

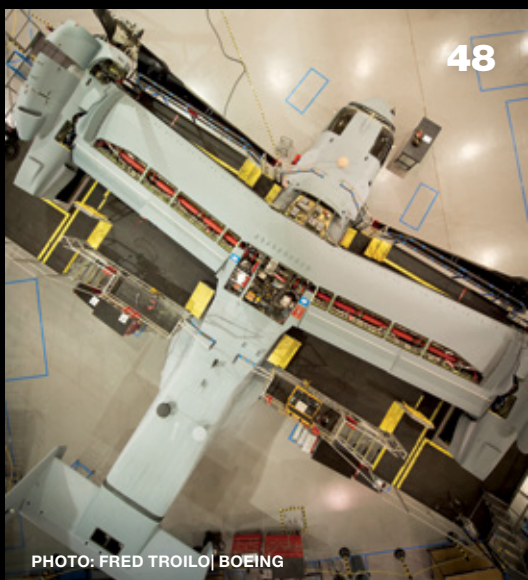
Frontiers



Uncompromising
services

Fast-growing services and support
business helps fuel Boeing growth

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The Dubai Airshow this month brings the global aerospace community to the United Arab Emirates. Boeing has a strong, three-decades-long relationship with the UAE, which has transformed into a major aerospace hub.

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When a V-22 Osprey leaves the Boeing factory near Philadelphia, the next stop is at partner Bell Helicopter's plant in Amarillo, Texas. There, the advanced tiltrotor aircraft are readied for delivery to customers following the addition of wings, empennage and rotors.

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Cover: From left, Ismail Abdullah, Lyn Carone, Wistremundo Dones and Chris Wynkoop provide 787 Dreamliner fleet monitoring and support in the Operational Control Center in Everett, Wash. BOB FERGUSON | BOEING

Photo: Paul Rubie inspects welds at the Quick Response Center, a Boeing facility in Huntington Beach, Calif., that provides parts for both military and commercial aircraft. BOB FERGUSON | BOEING

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The stories behind the ads in this issue.



This new ad features a poster Boeing is deploying in conjunction with this year's Safety Promise, an enterprisewide annual recommitment to safety. The poster and others are available on the Go for Zero website on the Boeing intranet.



Created to demonstrate Boeing's appreciation and gratitude to veterans, this ad will run in *The Washington Post* and *The Seattle Times* on Nov. 11, which is Veterans Day in the United States and known as Remembrance Day in other countries.



Part of the "A Better Way to Fly" campaign, "Quieter" is the latest in a series of ads showcasing the many ways Boeing airplanes and services enable opportunity and success for customers. The ads are running in trade publications and online.



The 2015 Boeing Store Wish Book features more than two dozen pages of official Boeing Store merchandise including seasonal apparel, gifts, gadgets, collectibles and more. Visit your local Boeing Store or boeingstore.com.



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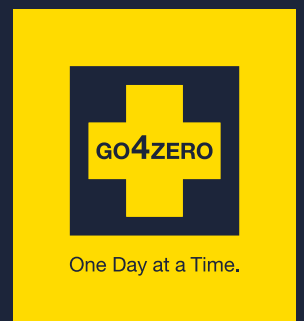
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Leanne Caret
President
Global Services & Support
Boeing Defense, Space & Security

Stan Deal
Senior vice president
Commercial Aviation Services
Boeing Commercial Airplanes



A world of services

Boeing focuses on global leadership in providing support and services

In this Q&A, Leanne Caret, president of Boeing Defense, Space & Security's Global Services & Support, and Stan Deal, senior vice president of Commercial Airplanes' Commercial Aviation Services, discuss the importance of the services business to the company's future and growth. For more about Boeing's growing services business, see Page 18.

When people think about Boeing, they think about airplanes, satellites, helicopters and spacecraft. Why are services critical to Boeing's business?

CARET: It's true—there's nothing quite like a roaring takeoff or a spectacular launch, but what people don't often consider is all the work it took to get there. Behind the scenes, there are literally thousands of people making sure the maintenance, engineering, training and logistics are in place, long before an aircraft or spacecraft gets off the ground. All this takes place largely out of sight from most fliers, but it's really important to our customers. For Boeing, it makes sense that we don't just sell platforms but also the services that our customers need to use once they take delivery.

