Alenia Aeronautica has built an all-new factory in Grottaglie, Italy, where barrel sections for the 787 will be created. This large tool will move the barrel section through the factory—from layup to autoclave and then on to trimming and drilling and inspection.

INTERNATIONAL INDUSTRIALIZATION

New sites at 787 partners across the globe are coming online to produce the Dreamliner. Here's an inside look at six of these facilities

Vincenzo Caiazzo of Global Aeronautica noted how Vought and Alenia North America, which traditionally compete against each other, formed a joint venture to comwplete integration of 787 fuselage sections.

By Lori Gunter

The decisions made by Boeing more than three years ago are literally changing the landscape of three cities on three continents.

Factories have sprung from the ground in record time from the swamps in Charleston, S.C., the olive groves in Grottaglie, Italy, and the industrial center of Nagoya, Japan. This massive global industrialization effort—which includes the creation of more than 3 million square feet of new factory space—is aimed at achieving the objectives of the Boeing 787 Dreamliner program.

Six sites, which are coming online to support 787 production, recently opened their doors to provide a glimpse at their progress. These facilities reflect a collaborative business model that's as revolutionary as the 787 airplane. This collaboration ensures Boeing gets the best ideas and uses the best abilities from throughout the industry to design and create a product that's like no other.

"One of the reasons we formed global partnerships was to help spread the investment required to create a new airplane," said Scott Strode, vice president of 787 Development and Production. "Because of advances in technologies such as composite materials, existing facilities could not accommodate either the kind of work, or the amount of work, that comes with a program like the 787."

"To look at the first [center wing-tank-skin panel] is very rewarding and very humbling."

—Scott Strode, vice president of 787 Development and Production

CREATING AN ITALIAN MASTERPIECE

Only in Italy can an airplane factory be seen as a canvas for a beautiful piece of art. Alenia Aeronautica, a Finmeccanica company, filled that canvas with an impressive facility in Grottaglie. The site features distinctive touches, such as large overhead cantilevered windows that spread natural light throughout the factory.

And it's a vast factory to fill. The clean room—an environmentally controlled area where composite material is automatically laid on forms to create one-piece 787 fuselage barrels—is 6.2 million cubic feet. It is just a small part of the whole building, which is about the size of 15 soccer fields or 24 American football fields.

"More than 300 workers will be at the Grottaglie facility by the end of this year," said Maurizio Rosini, chief operating officer of Selex, the Alenia subsidiary that will run the Grottaglie facility. "That number will rise to nearly 800 by the year 2010."

Those workers will create the composite center fuselage sections known as Sections 44 and 46 for the Dreamliner.

Using new automated composite tape lay-down machines and sophisticated forms, called mandrels, the team will first create the barrel sections. Then a massive transportation tool will move the barrel sections into an autoclave—the largest in Europe—which essentially will bake them under pressure to create a solid structure. The moving tool will return, taking the piece to be trimmed and drilled and then moving it to the inspection station. When complete, the barrel sections are to be flown on board a specially modified 747, called the Large Cargo Freighter, from Italy to Charleston, S.C.

TRANSFORMING A SOUTH CAROLINA SWAMP

In only one year, the South Carolina team has raised a world-class production facility where alligators, snakes and banana spiders once roamed a vast swamp next to the airport. Today, a sprawling complex occupies the space. The complex houses factories and a training facility for Vought Aircraft Industries and Global Aeronautica.

Vought will produce the aft fuselage sections of the 787, known as Sections 47 and 48, in its 342,000-square-foot facility. Each section will be a one-piece composite fuselage barrel, made using tools and processes similar to those found in the Italian factory. Layup of the composite material will happen in a 70,000-square-foot clean room.

By the end of the year, more than 100 employees will be working at the site in support of the 787.

"We are really proud of our new, state-of-the-art factory," said Mark Dickey, general manager of Vought's North Charleston site.

Dickey said preproduction testing began in June and work on the first 787 production pieces starts this month. In the first quarter of 2007, Vought will deliver its first barrel section to Global Aeronautica, a joint venture formed by Vought and Alenia North America to complete integration of 787 fuselage sections.

"Two companies that traditionally compete against each other decided to form an international joint venture to have access to a broad spectrum of integration activities for fuselage sections, normally performed by the prime manufacturer," said Vincenzo Caiazzo, chairman of the board of managers for Global Aeronautica.

Global Aeronautica will connect the two Alenia center-fuselage sections from Italy and the wheel well and center wing box from Japan with one another, and the two Vought aft fuselage sections to each other, creating two large structures. Each will be "stuffed" with systems elements including wiring and tubing. In addition, the sections will be painted and tested before being loaded on the Large Cargo Freighter and flown to Everett, Wash., for final assembly.

Global Aeronautica is on track with the program plan to deliver the first integrated fuselage sections to Boeing early in the second

Mark Dickey (center), general manager of Vought's North Charleston, S.C., site, leads visitors on a tour of the spacious factory that Vought completed recently.

quarter of 2007, said Newt Newton, Global Aeronautica vice president and deputy general manager. There are nearly 50 people working for Global Aeronautica today with an anticipated work force of 100 by year-end. Peak employment is expected to be about 400.

Newton is particularly proud of Global Aeronautica's 338,000-square-foot factory. "We are focused on doing the job and doing it right," he said. "First it was creating the building, and now it is creating the Dreamliner."

