

Frontiers



Dream role

Boeing South Carolina:
Growing with the 787



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PHOTO: NASA



30

PHOTO: BOB FERGUSON | BOEING

Cover: Boeing South Carolina's Yan Rojas prepares a 787 Dreamliner aft-body section for frame installation. **BOB FERGUSON | BOEING**

Photo: Boeing South Carolina teammate Samuel Canty prepares a 787 Dreamliner wing for fuselage join in Final Assembly. **BOB FERGUSON | BOEING**

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Boeing South Carolina employees are producing three complete 787 Dreamliners a month, with rates scheduled to reach seven a month by the end of the decade. They also support 787 final assembly in Everett, Wash. Their journey has been challenging, but Boeing South Carolina employees are proud of what they have accomplished—and excited about the future, which includes sole production of the 787-10.

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The stories behind the ads in this issue.



Part of a new campaign featuring the CH-47 Chinook, the world standard in heavy-lift rotorcraft, this ad is running in domestic and global trade publications.



This ad commemorates the recipients of Boeing's Engineer of the Year and Engineering Excellence Team of the Year awards, which were announced last month. The awards recognize outstanding technical contributions that have boosted productivity and company growth and celebrate engineering excellence in the workforce.



"Enduring Support," which focuses on Boeing's training expertise, is one of several ads in a Boeing Defense, Space & Security advertising campaign highlighting the capabilities Boeing brings to its customers. The ads are running in print and online business, political and trade publications.



This ad, which ran during the Aero India air show last month, was developed to highlight Boeing's commitment to the future of aviation in India—and globally. The air show is a platform to advance business opportunities in the international aviation and defense sectors and takes place in Bangalore, India. The ad appeared in local publications.

IAM PROMOTIONS

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LEADERSHIP MESSAGE

Ray Conner

Boeing vice chairman
President and chief executive officer
Boeing Commercial Airplanes



Winning together

We can create a culture everyone wants to be part of by focusing on our people

Fifty years ago, Boeing President Bill Allen said something that still rings true today:

What we have to sell to all our customers is ability. Ability is not to be found in buildings and equipment, or in machines; the ability of The Boeing Company rests with the people who are Boeing.

We've been thinking about that a lot at Commercial Airplanes as we work to develop an ideal culture—one that brings out the best of our past while leading us into a successful future. With Boeing's centennial just a year away, we feel an obligation to build on this company's incredible legacy—to carry forward the passion and courage that have taken Boeing from the Red Barn to the surface of the moon and beyond.

Commercial Airplanes already has the best lineup of products and services in the industry, and a strong

strategy for market leadership. We've also identified six Keys to Winning that will give us a competitive edge in the eyes of the customer.

Now we're focusing on the people who bring it all to life. We're tapping into the special qualities that have defined Boeing for nearly 100 years.

Bill Allen's quote captures the essence of that: We are the people of Boeing, and we do big, important, difficult things that change the world. That's true across the enterprise, whether we work with satellites, defense, engineering, customer support or elsewhere in this company.

At Commercial Airplanes, we drew inspiration from Allen's belief in the people of Boeing as we worked to develop a cultural blueprint we call the Winning Together Principles. These reflect the Boeing Management Model and the broader Boeing Vision, which aims to inspire and focus employees on our values, purpose and shared destiny.

At its heart, Winning Together is about enhancing the legacy that makes us proud to be part of Boeing. Here are the key elements:

- Our goal is to know we deliver superior customer value. That requires confidence in our products and ourselves—and confidence depends on preparation and engagement.

- Boeing's greatness lies in our pioneering spirit, which is driven by courage, passion and integrity. That's the DNA of the company, and of the amazing people who come to work each day to do great things.
- We're united by a set of beliefs—that relationships matter, every detail matters and that customer-focused innovation is central to what we do.
- We believe in the philosophy on which this company was built: Make a commitment, keep the commitment.
- And we operate by three rules: We are people-centered, we respect everyone and we take responsibility, even when tough decisions are called for.
- Within that cultural framework, we aim for continuous improvement and a focus on safety as we work to fulfill customers' expectations.

These are our principles. Now it's up to us to live them and make them real, to create a culture everyone wants to be part of—one that inspires us to give our best every day. Because, as Bill Allen put it so well: "The ability of The Boeing Company rests with the people who are Boeing." ■

PHOTO: MARIAN LOCKHART | BOEING

SNAPSHOT

Scout over

Scout's first 787-9 Dreamliner lands alongside Boeing's Everett, Wash., factory following a pre-delivery test flight earlier this year. Low-cost carrier Scoot, based in Singapore, began operations in mid-2012 using Boeing 777s and took delivery of its first

787 in January. The factory's six massive doors feature a graphic tribute to the widebody jetliners produced inside. The mural spans 1,900 feet (580 meters) and covers more than 100,000 square feet (9,300 square meters).

PHOTO: GAIL HANUSA | BOEING





QUOTABLES

“The 787 has a ‘Goldilocks effect.’”

—Aviation consultant George Hamlin on how the 787 Dreamliner’s long range and size, “not too big and not too small—it is just right,” is allowing airlines to open new long, thin routes not economically possible to serve before, such as Los Angeles–Melbourne, Australia (United Airlines), Stockholm–Oakland, Calif. (Norwegian) and London–Austin, Texas (British Airways). *The Street*, Feb. 5

“It never gets old seeing that airplane fly, especially when you know you’ve touched each one that was built.”

—Tony Murray, a senior production manager for the C-17 in Long Beach, Calif., where manufacturing of the military airlifter is nearing the end. For more on this versatile aircraft and the men and women who have built it, see story, Page 30.

WHAT WE DO

The road ahead

This Boeing South Carolina engineer chased his dreams—and found the 787

BY RADOUANE BOUKRAA, AS TOLD TO ROB GROSS

Radouane Boukraa is an industrial engineer at Boeing South Carolina in North Charleston, where he supports fabrication of the aft-fuselage sections of the 787 Dreamliner. In this *Frontiers* series that profiles employees talking about what they do at Boeing, Boukraa describes how he helps ensure there are no disruptions in Dreamliner production.

Growing up in Casablanca, Morocco, I learned early the value and importance of education and hard work. My parents taught me to set my goals high and have a broad vision, but I never knew that vision would bring me all the way to South Carolina, helping build the 787 Dreamliner.

