NASA TECH BRIEF

Lewis Research Center

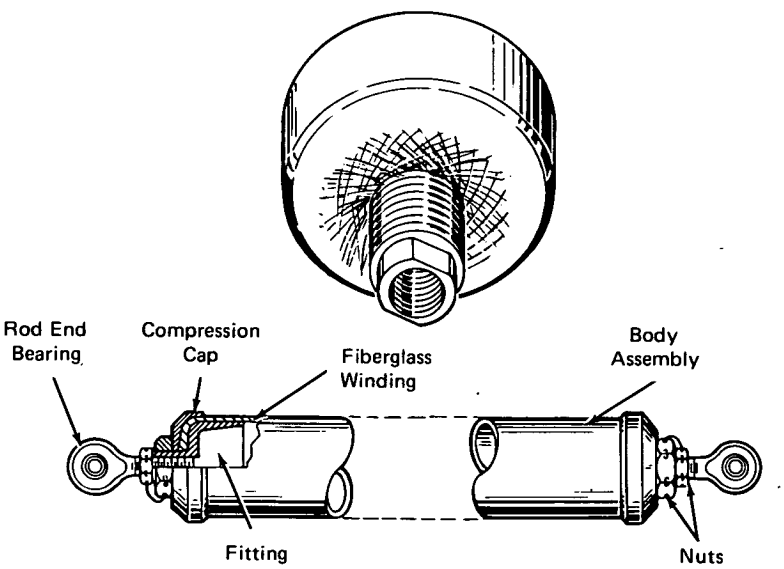
Improved Fiberglass-to-Metal Joint Produces Lighter Stronger Fiberglass Strut

A highly efficient joint has been devised for attaching metal end fittings to tubular fiberglass struts. Axial tension and compression loads are transmitted between the fiberglass tube and the end fittings without depending on glass-to-metal bonding, conventional fasteners such as rivets, bolts, etc., or a combination of these connections. Conventional joints are inefficient, add substantial weight, and detract significantly from the high-strength potential of tubular fiberglass structures compared to equivalent metal structures.

Use of this new joint design significantly reduces both the structural weight of the strut and its cross-sectional area. Reduction in cross-sectional area also results in a reduction in axial heat conduction. This new design, developed for cryogenic tank support members, can be applied to any axial tubular fiberglass structure where a high strength-to-weight ratio and/or low axial heat conduction are desired.

In this design (see figure), the end fittings are attached during fabrication of the tubular section in a single operation. The fittings are mounted on a salt mandrel. Fiberglass filaments are continuously wound under tension around the mandrel and over the skirts of the fittings, and imbedded in a conventional resin system making an integral structure. Metal compression caps are mechanically attached to the end fittings, and the entire assembly is cured. After being cured, the salt mandrel is dissolved and washed out.

With this new design, axial tension loads are transferred between the end fittings by the fiberglass filaments which bear on the internal spherical surfaces of the end fittings. The load path is direct in that the fibers in tension are continuous around the end fittings and load transfer does not depend on shear through the bond line between the glass and the metal. Similarly, axial compression loads are transferred by the fiberglass structure which bears on the internal surface of the metallic compression caps. This load path is also direct and does not depend on lap-shear load transfer. This new design shows high structural efficiency compared to conventional structural fasteners applied to fiberglass composites.



(continued overleaf)

Notes:

1. The following documentaion may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   Reference: NASA CR-72538 (N69-25232), Cryogenic Tank Support Evaluation – Interim Report
2. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B73-10258

Patent status:

NASA has decided not to apply for a patent.

Source: J. R. Barber
Lewis Research Center and
H. E. Johnson and K. T. Eugene of
Lockheed Missiles & Space Co.
under contract to
Lewis Research Center
(LEW-11661)