What is the future vision for Boeing services?

DEAL: Strategically, where we are heading as a company is to grow Boeing's services businesses two or even three times the size we are today over the next decade. Boeing services businesses, combined, has the potential to be as large as our two product businesses. For the past year, Leanne's team and my team have been working together, focusing on growing our business and becoming the global leader in providing support and service to aerospace customers.

Boeing has thousands of competitors in the services business. Why should customers turn to Boeing first?

CARET: It is an exciting time. We have almost 100 years of providing support to our customers. That translates into



real experience that our competitors can't match. That makes a difference when you need parts quickly for a C-17 or are trying to convert a 737 passenger airplane into a cargo freighter. We know how to do this better than anyone else.

We also have all the resources of Boeing at our disposal, which means a worldwide supply chain that is present right in our customers' backyards. We have technical reach-back into the aircraft programs and strong relationships with the aircraft design and engineering teams. And, maybe most important, our employees are the greatest any company could have working for them. The talent and dedication of our people really is a differentiator, and it shows in the quality of our work.

Leaders of CAS and GS&S have been discussing ways to work more

closely together. What progress have you made?

DEAL: We've made a lot of headway working together. Our Aviall parts distribution, repair and refurbishment subsidiary is a great example of how we're using all the assets at our disposal to serve our customers better than ever.

We're also learning from each other all the time and developing new and better services based on what we find out. For example, our Airplane Health Monitoring service, which was developed to enable airlines to keep a pulse on the status of their fleet, is now being used on some defense platforms. We also have some of our technical data authors and illustrators working together on assignments between our organizations, which will help us be more flexible and responsive to customers.

How will employees benefit from CAS and GS&S working more closely together?

CARET: It will put some new career development opportunities in front of our employees that they may not have considered if they've previously only worked in the commercial or the defense parts of our business.

DEAL: I definitely agree. We are looking to grow our share of the services market, and that will benefit employees. A key ingredient to accomplish this is aggressively working our cost and our flow time. To win in the market, we have to question how we do things.

What does CAS expect to learn from BDS, and what does GS&S expect to learn from Commercial Airplanes?

CARET: Our customers may be very different, but a lot of the work we do for them is the same. We are aggressively focusing on ways to be more flexible, to respond to customers more quickly and to identify synergies between CAS and GS&S that will help drive down our costs. Our innovation isn't always in the technical areas. It extends to new business models, contracting approaches and distribution techniques that make us even more affordable.

DEAL: We're off to a great start, but we've only scratched the surface.

What's in it for our customers?

DEAL: Everything we're doing is focused on providing Boeing customers with better service, better support and more value at a lower cost.

CARET: I totally agree. Our customers depend on us. If we can get even better at helping them do their jobs, then it's a win-win scenario. ■

SNAPSHOT

Perfecto

The Boeing-built Morelos-3 satellite for the Mexican government launches last month aboard an Atlas V rocket from Cape Canaveral Air Force Station in Florida. It was the 100th consecutive successful launch for the United Launch Alliance, a partnership of Boeing and Lockheed Martin, since its formation in 2006. The 702HP (high power) geomobile satellite is part of the Mexsat constellation of satellites, which provides secure communications for Mexico's national security needs as well as communications to rural areas. This includes education and health programs, voice, data, video and Internet. PHOTO: UNITED LAUNCH ALLIANCE





QUOTABLES

“Virtually everyone can carry on a bag, which is fantastic.”

— Sangita Woerner, vice president of marketing at Alaska Airlines, the first airline to introduce Boeing’s new 737 Space Bins, which increase the room for carry-on baggage by about 48 percent. *USA Today*, Oct. 9

“It’s a great feeling to hear how our customer relies on us to keep the A-10 flying.”

— Mickey McPartland, project engineer on the A-10 program, during an event to celebrate the 100th set of new Boeing-enhanced wings fitted on the U.S. Air Force’s aging fleet of A-10 Thunderbolt ground-attack aircraft. *Boeing News Now*, Oct. 6

“Every time I step onto a plane and see it was built by Boeing, I stand a little taller.”