My primary responsibilities in support of the 787 at Boeing South Carolina include cycling all of the tooling, tools and fabrication carts the team requires to manufacture the composite aft-fuselage barrels. My group is also responsible for developing the production “bar charts,” or job schedules, for the production teams.

A big part of what I do is identify and troubleshoot any issues that might affect production. For instance, if we have a tooling failure, that could potentially cost us days, not hours. We work together to make sure that doesn’t happen.

I’m very engaged with the Employee Involvement teams from the production areas I support, and have participated in a number of Lean+ improvement projects. A notable one was the development of a process that reduced cleaning time of

tools by 11 percent. That’s huge for our production teams. Boeing South Carolina is building three complete 787s a month for delivery here to customers, and is sending 10 aft- and midbody-fuselage sections a month to 787 final assembly locations here and in Everett.

I love what I do, especially knowing that my job has a direct impact on our productivity and our success. Working for Boeing is a dream come true for me—and my parents are proud to see the lessons they taught me long ago being put to use today.

My parents had the benefit of an education, and there were strict rules in my house about studying, mastering my subjects and preparing myself for future success. After finishing technical school I eventually went to work with a steel company as a maintenance technician. It was dirty, rough work, but I’d discovered what I wanted to do—manufacturing. When I found out about an opportunity to move to the U.S., I applied at the embassy despite not speaking any English at the time. I received my confirmation, interviewed at the embassy, and in July 2002 was on my way to America.

I knew I wanted to pursue engineering, and after enrolling in an English as a Second Language course and completing some elective work, I enrolled at North Carolina State University as an industrial engineering major. After graduating in 2008, the year I also became a U.S. citizen, I went to work as a maintenance and reliability engineer, and later as a manufacturing manager. I started applying with Boeing when I found out about the 787 final assembly line coming to South Carolina, and accepted a job offer in June 2012.

My parents love to tell their friends in Casablanca about their son who works for Boeing in the United States. I’m grateful that they instilled a dream in me, then gave me the road map to chase it. ■

ROBERT.G.GROSS2@BOEING.COM

For more about Boeing South Carolina, see story on Page 16.





Radouane Boukraa

HAS WORKED FOR BOEING:
Nearly 3 years

LOCATION:
North Charleston, S.C.

TEAM:
787 Aftbody
Composite Fabrication

PHOTO: ALAN MARTS | BOEING

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787 DR...

HISTORICAL PERSPECTIVE



Bridge to the moon

Project Gemini laid the foundation for the moon landings that followed

BY HENRY T. BROWNLEE JR.

Fifty years ago this month, two American astronauts, Virgil “Gus” Grissom and John Young, climbed into a spacecraft nicknamed “Molly Brown” and blasted into orbit from Cape Canaveral, Fla. Their flight, in the new Gemini spacecraft, marked another key milestone on the U.S. journey to a manned moon landing four years later.

McDonnell Aircraft built the two-person Gemini capsule, as well as the smaller Mercury capsule that first carried U.S. astronauts into orbit. And North American Aviation built the Apollo spacecraft used for the moon-landing flights to come. Both McDonnell and North American are Boeing heritage companies.

What became known as Project Gemini began in December 1961 when NASA signed a contract with McDonnell Aircraft as prime contractor for a second-generation manned spacecraft that could carry two people and bridge the gap between the Mercury and Apollo programs, proving concepts such as spacecraft rendezvous and docking that would be needed to land astronauts on the moon and return them safely to Earth.

The Gemini spacecraft was a conical structure nearly 19 feet (5.8 meters) high, 10 feet (3 meters) in diameter at its base and weighing more than 7,000 pounds (3,180 kilograms). McDonnell Aircraft designed and built 11 of the capsules in its St. Louis factory.

The program was officially designated “Gemini” on Jan. 3, 1962. In Latin, the word means twins, or double. It is also the name of the third constellation of the Zodiac and its twin stars Castor and Pollux.

Much to the chagrin of NASA, Grissom, the mission commander, nicknamed his Gemini 3 capsule “Molly Brown,” a

reference to the Broadway musical and film *The Unsinkable Molly Brown*. An American socialite, Brown was on the *Titanic* but survived the sinking of the ocean liner when it hit an iceberg on its first voyage across the Atlantic.

Grissom was one of the original seven Mercury astronauts, and the second American into space. But his Mercury capsule sank when it splashed down in the ocean after a brief suborbital flight. The Mercury, Gemini and Apollo spacecraft were designed to float in the ocean after returning astronauts from space. But the hatch on Grissom’s Mercury capsule blew off upon hitting the water.

Young was among the second group of U.S. astronauts selected by NASA.

The Gemini 3 flight took place March 23, 1965. After being placed in orbit by a Titan II rocket, the spacecraft circled Earth three times before parachuting into the ocean almost five hours after liftoff from Cape Canaveral (later renamed Cape Kennedy).

“The longer we flew, the more jubilant we felt,” Grissom later recalled. “We had a really fine spacecraft, one we could be proud of in every respect.” Their flight, and those that followed in the Gemini capsules, were a key step toward the moon.

In a speech to Congress three weeks after Alan Shepard became the first American in space, on May 25, 1961, President Kennedy had challenged the country to send astronauts to the moon and back by the end of the decade. That first moon landing came July 20, 1969.

Two unmanned Gemini missions were flown to check out systems and the spacecraft’s heat shield that protected the astronauts during the fiery re-entry into Earth’s atmosphere. Starting with the Grissom and Young

mission, a total of 10 Gemini flights were made in 1965 and 1966. Astronaut Ed White became the first American to make a space walk, during the Gemini 4 mission in June 1965.

