Full-Scale Curved-Panel Test System Building 211

Completed in 1998, the Full-Scale Curved-Panel Test System, Building 211, located in the Safety Research and Development area at the FAA William J. Hughes Technical Center, is capable of testing full-scale curved-panel specimens under conditions representative of those seen by an aircraft in actual operation.

The data obtained from the tests will be used to validate analytical models being developed by the FAA. All testing is monitored using state-of-the-art video equipment for continuous observation. The test system was developed under contract with the Boeing Company, Long Beach, CA, and features a unique adaptation of mechanical, fluid, and electronic components, which will be capable of applying pressurization, longitudinal, hoop, and shear loads to a curved-panel test specimen.

The internal pressure will be applied using water as media, eliminating the possibility of a catastrophic accident. The system is capable of dynamically cycling the internal pressure as well as performing a static pressurization to levels above flight gradients.

The hoop and longitudinal stresses are simulated by the controlled application of distributed loads around the perimeter of the test panel. Hoop forces are distributed by individual loading linkages using a two-tier coaxial whiffle tree assembly, which generates four equal forces from each controlled load point. A total of seven load points are used on each side of the specimen, creating a total of 28 attachment points. Longitudinal forces are created using similar loading devices on each end of the panel, consisting of four load control points and 16 attachment points. Similar devices are available to apply bending and tension loads at each end of a frame.

An innovative shear loading system was developed that uses two load distribution points in the longitudinal direction at the edges of the specimen. The force is applied as a couple and is reacted by a couple in the hoop direction. A unique feature of the shear loading system is the elastomeric coupling between the loading mechanisms and the test specimen. The elastomer, which has soft shear modules, creates a close approximation to uniform shear distribution in both the applied and reacted couples.

R&D Facilities

All forces are generated using water as the fluid medium. The external loads are generated by applying water pressure to bladder type actuators, which are controlled by pressure activated dome valves. The dome valves are automatically controlled by the use of pneumatic control valves. The valves are driven by a computer control system in a closed-loop configuration. A graphical interface allows the operator to control the loads, speed, and type of test desired. Data acquisition from strain transducers, load transducers, pressure transducers, etc., will be displayed on color monitors in real time, as well as stored for off-line analysis. A unique video data acquisition capability is also a part of the system. A remote video system will be integrated with the test rig to track and record crack propagation and measure crack opening during the testing of the curved panels. The video system will automatically track and record the crack growth and has a very high zoom range to be able to cover the entire test panel and to be able to zoom to the narrow field of view required to observe the crack tip behavior.

To find out more about the Full-Scale Curved-Panel Test System, contact:

Airport and Aircraft Safety Research
and Development Division
Airworthiness Assurance Research
and Development Branch
Airframe Structures Section, AAR-431

Federal Aviation Administration
William J. Hughes Technical Center
Atlantic City International Airport, NJ 08405
Phone: (609) 485-4784
Fax: (609) 485-4569