

NASA Facts

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FS-2003-10-007 DFRC

Walter C. Williams Research Aircraft Integration Facility

NASA Dryden's Research Aircraft Integration Facility was officially opened under the name of Integrated Test Facility (ITF) on October 24, 1992. It was renamed the Walter C. Williams Research Aircraft Integration Facility (RAIF) on November 17, 1995. Williams was the first director of what later became the NASA Dryden Flight Research Center located on Edwards Air Force Base, Calif. The test facility allows researchers and technicians to integrate and test aircraft systems such as flight controls, avionics, electrical systems, and other related systems simultaneously before each flight. Flight test confidence is greatly enhanced by qualifying inter-active aircraft systems in a controlled environment. In the RAIF, each element of a flight vehicle can be regulated and monitored in real time as it interacts with the other aircraft systems. Until the ITF was developed, pre-flight checks were carried out independently and often at several locations.



The Building

The RAIF was built to accommodate a mix of commercial and fighter aircraft at one time. The RAIF significantly reduces aircraft systems checkout time and costs.

The RAIF is a 120,000 square-foot, multi-story building. It contains six test bays in three separate areas. Test bays one, two, and three are located behind a single door that is 50 feet high and spans 225 feet. The combined size of these test bays is 225 feet wide by 135 feet deep, 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 four and five have a common



door that is 40 feet high and 126 feet wide. Test bays four and five together are 125 feet wide by 99 feet deep. The door to test bay six is 40 feet high and 100 feet wide. Test bay six is 97 feet wide by 99 feet deep. A full-height wall separates test bays five and six.

Located in the central section of the RAIF 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 systems, a central hydraulic system for each side of the building, and central cooling air are required during systems integration and functional checks. With the exception of engine runs all inflight aircraft functions that simulate real flight can be carried out in the RAIF.

The front two-story section of the building contains offices for project management, engineering and administrative personnel.

Design and construction cost of the RAIF was \$22.5 million.

RAIF Functions

Key to ground test operations in the RAIF is the ability to perform real-time simulation with the actual flight vehicle, "fooling" the vehicle into thinking it is flying.

Testing in the RAIF 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 workstation 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 also are 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 also can 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 RAIF is data-linked to Dryden's mission control rooms and other facilities. This gives researchers and engineers real-time comparisons of flight and simulation results and allows for immediate clearance of flight test points. This same capability also provides realistic training for mission controllers.





Simulation

Simulation systems in the RAIF support many configurations for each project, with varying levels of aircraft hardware included. Simulations are used for a variety of research purposes such as determining time histories, frequency responses, conducting redundancy management tests, failure modes and effects tests, and pilot evaluations. Simulations also support pilot training, flight-research mission planning and report writing.

Ground Vibration Test

Ground vibration test (GVT) systems, formerly located in the Dryden Flight Loads Laboratory (FLL), are now in the RAIF. As research aircraft are prepared for certain flight programs, it is necessary to measure and test their strength to withstand vibrations. This ensures structural integrity and safety through all phases of flight research.

Support Staff

The RAIF is staffed by an experienced research team of 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.