NASA named Grissom to lead the first Apollo flight, which was to check out the new spacecraft in Earth orbit before the more ambitious moon flights. But Grissom, White and astronaut Roger Chaffee died when fire broke out in their Apollo spacecraft on the launch pad during a preflight training run. Young would go on to become the ninth U.S. astronaut to walk on the moon, as commander of the Apollo 16 mission in 1972. ■

HENRY.T.BROWNLEE-JR@BOEING.COM

Photos: (Far left) Launched into space by a Titan II rocket in March 1965, the Gemini 3 spacecraft carried astronauts Gus Grissom and John Young on three orbits of Earth and proved a key step toward future moon missions. (Below) McDonnell Aircraft Corp. employees make final adjustments and perform checks on the Gemini 3 capsule prior to launch. NASA



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WORKING ON A





FINISHING DREAM

Boeing South Carolina employees are excited about the future and take pride in their role in the Boeing family

BY JAMES WALLACE

Chuck Deutsch remembers what it was like in those early days, not long after what had been the site of old phosphate mines, abandoned for decades, was partially cleared, excavated and filled for the construction of two huge factory buildings to support production of a new kind of Boeing commercial jetliner—one with advanced technology and carbon-fiber skin.

He and those other first employees drove to and from work each day down a dirt road lined with trees, underbrush, and scattered wetlands on either side—not to mention a few snakes and alligators, which are not uncommon in the South Carolina Lowcountry.

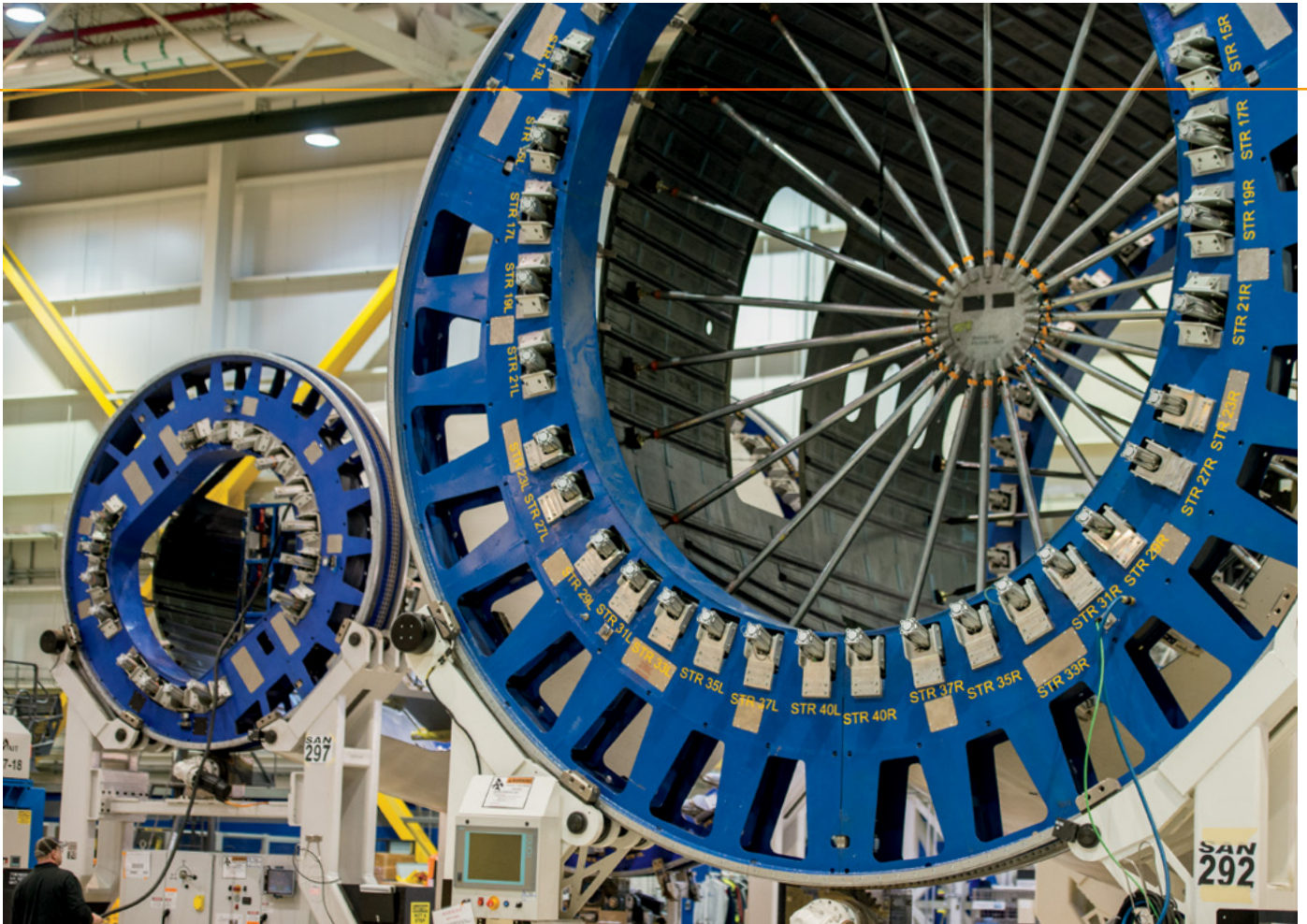
“It was pretty tough back then to get much done,” recalled Deutsch, who

started as a contract worker for Global Aeronautica in 2007, shortly after Global, a joint venture between Vought Aircraft Industries and Italian partner Alenia Aeronautica, began production at the site near Charleston, S.C., of the first composite midfuselage barrel for the 787 Dreamliner.

Next to the Global Aeronautica plant was a second plant for aft-body fuselage fabrication and assembly, operated by Vought. Upon completion, the fuselage sections manufactured and assembled at the two plants were transported in a modified 747 to Boeing’s Everett, Wash., factory for final assembly of new Dreamliners.

“The operation and people were so new. There were few processes in place,” Deutsch explained of the painfully slow pace of producing those first fuselage barrels. “It was a momentous occasion when we could

Photo: In South Carolina, 787 Final Assembly has progressed to a rate of three airplanes per month—almost three years to the day since final assembly began at the site. **BOB FERGUSON | BOEING**



accomplish 25 jobs (or tasks) a day.”

Things have certainly changed since those very early days.

Boeing subsequently acquired the Vought and Global Aeronautica plants, and later built a 1.2-million-square-foot (112,000-square-meter) Final Assembly building next door to increase 787 production as well as deliver complete Dreamliners to customers from North Charleston. In April 2012, the first Dreamliner built at the site rolled out the factory doors as employees celebrated. For the first time ever, Boeing employees had built a commercial jetliner somewhere other than on the West Coast.