— Sharon Bernhardt, an enterprise auditor in Boeing’s Office of Internal Governance in Arlington, Va. Read her story, and those of other employees, industry colleagues and enthusiasts, on Boeing’s centennial story sharing website at boeing.com/our-stories.

Virtual vision

Immersive Development team's 'playground for engineers' sparks innovation, answers

BY BRIAN CARBREY, AS TOLD TO JOANNA LEATH

As technical lead for the Immersive Development Environment (ImDev) in St. Louis, part of the Phantom Works organization, Brian Carbrey and his team apply virtual capabilities to help Boeing create innovative new products and solve problems across its customer base.

In the late '70s, my parents brought me to St. Louis when the space shuttle came to McDonnell Douglas, carried on the back of a modified 747. When I saw the shuttle on the ramp ... that was cool. It was the most complex engineering system humans had ever built. And it was right in front of me. I was 8 years old. I turned to my dad and said, "I wanna do that."

And I do. Aerospace ignites a passion in me and now, with my ImDev team, I help bring people together for the common cause of developing the future of aerospace. We're giving Boeing teams the tools and collaborative environment they need to create what's next.

When we first started out, we were only looking at how to create new military products. Since then, we've realized that virtual reality can be applied at every step of the product life cycle, on products all across the enterprise. Since realizing this, things have been crazy. It's been amazing.

Many of the teams we work with use the Computer Aided Visualization Environment, or CAVE. It is a small, dark room where we project high-definition, stereoscopic 3-D life-size product images. Forget about PowerPoint charts—we can virtually put customers into the product on day one. Instead of having to physically build parts to see if they work together, I show teams how to turn drawings into life-size, virtual versions of the product in a matter of minutes. It allows people to evaluate parts and products long

before cutting metal and saves weeks, sometimes months, of time.

The other part that keeps us busy is the motion-capture area. With today's technologies we have "neighbors" who live halfway around the world and I wanted to apply this principle to product development. Our goal was to connect people: People to people, people to product. So, we created an environment where people can enter into a virtual reality as an avatar, regardless of where they are. It allows us to interact in real time with products that may or may not already be built, with people all over the globe.

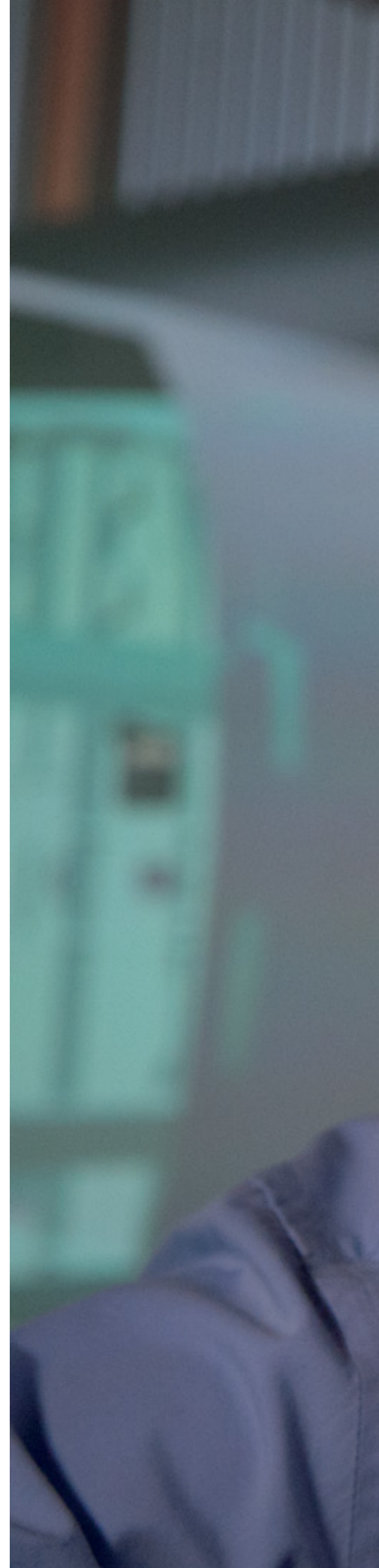
Seeing teams work together to advance aerospace is a beautiful thing, and I get to see it every day. When I was a kid, I was always looking up. I wanted to know what was out there, what was up there.

