Boeing 787: Subcontractors catch the right plane

by Bruce V. Bigelow

When Boeing rolled out its new 787 jetliner in Everett, Wash., on July 8 (on 7-8-7, get it?), Goodrich Corp. employees in Chula Vista, Calif., watched the ceremonies by satellite amid a celebration of their own.

THE RIGHT PLANE - Goodrich technician Miguel Joya works on a thrust reverser at the Chula Vista, Calif., plant. CNS Photo by Nancee E. Lewis. The Goodrich Aerostructures Group has been responsible for designing and building the nacelles, or jet engine pods, for the 787 since Boeing awarded the contract in 2004. If the 787 debut planned by Boeing is any indication, the aircraft maker expects the mid-sized, wide-body, twin-engined jet airliner to become as iconic as its long-range 747. Boeing says its Dreamliner will carry 210 to 330 passengers, depending on the variant and seating configuration.

Boeing has promoted the 787 as a breakthrough in advanced aircraft engineering and design. The company also adopted a new approach in development of the 787 by outsourcing important work to its global supply chain partners.

"We got on the right airplane," said David J. Castagnola, vice president for Boeing programs at the aerostructures group.

While Boeing set the group's design parameters, Castagnola said the Goodrich team made significant advances in aerodynamics, sound dampening and related innovations for the 787.

"There are a lot of design constraints" for nacelle components, said Jeff Rogers, a Goodrich vice president for 787 product development. "The air that gets pumped into the engine is 800 degrees. There's 70,000 pounds of thrust per engine. You have to find the right material that fits the requirements, but is still friendly to work with."

The 787 contract was valued at about $4 billion when Boeing awarded the contract to Goodrich in 2004. Yet Goodrich spokesman Patrick Palmer said that estimate has climbed significantly with the success of 787 sales, even though the value of the program has not changed officially.

Boeing recently reported that it has received 634 orders from 45 customers for the 787 aircraft - suggesting the program could continue for decades.

Goodrich aerostructures executives say their work on the program will likely continue through 2020. The

company has more than 4,300 employees worldwide, with about 2,000 at the Chula Vista headquarters.

"Any time you've got a launch aircraft that's got 600 orders, it's a big deal," said Peter Goelz, who follows the aerospace industry from Washington, D.C., for O'Neill & Associates.

Such numbers make the 787 the most successful aircraft launch in aviation history. In comparison, Goelz said, Europe's Airbus consortium launched its new A380 jetliner on 160 orders, not all of which were firm. Winning more business from Boeing also helps Goodrich Aerostructures ease its reliance on Airbus as the group's single biggest customer.

For the year that ended Dec. 31, Goodrich said 9 percent of its almost $5.9 billion in revenue came from Boeing, while 17 percent came from its work for Airbus, the European aircraft consortium. That balance began to shift in the first quarter that ended in March, when Goodrich said Boeing accounted for 10 percent of its total sales while Airbus revenue slipped to 16 percent.

Goodrich, based in Charlotte, N.C., also won contracts from Boeing to supply fuel sensor systems, proximity sensing systems, electric brakes, exterior lighting and the cargo handling system for the 787.

But the contract for the nacelles represents one of the aerospace company's biggest programs - and it may prove to be the single biggest contract for the aerostructures group.

"We haven't had a really big Boeing contract for a while, so being on this program is significant for Goodrich Aerostructures," Rogers said. "It's not just another airplane."

Castagnola is particularly proud of the group's development of a seamless inlet cowl, a ringlike aluminum structure that forms the lip surrounding the mouth of the jet engine.

The aluminum skin used to make the cowl is about one-tenth of an inch thick and 30 inches wide. It requires special machinery to stretch and bend the material like a taco shell that must fit precisely around a doughnut-shaped structure that is nearly as big as the fuselage of a Boeing 737.

Any seams, bends or indentations will disrupt the air flow, which is intended to pass over the surface in a smooth sheet.

"We're delivering the first laminar flow inlet cowls, a highly efficient design that cuts down on drag and improves fuel efficiency," Castagnola said. In other words, nacelles require far more engineering than passengers might think while gazing from their window seats at the engine housings attached beneath the wings.

"Designing and building airplanes is really hard," Castagnola said. "We believe it's one of the hardest things in mankind today, to bring an aircraft like the 787 to market."

The real significance of the group's 787 work, though, may lie in the complexity of the development effort.

In addition to using computer-aided design to develop the 787, Boeing used computer-based modeling to simulate the entire manufacturing process. In a departure from its past practices, Boeing also shared much of the development effort with its international team of subcontractors and suppliers.

"That's been a big selling point, but the subcontractors also have taken on a big capital risk, along with a lot of the development risk," said Aaron Altman, a University of Dayton assistant professor of aerospace engineering.

"There are peers of yours who are also making production parts, and making parts come together for the first time to work with other parts is no small challenge," Rogers said.

Boeing contends the 787 will use 20 percent less fuel than similarly sized commercial jets, which was derived by using more-efficient jet engines, advanced control systems, aerodynamic improvements and a far lighter airframe. Boeing says as much as 50 percent of the 787 structure will be made with advanced carbon fiber composites, which required developing new automated manufacturing techniques. Boeing's decision to design the 787 to use either General Electric or Rolls-Royce engines was especially challenging for Goodrich, which had to develop its nacelles and thrust reversers to work with both jets.

"We have designed and built and provided over 30 nacelle test components in just 36 months," Castagnola said. "That is an unprecedented achievement and it's never been done by any engine nacelle company."

At the same time, Castagnola said the Goodrich plant in Chula Vista has had to develop its production capabilities to match Boeing's requirements. The 787 is expected to begin test flights in September, with the first aircraft entering service in May 2008.

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