NASA Facts

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Integrated Test Facility

The Integrated Test Facility (ITF) at NASA's Dryden Flight Research Center, Edwards, Calif., provides the capabilities to thoroughly ground test advanced, highly integrated research aircraft.

The 120,000 (11,148.36 sq m) square foot multi-story ITF was officially opened Oct. 24, 1992.

Built to accommodate a mix of commercial and fighter-size aircraft at one time, the ITF is significantly reducing aircraft systems checkout time and costs. It allows researchers and technicians to safely integrate and test aircraft systems such as flight controls, avionics, electrical, and other related systems simultaneously before each research flight. Until the ITF was developed, pre-flight checks were carried out independently and most often at several different locations.

The ITF capability greatly enhances flight test confidence by giving researchers and engineers the ability to qualify interactive aircraft systems in a controlled environment. Each system within the aircraft can be regulated and monitored in real time as it interacts with the other aircraft systems.

The Building

The ITF contains six test bays in three separate areas. Test bays 1, 2 and 3 are behind a single door that is 50 feet (15.24 m) high and spans 225 feet (68.58 m) -- large enough for a single transport-size aircraft to be placed in the multiple-bay area. On the opposite side of the structure, test bays 4 and 5 have a common door 40 feet (12.19 m) high and 125 feet (38.1 m) wide, while the door to test bay 6 is 40 feet high and 100 (30.48 m) feet wide. A full-height wall separates test bays 5 and 6.

In the central section of the ITF, separating the two sets of test bays, are the test systems used to carry out the automated test and integration functions. Each test bay is linked to a second floor control room overlooking that area.

Aircraft services, including electrical and hydraulic power, and cooling air are available in the test bays to support routine maintenance and other support requirements during systems integration and functional checks. All aircraft functions can be carried out in the ITF, as if in flight, except engine runs.

A two-story section adjoining the central section and test bays contain offices for project management, engineering, and administrative personnel.

Design and construction cost of the ITF was $22.5 million.

ITF Functions

Key to ground test operations in the ITF is the ability to perform real-time simulation with the actual flight vehicle, “fooling” the vehicle into thinking it’s flying.

Testing in the ITF is carried out through automated techniques in which each aircraft is interfaced to a high fidelity real-time simulation. The process is controlled by an engineering work station that establishes initial conditions for the test, initiates the test run, monitors its progress, and records and stores data generated. The workstation also analyzes results of individual tests, compares results of multiple tests, and produces reports.

Computers used in the automated aircraft testing process are also capable of operating in a stand-alone mode with a simulation cockpit, complete with its own instruments and controls. Development and modification of control laws, qualification of aerodynamic, propulsion, and guidance models, and flight planning -- functions traditionally associated with real-time simulation -- can also be carried out in this manner.

Workstations provide test engineers with computer-aided test tools, minimizing the time required to qualify new flight software.

The ITF is data-linked to the Dryden mission control rooms and other facilities. This gives researchers and engineers a real-time comparison of flight and simulation results and to allow immediate clearance of flight test points. This same capability also provides realistic training for mission controllers.

Simulation

Simulation systems in the ITF support many configurations for each project, with varying levels of aircraft hardware included.

Simulations are used for a wide variety of test purposes such as determining time histories and frequency responses, and conducting redundancy management tests, failure modes and effects tests, and pilot evaluations. Simulations also support pilot training, flight test planning, and report writing.

Current simulations include the following aircraft: F-18, SR-71, F-15, F-16XL, CV-990, X-31, X-29, and the National Aerospace Plane (NASP).

Ground Vibration Tests

Ground vibration test systems, formerly located in the Dryden Thermostructures Research Laboratory, are now in the ITF. As research aircraft are prepared for certain flight programs, it’s necessary to measure and test structural frequencies. This insures structural integrity and safety through all phases of flight research.

Support Staff

The ITF is staffed by an experienced team of 210 technicians and engineers with backgrounds in all phases of flight simulation, flight control verification and validation, control theory, aircraft structures, electromechanical hardware design and fabrication, and remotely augmented aircraft operations.

The facility is the only one of its kind in the United States. It is considered a national aerospace research asset that is available for use, under specific agreements, by other government agencies and U.S. aerospace companies.

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