That's what still motivates me today. I want to know what's out there. I want to know how fast we can go. We built ImDev to help teams answer those questions.

With ImDev we essentially created a playground for engineers. I see the young person come out of these men and women using it. It's pure passion and I love seeing that sparked. It helps them think differently. It's a place where people come together and realize: We can do this. It's a place where we figure out: What's next? What else can we do?

It's the "what's next" piece that gets me. I was inspired by the people who came before me to do what I do. The men and women who put the space shuttle on that ramp in St. Louis when I was 8 did that. We have to invoke that passion in the next generation so they can show us what's next. That's my responsibility. Our innovation can change people's lives. And I don't take that lightly. ■

JOANNA.M.LEATH@BOEING.COM



Brian Carbrey

HAS WORKED FOR BOEING:
22 years

LOCATION:
St. Louis

ORGANIZATION:
Phantom Works

Brian Carbrey wears specialized glasses that clarify 3-D holograms of engineering models.

PHOTO: BOB FERGUSON | BOEING





NO SMOKING
OR OPEN FLAMES
HERE

HISTORICAL PERSPECTIVE

Special delivery

New 737 center opens where Boeing made history getting airplanes to customers

BY MICHAEL LOMBARDI

Delivering an airplane to a customer is not just the final step in the production process but one of the most important. For customers buying a multimillion-dollar, high-technology jetliner, it represents the ultimate purchase experience—and one Boeing wants to make sure is a first-class event.

Boeing recently built new, state-of-the-art delivery centers for its widebody jets manufactured in Everett, Wash., and for 787 Dreamliners made in North Charleston, S.C.

And last month, Commercial Airplanes opened an expanded and remodeled, 90,000-square-foot (8,400-square-meter) delivery center for its 737 jetliners at Boeing Field in Seattle, replacing a decades-old facility there. The new center includes offices for customers, an area for special events, a departure lounge with a security screening area and boarding ramp, as well as enough ramp space for three 737s.

It's going to be a busy place.

The 737 soon will pass the DC-3 family to become the most produced commercial airplane in history. Boeing plans to increase 737 production rates from 42 airplanes a month to 52 by 2018. "The customers are already commenting on how much they love the new facilities," said Erik Nelson, vice president of Field Operations and Delivery for the 737 program. "The larger, more capable delivery center is essential as we continue to increase our rates and start building the 737 MAX." Deliveries of Boeing's new 737 MAX are scheduled to begin in 2017.

In the early days of the company,

delivery of an airplane was not performed with any ceremony and often was as mundane as packing the parts into a shipping crate. There were few airfields back then to connect Seattle to the final destination, so disassembled Boeing airplanes often were shipped by boat and rail.

Indeed, the first Boeing airplanes were floatplanes, as the best open, level place for an airplane to take off from was one of Seattle's many waterways.

Starting in 1920, Boeing was building and delivering large numbers

of rebuilt U.S. Army DH-4 bombers, which were assembled and delivered from a new airfield called Sand Point on a spit of land that projected into

Photos: (Far left) Parked outside the Boeing hangar at Boeing Field, P-12E fighters await delivery to the U.S. Army Air Corps in October 1931. (Below) The first Delivery Center for commercial jets was established at the south end of Boeing Field, adjacent to the Boeing Developmental Center. Here, 707s and 727s are readied for delivery. BOEING ARCHIVES



Seattle's Lake Washington. It was the same airfield where the Douglas World Cruisers began and finished their first-ever around-the-world flight in 1924. From Sand Point, Boeing also delivered Army and U.S. Navy fighters as well as the company's first production commercial airplanes, the Model 40.

In 1926, the U.S. Navy began to turn Sand Point into a naval air station and the local community responded by approving the construction of the region's first municipal airport and dedicating it to William Boeing. The King County International Airport, also known as Boeing Field, opened in 1928. And the Boeing Airplane Company established a hangar at the field and soon began to deliver airplanes there—the first a Boeing Model 80.