Today, the Boeing South Carolina site in North Charleston is producing three 787s per month, a rate that will increase to seven Dreamliners per month by the end of the decade. That will match current 787 production at the Everett plant on the other side of the country.

And Boeing South Carolina supports 787 production in Everett and North Charleston with 10 mid- and aft-fuselage sections a month, a rate that will increase to 14 a month by the end of the decade.

Deutsch is now a manager, leading a team in Midbody Operations responsible for lower system installation.

“Coming into this, most of the folks didn’t have much aviation experience,” Deutsch said. “But I tell you what, the amount of experience that has been groomed here now is nothing short of amazing. It hasn’t been that long ago that it all started here—a new industry rising up in South Carolina. And to see these people do the kinds of incredible work they are doing is inspiring.”

As he talked about “the energy on the shop floor” and how “everybody here is challenging one another to do even better,” behind Deutsch was the midbody fuselage of a U.S.-based airline’s 787, followed on the production line by the

midbody section for an airline in China.

Like their 787 colleagues in Everett, the North Charleston employees are producing both the 787-8 and the longer 787-9. The first North Charleston-made 787-9, for United Airlines, entered final assembly late last year. In a couple of years, production will begin on the still-longer 787-10, which will be built only by Boeing South Carolina. Ground has been broken and dump trucks are moving dirt for a state-of-the-art paint facility. When it opens in late 2016, Dreamliners won’t have to fly off to be painted in Louisiana or elsewhere before they are delivered to customers—one more improvement in efficiency.

A second autoclave is coming, to support manufacturing of the longer aft-body fuselage of the 787-10 and program rate increases, in the same former Vought building where employees produce the 787-8 and 787-9 aft-fuselage barrels. The building has more than doubled in



size since the Vought days.

Engineers are arriving, too. Some, like Taurus Brackett, are here to design the engine nacelles for the new fuel-efficient 777X, which is under development and will be assembled in Everett. In May 2013, Boeing announced that an Engineering Design Center and propulsion operation would be established at Boeing South Carolina. At the time, Brackett was finishing his degree in mechanical engineering at Georgia Tech in Atlanta. He had done a couple of engineering internships for Boeing in Seattle. He was hired full time in February 2014.

“I love this,” he said of the 777X propulsion analysis work he’s now doing in North Charleston. “I was really worried that maybe as the new guy I’d be running out to get coffee for everyone. Instead, I’m running numbers. I love numbers. It’s awesome to think that the decisions I’m making today will be decisions that could last on this program for the next 30 years. That’s a cool feeling.”

Engineers are also here to design the nacelle inlet for the new 737 MAX. The nacelles will be assembled on site. The nacelle work is being done at the recently completed Propulsion South Carolina, a 225,000-square-foot (21,000-square-meter) facility located next to the Interiors Responsibility Center, about 10 miles (16 kilometers) north of the main Boeing South Carolina campus.

At the Interiors Responsibility Center employees are producing 787 cabin interior components, including stow bins and closets.

And just down the street from the Interiors and Propulsion buildings, Boeing has leased more than 100,000 square feet

Photos: (Far left) Newly cured composite barrel sections in Boeing South Carolina’s Aftbody Operations await frame installation. (Left) Aftbody teammate Bryan Howell uses a power feed drill motor to drill the bulk cargo door on a 47 section barrel. **BOB FERGUSON | BOEING**



(9,300 square meters) for Boeing Research & Technology–South Carolina. The facility, focusing on advanced manufacturing technology and composite fuselage manufacturing, has its own autoclave.

Antonio Nelson is a team lead at the Interiors Responsibility Center, where he's worked for three years since joining Boeing. When he started, not long after the center opened, it resembled a "ghost town," he said. There were few tools, and few workers. Now, there are a lot more of each. With lessons learned and experience, the work has become more efficient.

Nelson said his team sometimes calls on Interiors colleagues in Everett for help.

"If we run into any issues, Everett probably already has had to deal with them," he said.

When the North Charleston Interiors center opened, not only was the production system new, but so were the employees. It was challenging to produce one complete 787 cabin interior a month, Nelson said. Now, they are turning out three a month.

Nelson, a Charleston native, was remodeling homes before he was hired by Boeing. He likes working with his hands. And he loves the culture and atmosphere he has found at Boeing.

"You leave your home every day and come to work here and it's like walking into another family," he said.

And that family has gotten pretty big.

The Boeing South Carolina workforce numbers more than 7,500, including contract workers. Overall, the site is just over 100 acres (40 hectares) shy of being the same size as the

Everett site. Boeing owns or has leased land at the main North Charleston campus for future expansion if needed.

"It's almost like we have built a city here," said Jerry Edmondson, Site Services manager for the Shared Services Group at Boeing South Carolina. He helped scout the site for Texas-based Vought back in 2005.

"We have seen this site grow from where we were just building fuselage sections to now, when we are flying out a complete airplane," he said. "It's not every day that people get the opportunity to be part of what we have here ... And there is room to grow."

Walking around the site, talking with employees, it's impossible not to notice that something special is happening here. They are excited about the work, about the progress and especially about the future. They wear their Boeing teamwear with pride. And the community takes pride in them. Every employee, it seems, has stories about being stopped by folks in the local community when they are wearing their Boeing teamwear away from work.

"If you go out into town and you happen to be wearing your Boeing shirt—at the gas station, the grocery store, the lumberyard—someone is sure to stop you and want to talk about Boeing. Next, they want to know how they can get a job at Boeing," said Daniel Painter, a team lead for Section 47, one of the two fuselage sections manufactured in Aftbody Operations.

Painter went to work for Vought in 2007. He had just spent four years in the U.S. Marine Corps, where he was a small arms weapon repair technician. Many Boeing



Photos: (Far left) Boeing South Carolina teammate Adriane Mitchell performs pre-join work on a 787 fuselage in Final Assembly. (Left) After being fabricated and assembled at Spirit AeroSystems in Wichita, Kan., the 787 forward section is delivered by Dreamlifter to Final Assembly, where it is joined to the midbody section. **BOB FERGUSON | BOEING**



South Carolina employees have military experience. The site shares runways with Joint Base Charleston, formerly Charleston Air Force Base, which has a large fleet of Boeing-made C-17 Globemaster III military-transport aircraft.

