



## Low-Dead-Volume Inlet for Vacuum Chamber

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Gas introduction from near-ambient pressures to high vacuum traditionally is accomplished either by multi-stage differential pumping that allows for very rapid response, or by a capillary method that allows for a simple, single-stage introduction, but which often has a delayed response. Another means to introduce the gas sample is to use the multi-stage design with only a single

stage. This is accomplished by using a very small conductance limit. The problem with this method is that a small conductance limit will amplify issues associated with dead-volume.

As a result, a high-vacuum gas inlet was developed with low dead-volume, allowing the use of a very low conductance limit interface. Gas flows through the ConFlat flange at a relatively high flow

rate at orders of magnitude greater than through the conductance limit. The small flow goes through a conductance limit that is a double-sided ConFlat.

*This work was done by Guy Naylor and C. Arkin of ASRC Aerospace Corporation for Kennedy Space Center. For further information, contact the Kennedy Innovative Partnerships Program Office at (321) 861-7158. KSC-13317*

## Thermal Control Method for High-Current Wire Bundles by Injecting a Thermally Conductive Filler

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A procedure was developed to inject thermal filler material (a paste-like substance) inside the power wire bundle coming from solar arrays. This substance fills in voids between wires, which enhances the heat path and reduces wire temperature. This leads to a reduced amount of heat generated. This technique is especially helpful for current and future generation high-power spacecraft (1 kW or more), because the heat generated by the power wires is significant enough to cause unacceptable overheating to critical components that are in close contact with the bundle.

Powered test results in thermal vacuum showed a significant decrease in

temperature with filler of  $\approx 50$  °C. Without filler, the bulk wire temperature was around 100 °C, whereas with filler, it was around 50 °C. The heat generated by the bundle was reduced by  $\approx 15$  percent. The procedure generated the development of an injection manifold for simultaneous injection around the perimeter of the bundle, which is unique. This manifold ensures a consistent and thorough fill of gaps between wires.

The unique or novel features are twofold. This is the first instance where thermal filler material was used to fill in voids in between wires to enhance thermal path, and reduce wire temperatures and heat generated. The injection man-

ifold designed for the procedure is also unique. A thermal test was performed in order to evaluate the advantages of the use of this procedure. In the test with 2.5 A running through the wires, an approximately 50 °C temperature reduction was measured after the filler injection procedure. Heat conduction path improved by up to a factor of 11, and waste heat generated was reduced by 15 percent.

*This work was done by Juan Rodriguez-Ruiz, Russell Rowles, and Greg Greer of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15987-1*

## Method for Selective Cleaning of Mold Release From Composite Honeycomb Surfaces

**A simple, EPA-friendly approach solves a long-standing problem in heat-formed composite manufacturing.**

*Goddard Space Flight Center, Greenbelt, Maryland*

Honeycomb structures are commonly employed as load- and force-bearing structures as they are structurally strong and lightweight. These structures include many aircraft and spacecraft surfaces, including aircraft wings and fuselages, spacecraft pressure vessels, and heat-shield materials.

Many other processes in other areas of transportation and defense, as well as the pharmaceutical and construction industries, employ pressure vessels with similar heat-formed composite structures.

Manufacturing processes for heat-molded composite honeycomb structures

commence with the placement of pre-impregnated composite layups over metal mandrels. To prevent permanent bonding between the composite layup and the metal mandrels, an agent, known as a mold release agent, is used. Mold release agents allow the molded composite mate-