During World War II, a camouflaged Boeing Field was the site for deliveries of the B-17 Flying Fortress and B-29 Stratofortress. At the height of production Boeing handed over an average of 12 B-17s each day.

With the beginning of the jet age and introduction of the 707 commercial jetliner, Boeing opened a Commercial Delivery Center at the south end of Boeing Field. Commercial deliveries later were moved to the north end of the airport; the former site now is used for testing and delivery of military derivatives of Boeing commercial jets, including the E-3 Sentry Airborne Warning and Control System, or AWACS, and P-8A Poseidon.

Now, the 737 has a new, upgraded delivery center, the most recent chapter in Boeing's century-long history of delivering world-class jetliners. And with the 737 order backlog numbering in the thousands, it looks to stay a busy place for many years to come. ■

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Photos: (Top) At nearly 6,000 square feet (560 square meters), the entryway of the Seattle Delivery Center is the focal point of the facility, connecting the new building with the existing one, which also has been remodeled. **JIM ANDERSON | BOEING** (Bottom) A Xiamen Air 737-800, parked and ready for delivery from one of three new covered jetways at the Seattle Delivery Center. **MARIAN LOCKHART | BOEING**



Every branch.

Every war.

Every story.

Today, we honor those who served
and those who serve.

For all they have given to the country,
we can never thank them enough.

 **BOEING**



An aerial view of London, England, seen through the curved frames of airplane windows. The scene is bathed in the warm, golden light of a sunset or sunrise. On the left, the Elizabeth Tower (Big Ben) stands prominently. The River Thames flows through the center, with several boats and bridges visible. In the background, the London skyline is visible, including the London Eye on the right. The overall atmosphere is serene and picturesque.

FROM LONDON TO QUIETER A BETTER WAY TO FLY.



Boeing commercial airplanes are quieter than ever, significantly reducing noise near airports. They're also the world's most fuel-efficient airplanes, cutting greenhouse gas emissions by up to 25%. And the Boeing ecoDemonstrator program is accelerating the development and use of new technologies to further minimize aviation's environmental footprint around the world. That's a better way to fly.



Accelerating

Boeing's strong commercial and defense businesses have an essential partner—services

STORIES BY DAN RALEY

New airplanes roll out of the factory and down the runway and disappear into the clouds, headed for any number of global destinations. This particular moment marks not closure but another beginning—in Boeing's business relationship with its customers.

Customer support and services, which involve everything from flight training to parts distribution to predictive data analytics for maintenance and repairs, and available to both commercial and military customers, come into play whenever an aircraft changes hands. The business represents a growth area with upward projections that can't be understated—Boeing estimates the value of the services market over the next 20 years to equal the markets of either the single-aisle or twin-aisle commercial airplanes.

Services have evolved to the point that Boeing now considers them as essential as sales and production, effectively keeping the company and the customer connected for decades over the life of the product, according to Stan Deal, senior vice president, Commercial Aviation Services.

"It's an important area for us to accelerate and grow," Deal said. "Where we're headed as a company is a deliberate focus on how services become as important to our business as either Commercial Airplanes or Defense, Space & Security."

Eighty years ago, Boeing launched its services business when Herbert "Nemo" Ponceti boarded a ship and escorted 11 disassembled

P-26 "Peashooter" fighters from Seattle to Shanghai. Ponceti was an engineer, mechanic and training expert, a resourceful aviation jack-of-all-trades. In 1935, he taught Chinese pilots and mechanics how to fly and fix the airplane once he showed them how to reassemble it. He had no support system of any kind, no call center, no parts warehouse. He traveled only with a suitcase stuffed with tools and manuals.

Today, Commercial Aviation Services, or CAS, employs more than 11,000 people in 60 countries. In March, CAS converted a facility that made C-17 parts in Huntington Beach, Calif., into the Quick Response Center, which deals globally with urgent equipment replacement needs for both commercial and military aircraft customers. Last year, CAS also opened a Customer Operations center in California and generated record sales, which included parts provided by its wholly owned Aviall subsidiary and navigation charts developed by the Jeppesen subsidiary. CAS is training more pilots and crews than at any time in its history, according to Boeing.