ADDITIONS FOR NAGOYA'S INDUSTRIAL CENTER

All three of the Japanese heavy industry partners—Mitsubishi Heavy Industries, Kawasaki Heavy Industries and Fuji Heavy Industries—have built new factories dedicated to 787 work. Each includes machinery for laying down composite materials, a massive autoclave, trim and drill operations and nondestructive inspection machines. Yet each has distinct capabilities and features.

Mitsubishi Heavy Industries (MHI) will build the wing boxes of the 787. These contoured boxes provide the lift and fuel-carrying capacity needed for the airplane. The new 505,800-square-foot composite manufacturing factory is located just beyond the historic factory where World War II "Zero" fighters were designed and manufactured. Next door is another new facility, dedicated to finishing the wing boxes with systems installations and other details. This part of the factory is still under construction, with completion expected in the third quarter of 2006.

Takashi Fujimoto, director and 787 program manager for MHI, said when the wing boxes are complete they will be loaded on a barge and shipped to Nagoya Airport for loading on the Large Cargo Freighter. It will fly them to Everett, where they will be finished and prepared for final assembly.

The largest tool in any factory for the 787 is MHI's one-piece wing-box-skin tool. This allows MHI to create a one-piece wing skin that measures more than 72 feet in length.

Less than an hour's drive from MHI's factory is Kawasaki Heavy Industries' new 787 factory. KHI is building the airplane's forward fuselage section, keel beam, pressure bulkhead and aft wheel-well bulkhead, as well as its fixed trailing edge.

With work on aluminum fuselage panels for the 777 right next door, this facility highlights the difference between aluminum construction and composite construction. For the 777, KHI ships panels with countless rivets that are then constructed into fuselage barrels in Everett. But for the 787, KHI will create a one-piece barrel with significantly fewer connectors because the stringers (horizontal reinforcing components) are an integrated part of the structure—just like all other 787 fuselage sections.

Hirokazu Komaki, 787 program manager for KHI, noted that testing of most of the machines in the KHI composite manufacturing factory has already been completed. He added the company has started to build the "proof for production" parts that will be used to verify they are ready to start building production pieces later this year. Like the MHI parts, KHI's fuselage section will be placed on a barge and shipped to Centrair (Central Japan International Airport in Nagoya) for transport to North Charleston on board the Large Cargo Freighter. Its other structural elements will be sent to Fuji Heavy Industries (FHI) for integration with the center wing section.

FHI's Nagoya facility is where assembly of the first 787 begins. Similar to the other sites, it is characterized by its high-tech machinery, huge autoclave and clean room. Here, for the first time, parts will be joined to create completed 787 structures.

The transport tool in this factory—which moves the in-process structure from station to station—is a musical delight, sounding more like an American ice cream truck than an industrial heavy

PHOTO BY MARK WAGNER, AVIATION-IMAGES.COM

Fuji Heavy Industries' transport tool moves composite skin sections for the airplane's center wing section around the factory. To alert workers to stay out of its path, it plays traditional Japanese tunes.

The door to the massive autoclave at Kawasaki Heavy Industries' new factory closes on composite parts that will verify the factory is ready to begin making production pieces for the first Dreamliner.

lifter. It plays a different tune for each direction that it moves. Yasuhiro Toi, FHI's 787 program manager, said the music is a safety feature that alerts employees when the transporter is moving.

Before assembly began, Hideyuki Sano, general manager of Manufacturing Engineering for the company, and Toi proudly showed off the first center wing-tank-skin panel. The center wing section is a more complex build than the barrels and is not a one-piece construction.

"You just have to look at it and think about the courage it took three years ago to move forward with an all-new airplane during a really terrible time in our industry," Strode said of the 787 program. "And then the thousands of decisions based on detailed analysis that had to be done in order to ensure this part will meet the safety and reliability requirements that will allow it to be in service well after most of us who have been involved in this effort have retired.

"The fingerprints of the entire Boeing team and our partners at FHI are on that panel, just like the rest of the parts that will follow," he added. "But to look at the first piece and see it really happening the way we planned it is very rewarding and very humbling." ■

loretta.m.gunter@boeing.com

BOEING GRAPHIC

Continental Airlines last month ordered another 10 787-8 Dreamliners (top), along with 24 Next-Generation 737s.

Singapore eyes 787s as Continental orders another 10

Another major international carrier is poised to join the list of airlines that have selected the Boeing 787 Dreamliner.

Singapore Airlines on June 14 said it signed a letter of intent to purchase 20 Boeing 787-9s, with purchase rights for another 20 of the airplane. Deliveries will be scheduled between early 2011 and mid-2013, the airline said.

"The decision to purchase the 787-9 is the culmination of an extensive evaluation of the performance characteristics and operating economics promised for the different versions of Boeing's new 787 aircraft," the carrier said in a statement.

"We look forward to working closely with Singapore Airlines to finalize the order to support the carrier's unique offerings," Boeing said in a statement.

The Singapore announcement followed Continental Airlines' decision in early June to order another 10 787-8 Dreamliners. With that decision, Continental has 20 787s on order, the most of any U.S. airline. Continental also said it had ordered an undisclosed mix of 24 Next-Generation 737s.