



An office in the sky

Commercial Airplanes flight test engineers are hard at work up in the air

By Kathrine Beck

Commercial Airplanes flight test engineers work in the sky. For every new model or modified production airplane, tens of thousands of individual tests make sure that the airplane performs as designed and meets customer requirements. The tests also document compliance with the requirements of the U.S. Federal Aviation Administration and other regulatory agencies around the world.

Many of these tests are conducted in flight. Commercial Airplanes flight test engineers are in the airplane, hard at work when the tests are performed.

Flight test engineers collect and analyze data on all aspects of the airplane, from the engines to the entertainment system. Generally, six to 12 flight test engineers work on board, although there can be many more, depending on what's being tested.

Within Flight Test Engineering, the Flight Test Analysis group works closely with airplane programs on modified airplanes and the first airplanes of new products such as the 777 Freighter and the 787 Dreamliner. Flight Test Analysis designs the tests to get

the data that program engineers need to answer the question, "Did it perform as planned?"

Although some data comes from equipment already built into the airplane, much of the data is collected from electronic sensors, which can be smaller than a paperclip. Thousands of sensors can be attached to points all over the airplane with tape, adhesives or fasteners, and are marked with red paper tags. The sensors measure pressure, temperature, strain and position; these measurements are used to calculate parameters such as flight loads and airplane performance, which ultimately are used to validate performance for certification.

Another group of flight test engineers, Flight Test Instrumentation, is responsible for placing the sensors and other test equipment onto the airplane. These engineers design the installation, choose the sensors, work to develop the software package that will capture and record the information, and maintain all test equipment.

Each airplane is completely reconfigured for the testing phase, with test equipment, racks and seating for the engineers. In ad-

dition, safety equipment unique to that test flight is added for the test engineers. A secure rope railing, similar to those used in lobbies, is installed to guide the engineers in the dark should the interior lighting fail.

During the tests, miles of bright orange insulated wire send data from the sensors to computer screens on the airplane. That orange wire has to be snaked through the entire airplane from everywhere sensors are placed—inside and outside, including the landing gear.

Flight test engineers sit behind these screens, watching the numbers roll, making sure that data is captured properly and analyzing it in real time. Test data is collected, stored and later crunched by ground-based software to create paper reports and electronic files that go to airplane programs, customers and regulatory agencies.

After the flight test phase, red-tagged sensors and orange wiring are removed, along with the racks, safety equipment and other items. The airplane is then returned to the configuration the customer ordered.

The interior of one of these flying test labs looks like a computer classroom, except that it can cruise around the Puget Sound region at 30,000 feet (9,144 meters) and perform extreme maneuvers in harsh conditions anywhere in the world.

“The demands of the job are high sometimes, but this job gives you experience you can’t get anywhere else.”

—Mark Litke, test director, Flight Test Operations

Boeing airplanes are tested in all kinds of environments. Yuma, Ariz., can provide good hot-day data with ramp conditions at 100 degrees Fahrenheit (38 degrees Celsius). Performance at high-altitude airports is tested at mile-high Colorado Springs, Colo., or Lima, Peru. Iceland’s Keflavik International Airport has excellent runways and weather for cross-wind testing, and Juneau, Alaska, and China’s Linzhi Airport, in a mountainous Tibetan valley, offer ideal places to test difficult approaches.

Schedules are as challenging as the terrain. “At any one time, we have engineers all over the world, 24 hours a day, seven days a week, 365 days a year,” said Christine Walsh, chief engineer, Flight Test Engineering.

Another group of flight test engineers—Flight Test Operations—makes sure the tests are scheduled efficiently and safely. Operations builds the long-range testing schedule, maintains weekly schedules, and flies and directs tests on board. Efficient scheduling is important because it minimizes flight test length and fuel use. Other members of the group manage test configuration requirements daily and provide maintenance crews with configuration direction. Proper sequencing prevents rework and makes sure that tests in similar weather or airplane conditions are scheduled together. Flight Test Operations also is responsible for ensuring that all testing is performed safely.

“The demands of the job are high sometimes, but this job gives

you experience you can’t get anywhere else,” said Mark Litke, a test director for the Flight Test Operations group. “It combines engineering with the excitement of being in the cockpit.”

Flight engineers from all three groups—Analysis, Instrumentation and Operations—are on board each test flight. “These three teams work closely together,” said Walsh. “It’s one of the few organizations in the company where you literally pack up your bags and spend weeks on the road with co-workers. We need to understand each other’s jobs and roles and responsibilities, and we have to all learn together.”

Of course, the 500 or so flight test engineers in Commercial Airplanes also spend time on the ground designing tests, equipment and processes and preparing and analyzing data. Sometimes they perform tests in airplanes on the ground or they monitor flight tests from the telemetry room, where they can watch the airplane in action on video, review transmitted data and communicate with the pilots in real time.

But even when in the office, their hearts are never far from flight. When flight test engineers see co-workers standing at the window, looking out on Seattle’s Boeing Field through binoculars, they tend to emerge from their cubicles with their own binoculars, asking, “What are you watching?”

“These folks love airplanes,” Walsh said, and she understands just how they feel. Walsh sends her mother pictures of the Boeing airplanes she helps test, and they end up on the refrigerator with other family photos. ■

kathrine.k.beck@boeing.com

PHOTO: Engineers from the Instrumentation group in Flight Operations, Test & Validation Andrew Cherny (from left), Kinita Harris and Harold Matsuoka check flight test instrumentation aboard WF002, the second 777 Freighter flight test airplane. During actual flight tests, these engineers monitor the instruments and data being collected. JOE PARKE/BOEING