

# Something big is in the air

Flight test program is under way for the 747 Large Cargo Freighter, an important 787 production tool

By MARY HANSON

“When you have a team of people who are fully focused on the goal—and understand the importance of the work they are doing—personal considerations get set aside, and you accomplish great things.”

Mike Bunney, director of Global Logistics for the Boeing 787 Dreamliner program, isn't just waxing philosophical. He's referring to the hundreds of Boeing employees who have spent the past three years designing, building and now flight-testing the 747-400 Large Cargo Freighter.

The LCF recently achieved some crucial milestones, including taking to the air for the first time and making its first-ever transoceanic flight. Specially designed and modified to carry the large composite fuselage sections and wings of the all-new 787, the LCF can carry three times the capacity of a standard 747-400 freighter. It's the first time Boeing has designed an airplane to serve as a tool within another airplane program.

“The LCF is a key element in our lean, global production system for the 787,” Bunney said. “Flying the 787 components from partner sites worldwide to Everett, Wash., for final assembly reduces travel times from as many as 30 days down to one. This not only

saves us a lot of money, but it's key to achieving our goal of performing final assembly in just three days.”

It also meant developing and building an essentially new airplane to do the job. Traditional freighters didn't have the capacity to hold the fully integrated 787 structures being built in Kansas, South Carolina, Italy and Japan.

## WORK BEGAN IN 2004

In early 2004, Boeing engineers in the Puget Sound region of Washington state, California and Moscow partnered with Aernnova in Spain (formerly Gamesa Aeronautica) and Stork Fokker of The Netherlands to begin designing the LCF to the exact specifications required by the 787 program.

Firm configuration of the airplane's design was achieved in October 2004, and parts production began at more than 200 suppliers around the world. The team also bought three used passenger jets, one through the Boeing Aircraft Trading organization and two from China Airlines.

The fleet is being modified by Evergreen Aviation Technologies Corp. (EGAT), a joint venture between EVA Air and General Electric based in Taiwan. A Boeing/EGAT team of more than 450 engineers, technicians, mechanics, construction specialists, quality control experts, ground-support personnel and others spent more than 500,000 collective work hours modifying the first airplane to its unique configuration, often working seven days a week and forgoing holidays and vacations.

On Sept. 9, a mere 375 working days after the modifications began, the first LCF made its first flight. The two-hour, four-minute



The 747 Large Cargo Freighter will play a critical role in the production of the 787 Dreamliner airplane. Using the LCF to fly 787 components from partner sites worldwide to Everett, Wash., reduces travel times from up to 30 days down to one.

JIM ANDERSON PHOTO



GAIL HANUSA PHOTO

**Part of the test program for the 747-400 Large Cargo Freighter is validating that the airplane's giant swing-tail properly opens and closes. Boeing employees in Everett, Wash., watch on Oct. 10 as the gigantic airplane's tail swings open for the first time.**

flight over Taiwan was a tribute to the LCF team and also to the extensive preparation by the three Boeing flight-test pilots tasked with putting the LCF through its paces.

"We spent countless hours in design reviews and, later, doing extensive simulation of the expected handling qualities of the airplane," said 747 Chief Pilot Joe MacDonald. Before the flight, MacDonald's biggest question was whether the airplane's enormous upper fuselage would affect the handling characteristics of the airplane. Upon landing, he said there were times during the flight he forgot he wasn't flying a standard 747-400.

"It all looks the same when you're looking out the front windows," he joked. "The airplane is handling really well."

Just one week later, after completing three test flights in Taiwan and exercising and/or verifying the electrical, oxygen, communications, pneumatics, hydraulics, flight controls, fuel and other airplane systems, MacDonald and his team—Randy Wyatt and Gerald Whites—flew the airplane nonstop from Taipei to Seattle's Boeing Field. There, the LCF will undergo an additional 240 hours of flying time and hundreds more hours of ground testing in order

to achieve certification by the U.S. Federal Aviation Administration in early 2007.

The first LCF is a highly visible indication the Boeing 787 Dreamliner is fast becoming a reality. The airplane is instantly recognizable flying around the Puget Sound area—not only because of its enormous size, but because it hasn't yet been painted beyond green primer. Its first flight occurred later than anticipated because of delays in getting parts, so aesthetics were sacrificed in order to keep the flight test program on track. It will be painted in January.

Most recently the LCF has been in the Everett, Wash., factory, completing its most visually stunning ground test: the opening and closing of the swing tail, the unusual system that is the means for loading and unloading the airplane's cavernous cargo bay. Hundreds of employees gathered to watch the enormous swing tail slowly open for the first time. "Now we know the whole system works," said LCF chief project engineer Kurt Kraft.

The swing tail was guided by an enormous mobile tail support, which carries most of the weight of the 44,000-pound (20,000-kilogram) tail and continually adjusts to changes in position during the opening and closing of the tail. That reduces wear and tear on the two hinges visible on the aft section of the fuselage.

## THINGS FOUND AND FIXED

As with any flight test program, the team has found things that



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**Above:** The cavernous cargo bay of the 747-400 Large Cargo Freighter is 65,000 cubic feet (1,840 cubic meters), more than three times the cargo capacity by volume of a standard 747-400 freighter. A fleet of three LCFs will ferry 787 assemblies between Japan, Italy, Kansas and South Carolina before flying them to the Boeing factory in Everett, Wash., for final assembly.

**Top right:** The 747 Large Cargo Freighter flies over the Puget Sound area of Washington state. The airplane's flight-test program is expected to last until early 2007.

need attention. These are primarily maintenance issues, and although some were unexpected, Kraft said that's not unusual when you consider the base airframes first entered service in the early 1990s.

"That's the nature of a flight-test program. You find things and you fix them," Kraft said. Nothing has been found that indicates a fundamental flaw that would prevent the LCF from fulfilling its mission.

"All things considered, the airplane is behaving really well," Kraft noted. "All the designs and aerodynamics are performing exactly as we predicted they would."

Back in Taiwan, the Boeing/EGAT team is hard at work building up the second LCF, which is expected to arrive in Seattle at the end of the year. Both airplanes will begin ferrying 787 components in early 2007. Modifications on the third LCF start next year. ■

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### Think big

Here are some fun facts about the 747 Large Cargo Freighter.

- It will be in nearly constant service at five locations: Everett, Wash.; Wichita, Kan.; Charleston, S.C.; Grottaglie, Italy; and Nagoya, Japan.
- More than 30,000 pounds (13,600 kilograms) of aluminum are removed from each airplane for the modification.
- The swinging portion of the airplane's tail weighs as much as a loaded World War II B-17 bomber.
- It will be loaded and unloaded with the help of the largest cargo loader in the world, at 120 feet (36.5 meters) long, 28 feet (8.5 meters) wide.
- The LCF is the biggest cargo airplane in the world, by volume.
- The volume of the main cargo deck is 65,000 cubic feet (1,840 cubic meters)—big enough to carry
  - 42 million ping-pong balls
  - 8 million 12-ounce drink cans
  - 80 Mini Cooper cars
  - A three-level, 10-lane bowling alley, with room to spare for a restaurant