Meanwhile, Global Services & Support, part of Boeing Defense, Space & Security, has more than 12,800 employees working at 260 locations worldwide. In April, it opened the 10,800-square-foot (1,000-square-meter) Boeing Avionics Maintenance, Repair and Overhaul center in the Republic of Korea, one of the first of its kind outside the United States, and in August it signed an agreement with Saudia Aerospace Engineering Industries and Alsalam Aircraft Company to create a Saudi Rotorcraft Support Center in the Kingdom of Saudi Arabia.

These groundbreaking facilities, combined with businesses in Boeing



GLOBAL PRESENCE

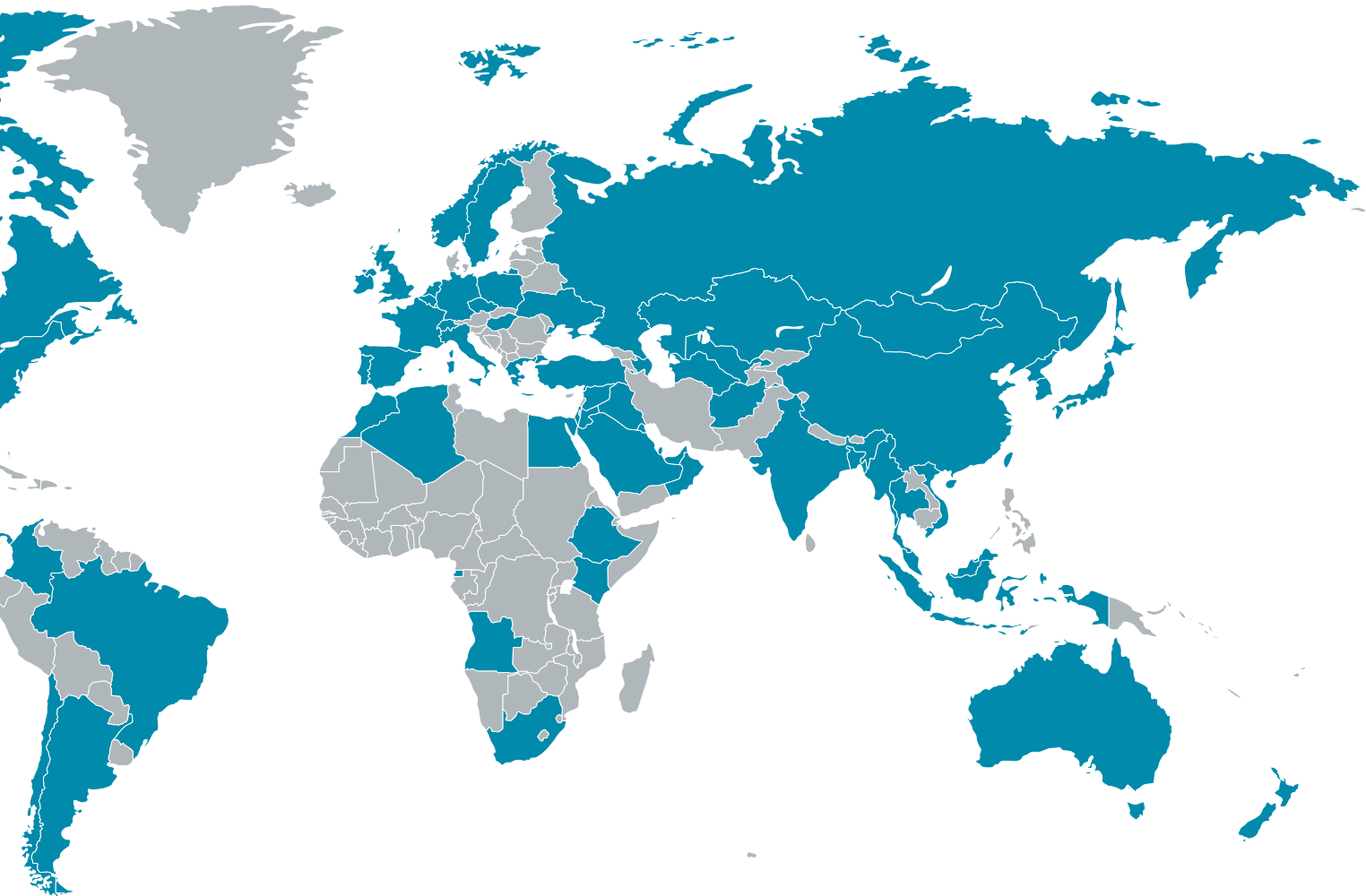
11,000+ CAS employees worldwide

12,800+ GS&S employees worldwide

Defence Australia and Boeing Defence United Kingdom, are a true reflection of global growth and local presence, according to Leanne Caret, president, Global Services & Support. Also known as GS&S, the organization itself has more than 16,500 contracts and orders in hand.

"Uncompromising service really speaks to itself—we have to deliver," Caret said. "Our business is based on those men and women who, 365 days a year, put themselves in harm's way. What we provide has to have the highest quality, reliability and availability so those customers can have confidence that when they conduct their mission, those services will not only get them there but also bring them home."

GROWTH



Boeing continues to explore ways to streamline its aviation services business and create opportunities, and CAS and GS&S have been trading best practices. For example, the newly revamped Quick Response Center pursues dual certification and common delivery of aviation parts delivered to commercial and defense customers, while the V-22 Readiness and Operations Center in Ridley Township, Pa., has created a data analytics system currently under study by every major major business unit in the company.

For nine years, Boeing has owned Aviall, the world's largest provider of new aviation parts and related aftermarket services. Each

company relies on its organizational strengths and customer alliances to support the other.

"Instead of thinking of Aviall, commercial and defense as completely separate entities, we're developing more of an integrated approach to supporting Boeing customers," Deal said. "We intend to grow Boeing's services business by providing outstanding support and driving efficiency for our customers."

This approach is a common theme now radiating throughout the Boeing services sector—which is to give the customer something it can't get anywhere else and do it in the most cohesive manner possible, Deal explained.

