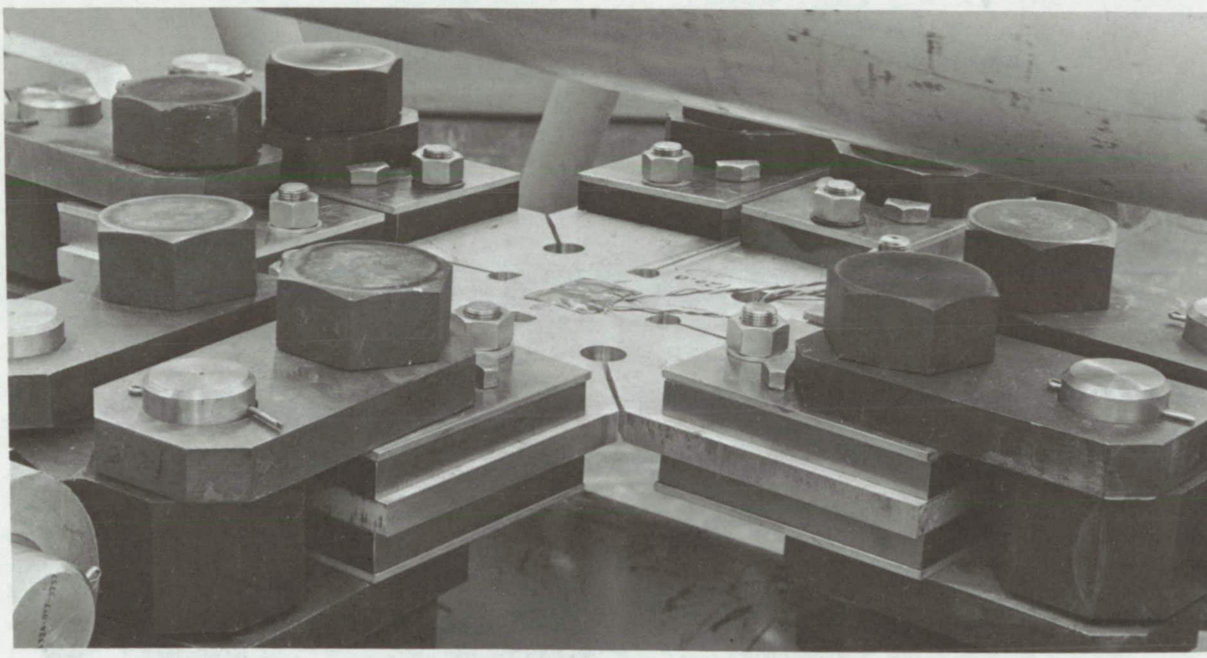
April 1968 Brief 68-10070

NASA TECH BRIEF

Development of Biaxial Test Fixture Includes Cryogenic Application



A test fixture has been developed with the capability of producing biaxial stress fields in test specimens to the point of failure. This fixture offers the advantage of determining a biaxial stress by dividing the applied load by the net cross section. With relatively minor modification, the test fixture can be used to evaluate materials, design concepts, and production hardware in a biaxial stress field at cryogenic temperatures.

With recent development of large pressurized tanks, a need has existed for an inexpensive method of testing critical tank areas to failure. In all pressurized tanks there are small areas of discontinuity that require structural certification. Since no facility existed with the capability of testing these small areas, a complete tank had to be built. Testing a complete tank is unsatisfactory because the exact location of rupture is often difficult to pinpoint and the design reserve of undamaged critical areas cannot be established. Numerous attempts to produce the stress fields experienced in a pressurized tank have met with limited success but were confined to very small test specimens.

A new biaxial test facility is capable of producing pressure vessel stress fields in panels 2 ft by 2 ft. The test panel is machined on both sides to form a frame

(continued overleaf)

around the test area. Clamp-type grips are used to transfer load into the corners of the test panel through bolts loaded at the centroid of area. Load is applied by 50-kip hydraulic actuators attached to the grips and to load plates on the ends of the fixture. Load transmitted to the test panel is controlled by calibrated load rods between the hydraulic actuators and the fixture frame. Since the load can be controlled to apply a uniform stress to the test panel, failure load can be determined simply by dividing the total applied load at failure by the net cross section of the panel.

For cryogenic application, a metal tub is fabricated beneath the test panel and filled with a liquid cryogen. Cryogenic liquid is also sprayed on the test panel and loading grips from perforated tubing. A plastic thermal barrier is secured above the metal tub to control splash and air currents.

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Marshall Space Flight Center
Huntsville, Alabama 35812
Reference: B68-10070

Patent status:

No patent action is contemplated by NASA.

Source: J. C. Helf, R. E. Kelly, D. A. Kerr, and C. R. Waldron of North American Aviation, Inc. under contract to Marshall Space Flight Center

(MFS-14185, 14189)