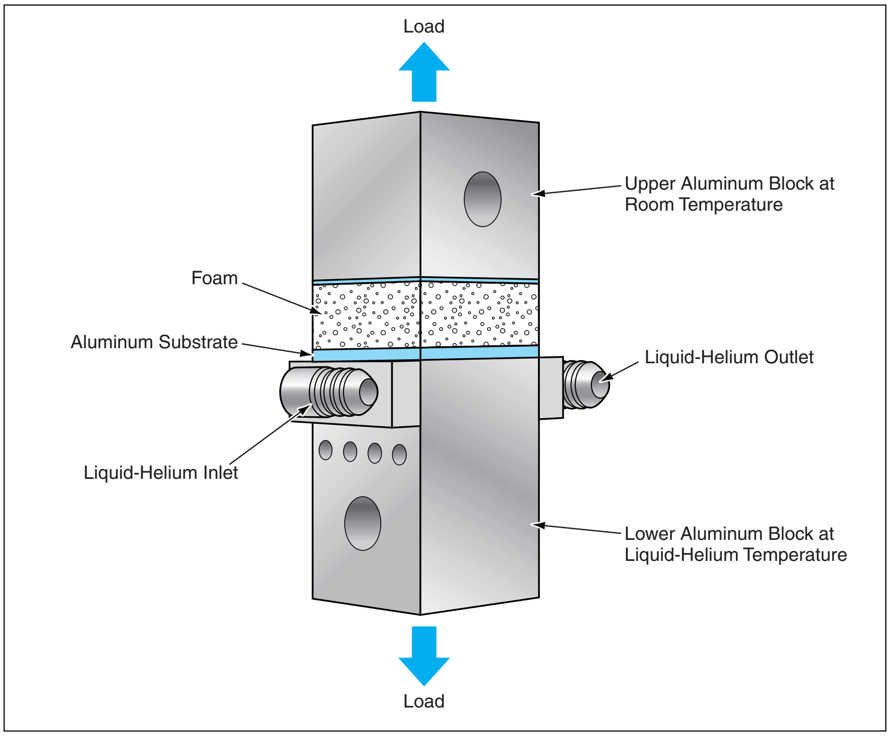
Cryogenic Temperature-Gradient Foam/Substrate Tensile Tester

Tensile strengths are measured under more nearly realistic conditions.

Marshall Space Flight Center, Alabama

The figure shows a fixture for measuring the tensile strength of the bond between an aluminum substrate and a thermally insulating polymeric foam. The specimen is meant to be representative of insulating foam on an aluminum tank that holds a cryogenic liquid. Prior to the development of this fixture, tensile tests of this type were performed on foam/substrate specimens immersed in cryogenic fluids. Because the specimens were cooled to cryogenic temperatures throughout their thicknesses, they tended to become brittle and to fracture at loads below true bond tensile strengths.

The present fixture is equipped to provide a thermal gradient from cryogenic temperature at the foam/substrate interface to room temperature on the opposite foam surface. The fixture includes an upper aluminum block at room temperature and a lower aluminum block cooled to −423 °F (≈−253 °C) by use of liquid helium. In preparation for a test, the metal outer surface (the lower surface) of a foam/substrate specimen is bonded to the lower block and the foam outer surface (the upper surface) of the specimen is bonded to the upper block.



This **Test Fixture** applied both a tensile load and a through-the-thickness temperature gradient to the foam/substrate specimen.

In comparison with the through-the-thickness cooling of immersion testing, the cryogenic-to-room-temperature thermal gradient that exists during testing on this fixture is a more realistic approximation of the operational thermal condition of sprayed insulating foam on a tank of cryogenic liquid. Hence, tensile tests performed on this fixture provide more accurate indications of operational bond tensile strengths. In addition, the introduction of the present fixture reduces the cost of testing by reducing the amount of cryogenic liquid consumed and the time needed to cool a specimen.

This work was done by Christophe Vailhe of Lockheed Martin for **Marshall Space Flight Center**. *Further information is contained in a TSP* *(see page 1).*

MFS-31672

Flight Test of an Intelligent Flight-Control System

A neural network helps to optimize handling qualities.

Dryden Flight Research Center, Edwards, California

The F-15 Advanced Controls Technology for Integrated Vehicles (ACTIVE) airplane (see figure) was the test bed for a flight test of an intelligent flight control system (IFCS). This IFCS utilizes a neural network to determine critical stability and control derivatives for a control law, the real-time gains of which are computed by an algorithm that solves the Riccati equation. These derivatives are also used to identify the parameters of a dynamic model of the airplane. The model is used in a model-following portion of the control law, in order to provide specific vehicle handling characteristics. The flight test of the IFCS marks the initiation of the Intelligent Flight Control System Advanced Concept Program (IFCS ACP), which is a collaboration between NASA and Boeing Phantom Works.