



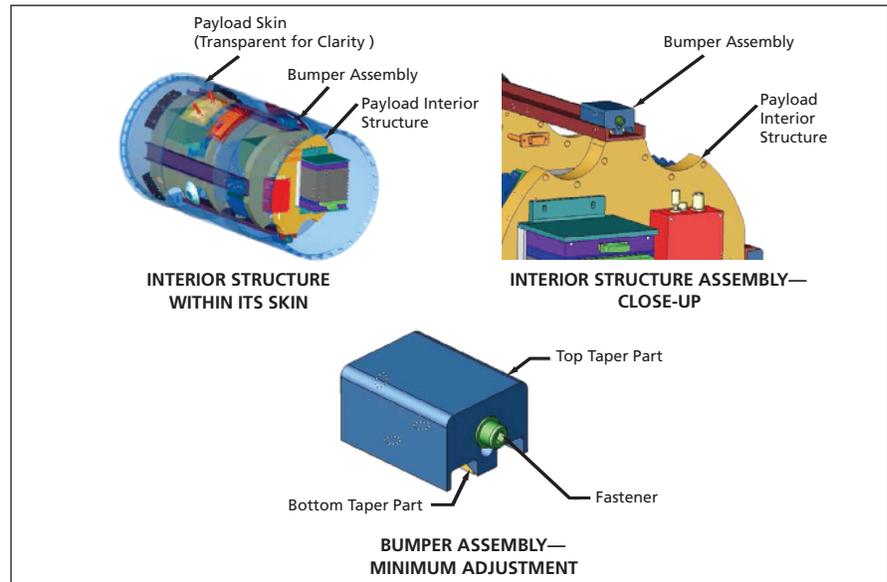
Retaining Device for the Interior Structure of a Spacecraft Payload

Device protects without penalizing interior space.

Goddard Space Flight Center, Greenbelt, Maryland

A device denoted as a bumper assembly for a spacecraft payload container comprises an interior structure surrounded by skin or some other protective enclosure (see figure). When arranged with three or more like assemblies, this bumper assembly is designed to secure the interior structure within a payload's protective enclosure during the stresses endured in flight and, if required, recovery of the payload. Furthermore, proper use of this innovation facilitates the ability of designers and engineers to maximize the total placement area for components, thus increasing utilization of very valuable and limited space.

Typically, the interior structure includes substantially circular decks nominally orthogonal to and centered on the cylindrical axis with the decks connected by axial columns. At one end of the cylinder, the interior structure is attached to the skin by use of fasteners. At other locations, the column portions of the interior structure are connected to the cylindrical skin via four bumper assemblies. The bumper assemblies provide lateral, (that is, radial and circumferential) support while allowing sliding parallel to the cylindrical axis to accommodate axial expansion and contraction. The shape of the interior structure can be varied from the stated "typical" one. The attachment of the end of any interior structure to a protective enclosure, while placing the bumper assemblies in a radial symmetric pattern on the structure's other end,



The **Bumper Assembly** for a spacecraft payload container protects the interior of the payload container, as shown in different magnified views.

would allow similar support during the process of positioning and securing the bumper assemblies.

Each bumper assembly includes two mating wedges held together by a bolt. The bolt is inserted through a clearance hole in one wedge to engage a threaded hole in the other wedge. The positioning and securing of the interior structure can be adjusted by turning the bolt to slide the wedges along their mating sloped surfaces. This arrangement of the interior structure is accomplished

from the structure's outside area and does not require access holes or surfaces machined within its protective enclosure to achieve that accessibility. This accessibility minimizes the time needed to finish the securing of the interior structure within a payload's protective enclosure.

This work was done by Orville N. Fleming, Jr., of Northrop Grumman Corp. for Goddard Space Flight Center. Further information is contained in a TSP (see page 1).

Tool for Torquing Circular Electrical-Connector Collars

A simple tool exerts a strong grip.

Goddard Space Flight Center, Greenbelt, Maryland

An improved tool has been devised for applying torque to lock and unlock knurled collars on circular electrical connectors. The tool was originally designed for, and used by, astronauts working in outer space on the Hubble Space Telescope (HST). The tool is readily adapt-

able to terrestrial use in installing and removing the same or similar circular electrical connectors as well as a wide variety of other cylindrical objects, the tightening and loosening of which entail considerable amounts of torque.

Other tools developed previously for

mating or de-mating electrical connector collars were either designed for use on specific connectors or too generic and incapable of applying the requisite amount of torque [40 lb-in. (4.52 N-m)] for the HST application. In contrast, the present improved tool can be used on a

variety of connector sizes and is capable of applying the requisite amount of torque. Indeed, only a moderate amount of hand clasping force [25 lb (≈ 111 N)] is necessary for applying double the requisite amount of torque.

The tool consists of two stainless steel arms that pivot about a common point. Attached to the gripping jaws on the arms are a total of four flat pads, made of commercially available rubberlike epoxy. The pads make tangential contact with the circular connector collar. Under the gripping force, the pads deform into greater conformity with the gripped ob-

ject and are thereby capable of exerting a greater tangential frictional force. Hence, this jaw-and-pad combination enables the tool to fit circular connectors of different diameters and to exert greater torque than could otherwise be applied. A simple spring-lever resists the user's hand-grasping force with just enough force to return the gripping jaws to the wide-open position.

Although deformation of the pads in repeated use of the tool degrades performance, the amount of degradation may be acceptable in some applications and was acceptable in the original HST

application. In that application, the tool performed as required when used to loosen, then later to tighten, 36 connectors in an operation to remove and replace a power-control unit. Theoretically, the tool could be used to perform the operation a total of five times.

*This work was done by Kathryn Gaulke and Russel Werneth of **Goddard Space Flight Center**, John Grunsfeld of Johnson Space Center, and Patrick O'Neill and Russ Snyder of Swales Aerospace. Further information is contained in a TSP (see page 1). GSC-14670-1*