order of 6 to 15 lb (2.72 to 6.8 kg) per spring damper were demonstrated to provide adequate damping levels. Effectiveness of shot damping of vibrations having amplitudes from 20 to 200 times normal terrestrial gravitational acceleration (196 to 1,960 m/s^2) and frequencies up to 12 kHz was demonstrated for shot sizes from 0.032 to 0.062 in. (0.8 to 1.6 mm) at fill levels of from 70 to 95 percent.

This work was done by Yehia El-Aini, William Mitchell, Lawrence Roberts, Stuart Montgomery, and Gary Davis of Pratt & Whitney Rocketdyne for Marshall Space Flight Center. For more information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov.

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act {42 U.S.C. 2457(f)} to Pratt & Whitney Rocketdyne. Inquiries concerning licenses for its commercial development should be addressed to

Pratt & Whitney Rocketdyne
P.O. Box 109600
West Palm Beach, FL 33410

Refer to MFS-32571-1, volume and number of this NASA Tech Briefs *issue, and the page number.*

Two-Arm Flexible Thermal Strap

This design allows for large elastic displacements in two planes and moderate elasticity in the third plane.

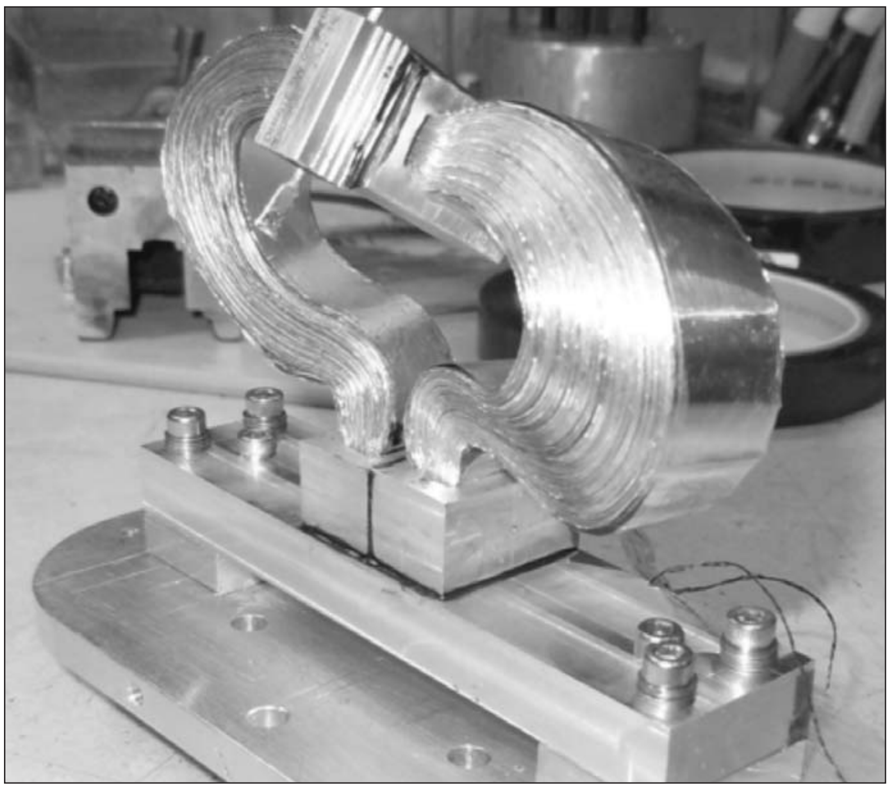
NASA's Jet Propulsion Laboratory, Pasadena, California

Airborne and space infrared cameras require highly flexible direct cooling of mechanically-sensitive focal planes. A thermal electric cooler is often used together with a thermal strap as a means to transport the thermal energy removed from the infrared detector. While effective, traditional thermal straps are only truly flexible in one direction. In this scenario, a cooling solution must be highly conductive, lightweight, able to operate within a vacuum, and highly flexible in all axes to accommodate adjustment of the focal plane while transmitting minimal force.

A two-armed thermal strap using three end pieces and a twisted section offers enhanced elastic movement, significantly beyond the motion permitted by existing thermal straps. This design innovation allows for large elastic displacements in two planes and moderate elasticity in the third plane. By contrast, a more conventional strap of the same conductance offers less flexibility and asymmetrical elasticity.

The two-arm configuration reduces the bending moment of inertia for a given conductance by creating the same cross-sectional area for thermal conduction, but with only half the thickness. This reduction in the thickness has a significant effect on the flexibility since there is a cubic relationship between the thickness and the rigidity or bending moment of inertia.

The novelty of the technology lies in the mechanical design and manufacturing of the thermal strap. The enhanced flexibility will facilitate cooling of mechanically sensitive components (example: optical focal planes).



Two-Arm Flexible Thermal Strap

This development is a significant contribution to the thermal cooling of optics. It is known to be especially important in the thermal control of optical focal planes due to their highly sensitive alignment requirements and mechanical sensitivity; however, many other applications exist including the cooling of gimbal-mounted components.

This work was done by Eugenio Urquiza, Cristal Vasquez, Jose I. Rodriguez, Robert S. Leland, and Byron E. Van Gorp of NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-47744