Married and with four children, Painter said he never gave a thought to working for an airplane company. But when he read the job skills Vought was seeking for new hires at its just-opened factory, he realized he would be using some of the same hand tools he used in the military to repair weapons.

Building commercial jetliners that have millions of parts is not easy. The learning curve for most employees at Boeing South Carolina has been steep. But few of the early employees who worked for a company called Boeing almost 100 years ago knew very much about building airplanes. With time, training and experience, they learned

new skills, new processes—and built airplanes better and more efficiently. And they passed along the knowledge gained to others. It's the same story at Boeing South Carolina, which received a lot of help from sites all over Boeing and particularly Everett.

The jobs behind schedule have been cut dramatically. There is much less of the so-called traveled work, or unfinished tasks that get put off to be accomplished out of sequence further down the production line.

“The big hump we all had to get over to become really good at this was just believing in ourselves and knowing that it could be done, that we could do this work if we had the right tools and processes in place,” Painter said. “And you are talking to the right guy if you want to know how good it is, because my team’s COA and first-pass quality are at an all-time high.”

COA stands for Condition of

Assembly, and along with jobs behind schedule is a way of measuring how well Boeing South Carolina is performing in sending aft- and midbody fuselage sections to final assembly in North Charleston and Everett.

Bryan Howell also works in Aftbody Operations, on Section 48. Like Painter, he, too, is a veteran, of the U.S. Air Force. Howell went to work at the North Charleston site about the same time

as Painter, only for Global Aeronautica. Unlike Vought, which fabricated and assembled the two aft-fuselage sections of the 787, Global Aeronautica received the two midbody fuselage sections from Alenia in Italy and Kawasaki Heavy Industries in Japan. Employees joined the two barrels and installed systems and electrical wiring. That's still what happens in Midbody Operations.

"I was excited when I came here in

2007 and I'm even more excited now, to see our Dreamliners taking off from

Photos: (Far left) Automated fiber-placement machines apply layers of carbon-fiber tape to form the 787 aft-body composite sections. The carbon fiber is placed using a precise pattern and layered to provide maximum strength. (Below) Final Assembly teammate Noli Sanchez prepares the leading edge strut on a wing before the wing-to-body join. **BOB FERGUSON | BOEING**





here,” Howell said. “We have gotten better, the tooling is better. It’s going really, really well.”

For Howell, a highlight was Family Day in the fall of 2013, when he and other Boeing South Carolina employees were allowed to bring family members to the site. Howell has three children.

“Seeing the pride on their faces was very special,” Howell said. “It finally sank in for them. This is what dad does. He really does build airplanes.”

Deutsch, the manager in Midbody Operations who started with Vought in 2007, also got a kick out of showing his family around the factory that day.

“My family knew what I did, but they had never been here,” Deutsch said. “When they took the tour, my father looked at me and said, ‘Wow! You really are building airplanes!’ He just had imagined me working in an office or something.”

The word about Boeing South Carolina and what is taking place here is spreading far beyond just family members.

Frank Hatten is a retired IBM manager

and current member of the Boeing South Carolina Education Relations team. He manages the site’s DreamLearners program, which targets young people up through the 12th grade and gives them an idea of what Boeing is doing in South Carolina, while encouraging them to study math and science. More than 100,000 students and adult educators have participated in the program since it began in September 2012.

“A lot of students think you have to be an engineer or have a master’s degree to come work for our company,” he explained. “This program brings them in and lets them know we need all kinds of people as long as they have certain skills sets.”

The state has programs to train aircraft maintenance technicians, and additional suppliers and other aerospace companies have established operations in South Carolina because of Boeing. A recent report by the University of South Carolina’s Moore School of Business said the aerospace industry in the state is now a \$17.4 billion-a-year enterprise.

“It’s become a destination for students coming out of college,” Hatten said. “They no longer have to go to the West Coast for a career in aerospace. Many want to stay in the Southeast. And Charleston is not a bad place to work.”

Shawn Blake is one of those newer Boeing South Carolina employees. She beams with pride when talking about her job in preflight and delivery, where she and her teammates prepare 787s for delivery after they are rolled out of the Final Assembly building.

Blake’s mother first told her about Boeing when she was an undergraduate at South Carolina State.

“My mom said Boeing was coming



here to Charleston,” Blake recalled. Actually, it was Vought that was looking for people to hire at its new factory.

Three years ago, Blake was finishing her master’s in industrial engineering at Clemson University in South Carolina when she visited a job fair and talked with the Boeing representative. She was told to “apply and keep applying.” Blake did. After two interviews, she was hired a few weeks after she graduated from Clemson.

“To find a job in my field so soon, most people can’t say that. It’s been so exciting,” Blake said. “But I had no background in aviation. It was a learning experience. It still is. Every day is a learning experience.”

She spends a lot of her time coordinating with mechanics and others to prepare each Dreamliner for delivery to the customer. It starts when the newly built 787 is fueled for the first time on the flight line and up until it’s ready for delivery. That delivery process has greatly improved during the time she has been at Boeing South Carolina, Blake said. “But we can do even better,” she said, a big smile flashing across her face.

Cindy Blodgett, a Quality specialist, understands that feeling and attitude of wanting to be even better—and what it’s like to start out with no aviation or aerospace experience. She was in the first group of two dozen employees

hired by Vought for the North Charleston plant. They became known as the “alpha class.” Blodgett had been a special education teacher in her hometown of Haleyville, Ala., when her U.S. Navy husband was transferred

(Continued on Page 28)

Photos: (Far left) Automated drill machines, like the one shown at far right, help to drill approximately 10,000 holes into each aft-body fuselage section. The machine also applies fasteners and seals them into place. (Above) Antonio Nelson, Interiors Responsibility Center South Carolina team lead, works on a 787 interior end cap. **BOB FERGUSON | BOEING**

BOEING SOUTH CAROLINA: 'FIRING ON ALL CYLINDERS'

Jack Jones, who has led Boeing South Carolina operations since 2011, recently announced his retirement after a Boeing career that included leadership positions in a number of commercial and military programs. His replacement in North Charleston, Beverly Wyse, joined Boeing in 1985 and most recently served as vice president and general manager of the 737 program in Renton, Wash., where employees now are building 42 airplanes a month and will hit 52 a month starting in 2018.