"Every day, GS&S and CAS are demonstrating the power of 'One Boeing,'" Caret said. "We partner around the globe so we become a true enabler to the rest of the company." ►

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The wide variety of customer support and services provided by Boeing is detailed in the following pages.

ILLUSTRATION: Boeing services for commercial and defense customers extend to every corner of the globe and involve more than 23,000 employees.

BOEING | MAP GRAPHICS: SHUTTERSTOCK

Right **PART**, right **PLACE**, right **TIME**

The call came into the shop after closing time. A broken hose had grounded a Teddy Bear Transport airplane, which ferries children in need of critical care, at nearby Dallas/Fort Worth International Airport. The aviation team asked Aviall, a wholly owned Boeing subsidiary since 2006, for help.

Danny Flores, who works in Aviall's Global Repair Services, didn't defer to the clock. He jumped in and made a replacement hose as quickly as possible and had it rushed to the waiting customer.

"They said it was an emergency," recalled Flores, an 18-year employee. "I was helping somebody out."

Not every Aviall work order comes with life-or-death implications, but the Texas-based company—the world's largest provider of aviation parts and related aftermarket services, according to the company—still fields each request with a sense of urgency.

Aviall and Boeing fit together like parts and distribution. With aviation services projected to offer a robust marketplace well into the future, the companies have pooled resources and rely on each other to generate opportunities, according to their leaders.

This past year, Boeing secured a defense production contract for the Next Generation Automated Test System worth \$100 million, influenced in part by Aviall's working relationships with 14 of the suppliers involved, according to Ed Dolanski, Aviall president and chief executive officer.

Boeing Defense, Space & Security was able to use Aviall to competitively bid for the contract, and more programs across Boeing are recognizing this potential to leverage subsidiaries like Aviall, he said.

"When it comes to being a distributor, agility and efficiency are absolutely key," Dolanski said. "We have a very lean organization. We don't have the largest team, if measured by number of employees—we have a very capable one that leverages technology to move

a lot of product through the pipeline. We're able to take commercial best practices and replicate them in the defense side of our company, and enable Boeing to leverage them."

