FAA William J. Hughes Technical Center

Airflow Induction Test Facility, Building 204

R&D Facilities

The Airflow Induction Test Facility creates a large range of in-flight conditions relevant to aircraft fire safety as well as other aircraft and airport safety issues. The facility contains a 5 1/2-foot-diameter subsonic wind tunnel; a low-turbulence, low-speed wind tunnel; an environmental chamber; and a high-pressure vessel.

The 5 1/2-foot-diameter wind tunnel is an induction type nonreturn design. The induction drive is provided by two Pratt & Whitney J-57 turbine engines exhausting into the diffuser cone. The high-speed exhaust from the two engines provides the primary flow that induces a secondary flow through the test section(s). The nonreturn design provides the facility with a continuous supply of fresh air, which is essential for combustion type work. This design is very rugged and unaffected by debris passing through the drive section. Tunnels of this design simulate an increase in altitude as the airspeed is increased. The tunnel contains two test sections:

1. High-Speed Test Section. The test section is 5 1/2 feet in diameter and 16 feet in length. Maximum airspeed in this section is limited to approximately Mach 0.9. The entire lower lobe of the section swings away to allow for the installation of the test article. A 5- by 16-foot elevator deck makes raising the test article into position simple and safe.

2. Low-Speed Test Section. This test section is 9 feet in diameter and 20 feet in length and is located upstream of the high-speed section and operates at a lower speed. Maximum airspeed in this section is limited to approximately 150 miles per hour.

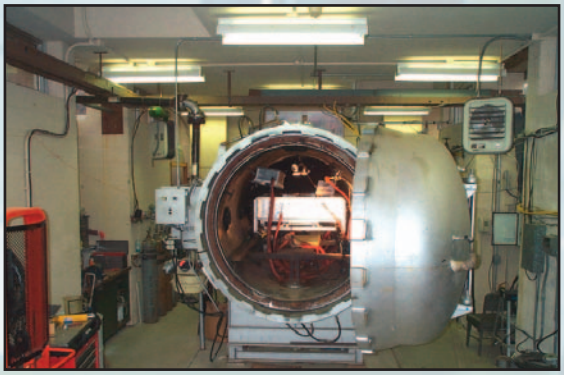
The 5 1/2-foot wind tunnel has been used for a variety of research applications. It has been used in aircraft fire safety studies when airspeed is a factor, such as during in-flight smoke venting and extinguisher agent dissipation in general aviation aircraft. Currently, soft-ground arrestor systems and artificial turf are being tested to determine the design requirements needed to withstand turbine engine jet blasts.

Low-Turbulence, Low-Speed Wind Tunnel

The low-turbulence, low-speed wind tunnel was originally designed to provide an environment to calibrate wind speed instruments. The highly accurate airspeed measurement capability, in conjunction with the six-component force balance system, makes this facility ideal for instrument calibration and model testing. The low-turbulence, low-speed wind tunnel consists of an Aerolab low-speed, open-circuit type wind tunnel and a force balance. The dimensions of the test section are 20 x 28 x 48 inches. The electrically driven wind tunnel can achieve speeds ranging from 0 to 160 mph in the test section. The six-component force balance system can accurately measure lift, yaw, pitch, drag, side force, and rolling moment. The low-speed wind tunnel has been used to accurately calibrate airflow and velocity devices and is now configured for model testing.

Environmental Test Chamber

The environmental test chamber is designed to simulate preset temperature, humidity, and air pressure (altitude) conditions. Chamber controllers can be programmed to simulate an entire flight from takeoff to climb-out, cruise, approach, and landing. The test chamber measures 72 x 71 x 93 inches. In the past, the environmental chamber has been used to study the behavior of in-flight fires at reduced pressures corresponding to various altitudes, to evaluate the performance of wing ice detectors, and to calibrate various environmental sensors. More recently, it was used to develop flightworthy instrumentation for measuring oxygen concentrations in center wing fuel tanks during flight tests on a fuel tank inerting system developed by the Federal Aviation Administration. Three flight test programs were conducted with Boeing, Airbus, and NASA. Currently, the chamber is being used to measure fuel tank vapor concentrations at subatmospheric conditions for comparison with model predictions. In addition, a scale model of a center wing fuel tank is being tested to support fuel tank inerting research.



High-Pressure Vessel

The high-pressure vessel is a 5-foot-diameter, 19-foot-long cylinder that is designed to continually operate at pressures as high as 600 psi. It is housed in a bunker-like facility originally intended for pressure-modeling flammability studies. The pressure vessel was transformed into an enclosure to contain and study aircraft-related explosions. In this application, the pressure vessel has been used to develop an exploding aerosol can simulator for use in the evaluation of halon replacement agents and to examine the impact of fuel vapor explosions on fuel quantity-indicating system compensators in support of the National Transportation Safety Board investigation of the TWA flight 800 accident. Currently, the pressure vessel is being used to determine the degree of fuel vapor explosion prevention as a function of oxygen concentration (inerting) over a wide range of ignition energies and at different altitudes (reduced vessel pressure).

To find out more about the Airflow Induction Test Facility, contact:

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