In this Q&A with *Frontiers*, Jones and Wyse discuss the remarkable journey the Boeing South Carolina workforce has made, and the challenges ahead with 787 Dreamliner production there scheduled to more than double by the end of the decade. Boeing South Carolina now is building three complete 787s a month, but it also produces 10 midbody fuselage sections and 10 aft-body fuselage sections a month for 787 production in North Charleston and in Everett, Wash.

Talk about the journey, of Boeing South Carolina and the employees.

Jones: When we started, there were very few mechanics who had ever worked on a commercial airplane. But we had a very intense training program. I can tell you the journey was not easy. I also can tell you the workforce, what they lacked in experience they made up for in attitude—an unbelievable attitude. There were a lot of people who said we wouldn't be able to do it. But today this site is firing on all cylinders, better than it ever has. It was just dogged determination and expectations on the part of everyone who worked here that we could make this happen.

What are the challenges ahead?

Wyse: It's really about building on what has been put in place here and continuing to look to our fabulous teammates and what they have accomplished. You have a talented and motivated workforce that has demonstrated to itself, the company and the rest of the aerospace industry that it not only can exceed its own expectations but can break through records that the company has not passed through before ... To get to 10 a month then positioning for 12 a month and later 14 a month (seven Dreamliners produced a month by

Boeing South Carolina and seven produced by Everett) we will need teammates to take us there and figure out how to do it. ... So it's about continuing to build on the environment and the excitement that has gotten this site to where it is today.

Renton is producing 737s at rates that once would have seemed unimaginable. Are there lessons learned for Boeing South Carolina?

Wyse: A lot of the same ideas and innovations that have made Renton





successful have been used here in North Charleston and vice versa. The teams have gotten better about sharing across the company. Jack has sent people to Renton and I have sent people to North Charleston. It's very powerful the way we are able to share back and forth.

Jones: That's one of the strengths of Boeing South Carolina. And our leaders have come from around the company, from Long Beach (Calif.) and St. Louis, from Everett and Renton, from San Antonio. We have a melting pot of some of the best of Boeing, sharing all those ideas.

What would you like employees around the company to know about Boeing South Carolina?

Jones: Boeing South Carolina is the only site within Boeing that actually builds the aft- and midbody components for the 787. Every aft- and midbody fuselage section of every 787 comes through these buildings. We are producing widebody airplane components here at 10 a month and 787 Dreamliners at three a month. The 787 program is at the fastest rate of any widebody commercial airplane ever, at 10 a month. Everett builds seven a month and we build three. I'm not sure everyone really understands or appreciates that. ■

Photo: As part of the fabrication process, aft-body composite sections are cured in an autoclave, which uses heat and pressure over an extended period of time to bond the layers of carbon fiber. ALAN MARTS | BOEING

(Continued from Page 25)

to the Charleston area and she moved there. She was working for a company that made automotive drive shafts and heard about Vought while watching the news one night, and how Vought was building a plant in North Charleston to manufacture fuselage sections for a new Boeing airplane.

The alpha class met every Saturday starting in late 2005 for training. They had not yet been hired, and were not paid. That was followed by day-to-day training in January 2006. The training eventually included using a tiny autoclave in the employee HUB, which also had a small cafeteria and some classrooms.

“We could not yet play with carbon fiber,” Blodgett recalled of the HUB autoclave. “So we used fiberglass.”

Her first day on the job at Vought was April 3, 2006. Her first manager was Will Daisley. Today, Daisley is senior operations manager for composite fabrication at Boeing South Carolina.

“I’ve seen us grow from what was a green-field site where, frankly, very few of us knew what we were doing, to now, where we have a highly seasoned team,” Daisley said. “We are always looking to improve our process and to find more efficient ways to make our barrels. There are always opportunities to improve the production system.”

Before joining Vought, Daisley worked for a small composites company in Florida. He was excited by the opportunity with Vought to help push composite manufacturing technology. “One of the early challenges,” he said, “was understanding and refining the automation of the processes.”

Producing that first aft composite fuselage barrel was one of the highlights for Blodgett, who started in production. The first barrel came out of the autoclave shortly before Christmas in 2006. As part of the manufacturing process, the composite material is “bagged” for curing in the autoclave.

“It was like unwrapping a present,” Blodgett said of the day the first 787 aft-fuselage barrel was removed

from the autoclave.

Blodgett, who has been part of the planning for the new autoclave, noted that much has changed, especially since Boeing took over the Vought and Global Aeronautica operations.

“The growth has been amazing,” she said. “And our processes are constantly improving. We have learned so much as we have grown. There is so much new technology. We keep getting faster—and better.”

New tooling will be needed, too. The aft-fuselage section of the 787-10 is longer and has more windows.

“I can’t wait to see that new tooling rolling through our clean room and into the autoclave,” Blodgett said.

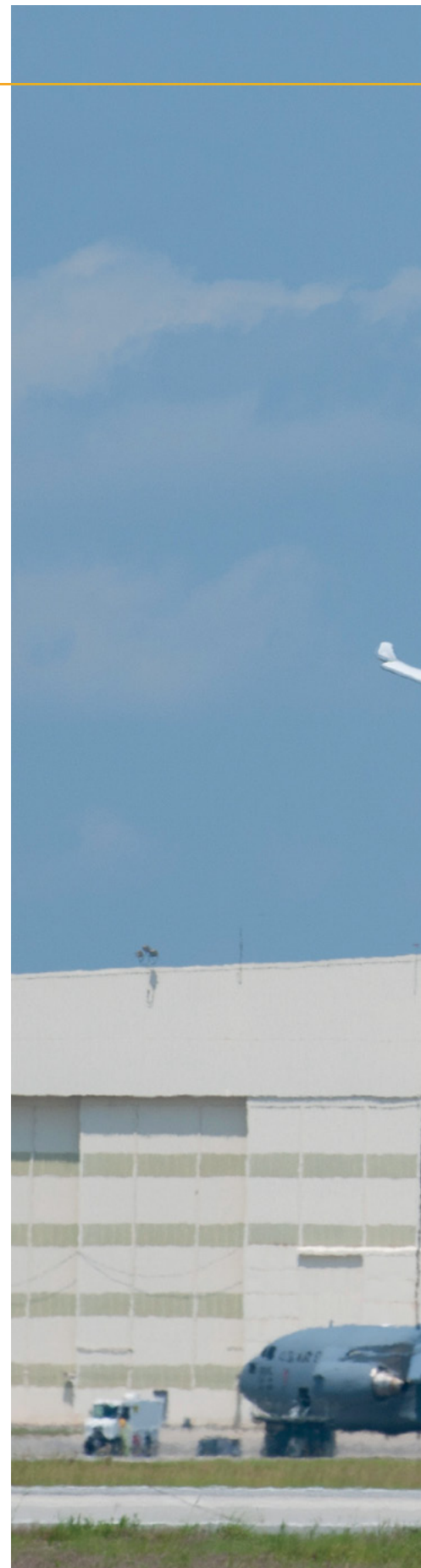
It took Blodgett and her teammates a couple of months to produce that first composite fuselage barrel for Vought. Today, employees in Aftbody Operations are producing 10 fuselage sections a month. That’s what’s needed to support the program’s production rate of 10 787s per month at the site and in Everett. And North Charleston will more than double its final assembly rate, eventually reaching seven per month by the end of the decade—a far cry from the two buildings sitting at the end of the dirt road that those first employees remember.

“Just look at how far we have come,” Blodgett said from the mezzanine above the factory floor in Aftbody Operations, where another fuselage section was about to go into the autoclave. “It’s exciting to be a part of it. The world is open to Boeing South Carolina.” ■

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Frontiers is interested in reader stories for future editorial use. Tell us about your own experience working at Boeing South Carolina at boeingfrontiers@boeing.com.

Photo: The first South Carolina-built 787 Dreamliner takes to the skies May 23, 2012, on the site’s first production test flight. The site now produces three 787 Dreamliners a month. **ALAN MARTS | BOEING**





SHIP # 279

"THE LAST ONE."



The end of C-17 production leaves employees with mixed emotions, but also with a great sense of accomplishment

BY ERIC FETTERS-WALP | PHOTOS BY BOB FERGUSON

This is the second of two *Frontiers* features about the Boeing C-17 Globemaster III. To learn more, see the February 2015 issue.

The C-17 aircraft progressing through the final assembly building in Long Beach, Calif., look nearly identical to the scores built here by employees during the past two decades.

But these are different. They're the final few models in production before the line shuts down.

As they finish seemingly routine tasks, employees pause to reflect on using certain tools for the last time. Farewell gatherings have become common, and a large area of the huge factory building sits silent, housing idle equipment. But sadness at the program's impending end is mixed with a sense of accomplishment for building a unique, high-performing airlifter that likely will fly for decades to come.

By the time the production run is complete later this year, 279 C-17s will have been built. Of those, 223 were

delivered to the U.S. Air Force. Other C-17 customers include military forces in the United Kingdom, India, Canada, Qatar, the United Arab Emirates, Kuwait and Australia, as well as the 12-nation Strategic Airlift Capability consortium of NATO and Partnership for Peace nations.

"It's been a really great ride," said Tony Giamberdino, a Paint Shop and Ramp manager who's worked on the C-17 program since 1993. "We keep communicating and help each other through this. We say 'no one left behind' up to the last day. We will go with all the pride we can and make the last C-17 as good as the first one—actually better than the first."

Boeing heritage company McDonnell

Photos: (Far left) An employee-written message on part of the final C-17 fuselage to be assembled in the Long Beach, Calif., factory commemorates it as the 279th aircraft to be built. (Above) After production workers attach the massive wings of the C-17 to the body, the fuselage is ready to be moved to the next step on the final assembly line.

Douglas won the contract to produce a large, powerful cargo airlifter in 1981, though a full-scale development contract wasn't awarded until four years later, kicking off detailed design, engineering and production work. The first C-17 took off on its debut flight on Sept. 15, 1991—a day that many employees still with the program remember in detail.

"I can still see T-1 take off. I close my eyes and see us standing in the back of a friend's pickup near the fence, watching it take off," said Roscoe Litchard, senior structural design engineer for

the aircraft's wing and control surfaces.

Manuch Nassiri, the program's chief engineer, said he remembers the effort that went into designing and building the first test aircraft, right up to long days and nights on the flight ramp right before the first flight. But there was more hard work ahead. In the immediate years after first flight, the C-17 team reworked the aircraft design to meet the U.S. Air Force's exacting specifications. Cost overruns also threatened the program. At one point, the Air Force threatened to order no more than 40 aircraft.

"It was very challenging, but also very rewarding," said Ron Gill, a Technical Fellow and manufacturing engineer who served on teams tasked with reducing production costs and improving quality on the program. "I believe that without that initiative, we would have shut down a long time ago."

He and others credit a series of leaders in the company and the Air Force who worked closely to solve the program's challenges. "It went from that to being critically acclaimed," said Drew Oberbeck, international



program manager for the C-17. He added that the new approach taken on the program then included ideas, such as greater employee involvement, that are now used across Boeing. “We empowered the teams from the top down. I think that’s what made it an outstanding program, with us continuously improving the aircraft.”

The C-17 won the prestigious Collier Trophy for 1994, symbolizing the top aeronautical achievement of that year. Boeing Airlift and Tanker Programs, maker of the C-17, also

received the United States’ top award for quality—the Malcolm Baldrige National Quality Award—for 1998. Additionally, C-17s have set 33 world records during their test flights.

For the employees who designed and built the aircraft, however, the most meaningful praise over the years for the C-17’s performance has come from the military pilots and crew who fly the aircraft, sometimes in harrowing conditions, said Craig Johnson, team leader on the wing-half join.

“They will pull us aside during their

visits here and thank us for what the plane can do,” he said. Michael Diaspro, a Major Joint mechanic, said he takes the pilots’ stories personally. “People’s lives depend on it. People have described the C-17 as overbuilt, but that’s probably a good thing.”

The C-17 also has served as

Photos: (Far left) Structure mechanic Robert Williams performs work on a vertical stabilizer. (Below) One of the last C-17s to be built at the Long Beach plant progresses through final assembly in late January.



“It’s one of the top-of-the-line workhorses out there. In terms of reliability, this is the best they’ve got. ... You’re like a little kid when you see one take off. You can say, ‘I did something on that.’”

—Richard Crocker, structure mechanic

“To see that last one flying out, that probably will be the most difficult thing to watch. The finality ... will be something that will take a little while to fully grasp.”

—Ron Gill, Technical Fellow and C-17 manufacturing engineer

Air Force One at times. John Terberg, the program's Supplier Management director, said one of his favorite moments was when President Clinton described how the aircraft safely took him to and from war-torn Bosnia in the mid-1990s. Terberg describes the airlifter as "a tank built with Mercedes-level quality."

In addition to serving U.S. forces and those of allied nations in Afghanistan, Iraq, the Balkans and other major conflicts since the 1990s, the C-17 has ferried thousands of people away from disasters, including major earthquakes and typhoons. It also carried one of the world's best-known orcas, Keiko, in 1998 when the whale was returned to the open ocean.

"You see the airplane on TV, you see its importance in the world. There's a great sense of pride attached to that, to see how important it can be in saving human lives," said Tony Murray, a senior manager of Production Operations. "It never gets old seeing that airplane fly, especially when you know you've touched each one that was built."

The final C-17 assembled in Long Beach is expected to be finished by the end of summer this year. Some of the involved employees are retiring, some will transition to jobs in the C-17 support and sustainment program, while others are transferring to other programs within Boeing. A few still are unsure of what they will do next. But nearly all will leave with fond feelings for their time on the program.

Lynne Jungers, the program's customer engagement specialist, said she is making sure she visits the production floor every day now, as she'll miss seeing the activity there. Dave Marendino, a Production Operations senior manager who has spent his entire Boeing career on the program, said he and a few other

Photos: (Clockwise from top) Electrician Kathie Trujillo installs wiring inside the forward section of a C-17 fuselage; Final Assembly employees stand inside the cavernous cargo area of a C-17, visible when the aircraft's huge rear door is open; Richard Crocker, a structure mechanic, installs a panel near the main landing gear.

"I love my job, I love what I do. But they say all good things must come to an end."

—Kathie Trujillo, electrician

"I'll be surfing out at Huntington Beach (Calif.) and see it fly overhead on a training mission, and I know I worked on it. There is a great sense of pride out there among the people building the aircraft."

—Cary Lacayo, Aircraft Maintenance technician and team lead





“It’s still exciting when the plane
flies away with the customer.
It still causes goose bumps.”

—Tony Giamberdino, Paint Shop and Ramp manager

“This airplane is not even
close to being ‘done.’”

—Manuch Nassiri, chief engineer on the C-17 program





employees who've always sat together at lunch are continuing that tradition—even though there's no food service available in the cafeteria now.

Human Resources Generalist Darlene Duncan finds herself assisting employees whom she helped hire years ago as they now transition from the end of their jobs. She said she will miss the people on the program the most, echoing many of her co-workers.

"The people here—we've been like a big family," said Gregory Atkins, who helps install flight control systems in the C-17's tail, a job that keeps him three stories above the factory floor much of the time. Several years ago, when he battled stomach cancer, his co-workers supported him during this difficult time by pulling together resources for him without telling him, he said.

"The plane brought us together, it was our purpose. But what you enjoy is working with the people," Litchard said.

Ken Barry, chief architect for Avionics and Flight Controls, said he's grateful to have been part of the C-17's production run, adding that many people have been instrumental in the program's success. And while no more are expected to be built beyond this year, he knows the aircraft has a long future ahead of it.

"It's not inconceivable this could be flying until 2060," Barry said. "We like to say the last pilots who will fly this aircraft still haven't been born yet." ■

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Frontiers is interested in reader stories for future editorial use. Tell us about your own experience with the C-17 Globemaster III at boeingfrontiers@boeing.com.

Photos: (From far left) Mechanic Gregory Atkins installs flight controls in a C-17's tail; Mel Frontray, a Final Assembly Interior mechanic, prepares to install a door on the forward fuselage of a C-17.

CUSTOMER PROFILE



Royal ascent

Morocco's flag carrier charts new path to success with delivery of its first 787

BY KEELAN MORRIS

When the king of Morocco, Mohammed VI, accepted the keys to Royal Air Maroc's first 787 Dreamliner in January, it marked the beginning of a new chapter for the North African state's national airline.

It was the first time in the airline's history that the king of Morocco had officiated at an airplane delivery ceremony—an indication of the significance that the 787, one of five that Royal Air Maroc has on order, will play in its future success.

"The Dreamliners are integral to Royal Air Maroc's expansion plans," said Driss Benhima, Royal Air Maroc's chairman and CEO.

The airline's first 787-8 serves on a route from Casablanca to New York's John F. Kennedy International Airport. Others are planned for extended operations to North America and South America. The 787's two-class cabin configuration, with 18 business-class seats and 256 economy seats,

represents a 17 percent increase in total capacity for the airline and an expansion of premium seating, Benhima explained.

Although a flight path to growth lies ahead, this was not always so for the airline, which has navigated through some congested skies. An open-skies agreement with the European Union in 2006 resulted in the entry into market of 44 airlines, leaving Royal Air Maroc facing competitive challenges at the end of the past decade.

"We faced stiff competition on our European routes, particularly from low-cost carriers, which resulted in operating losses in 2010 and 2011," Benhima said.

The airline responded by restructuring its routes to shift more capacity to its hub airport in Casablanca.

As a result, Royal Air Maroc achieved record operating profits in 2012 and 2013.

The airline has a strong West Africa

network that extends southward to Angola and serves every West Africa nation except Equatorial Guinea, with 31 destinations. Paired with its European network, which serves 32 destinations, the route structure positions Royal Air Maroc as an unrivaled bridge between the two continents.

"The geographic position of our hub airport is a key strength for the airline," Benhima said.

Royal Air Maroc has a fleet of 53 airplanes, most of them Boeing variants, including Next-Generation 737s, 767-300s, a 747-400 and the 787 Dreamliner. Boeing's relationship with the airline stretches back more than 40 years to the delivery of Royal Air Maroc's first Boeing airplane, a 727-200.

"We've taken delivery of 62 Boeing airplanes since our first one in May 1970," Benhima said, "but none is more important to the airline's future than the 787 Dreamliner." ■

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Photo: Royal Air Maroc's first 787 Dreamliner takes off on a test flight late last year at Paine Field in Everett, Wash. The airline took delivery of the airplane in early January. **TIM STAKE | BOEING**

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