Aviall, with 40 global locations, is always open, always busy. This international presence, a global sales force and same-day distribution are just a few of Aviall's competitive advantages. Its Central Distribution Center covers 500,000 square feet (46,500 square meters) and sits north of the world's ninth-busiest airport.

With its rows and rows of ceiling-high storage, the warehouse holds 2.4 million aviation parts of inventory worth more than \$2 billion. Its employees pick 12,000 to 15,000 parts per day, or three per outgoing box. It operates 24 hours.

Shipping sets up on one side of the rectangular warehouse, receiving on the other, with both areas surrounded by outside loading docks. Shiny red- and black-colored forklifts glide down the aisles between checkout and receiving stands, delivering and retrieving aviation parts nonstop. The vehicles are constantly beeping, both as a safety protocol when moving and evidence of the large volume of customer orders.

Each employee among the nearly 900 who work in Dallas wears an Aviall T-shirt or polo shirt on the job to foster a sense of teamwork. That includes Soure Ou, a shipping picker for nearly a year and one who is highly motivated to keep orders moving.

"We keep the world flying," said Ou as he carefully scanned a part. "I'm so proud to have this job."

Flat-screen TVs mounted high on the warehouse walls track orders and shipments. Three thousand orders, most encased in Aviall's signature white box, are shipped each day from Dallas, with 45,600 from all facilities worldwide. Aviall has 25,000 customers. There is no shortage of parts requests.

"We have so much going on," said Joshua Penelle, government supply





coordinator, while wrapping three oversized airplane tires in plastic. “Everybody has to do his or her part for the team. When we joined the Boeing team, that’s when our growth went through the roof.”

Boeing is in the unique position of being a parent company, customer and supplier, Dolanski explained. It orders a significant number of aviation parts from the distributor. Boeing also has deeply influenced, according to Aviall leaders and employees, the adoption of additional workplace safety measures.

“We don’t just think of ourselves as Aviall—we are Boeing,” Dolanski said. “We represent the brand called Aviall, which represents 240 original equipment

manufacturers, companies such as G.E., Rolls-Royce and Honeywell.”

Aviall, which stands for “aviation for all market segments,” offers same-day shipping for orders placed by 5 p.m. CST, enabling outgoing packages to reach FedEx by 8:30 p.m. for overnight flight connections. The warehouse shipping-rate success

Photos: (Clockwise from top) Aviall post pickers Douangmala Keovychith, left, and Aliquah Powell double-check a parts order in the Dallas-area warehouse; Christopher Hernandez renews a part in the Global Repair Services center at the Texas site; Aviall employee Carl Medford scans an aviation component number from an elevated forklift. BOB FERGUSON | BOEING





stands at 99.6 percent and quality control at 99.8 percent, with still plenty of room for improvement, according to Pat Coward, Aviall Dallas operations leader for four years.

The Boeing-Aviall relationship bodes well for the future, with new distribution and repair services under consideration five to 10 years out and beyond, Coward said.

“As part of ‘One Boeing,’ I think there’s a lot of opportunity for us to work together,” Coward said. “We’ve got all of Boeing’s intellect and buying power, and we have our distribution capabilities. There’s a huge chance for us to share best practices, especially within Commercial Aviation Services and Global Services & Support.”

In Dallas, Aviall employees prepare military parts for shipment in a secure area in the middle of the warehouse.

Quality control must be 100 percent—items are double- and triple-checked. Packages require documentation and security precautions that continually change and differ from commercial and general aviation transactions.

Military parts represent a significant Aviall growth area—the warehouse space for these parts has tripled in size, and the workforce quadrupled, since government shipping lead Timothy Fults joined the division eight years ago. He said he comes to work with plenty of motivation to get the job done right.

“I have a good sense of purpose here,” Fults said. “I feel like I matter. These parts are going on aircraft that our troops are flying. It’s important to me.”

The warehouse is only half of Aviall’s bustling business in Dallas. The Global Repair Services center occupies

another building directly opposite the Central Distribution Center. Employees service or repair hoses, tires, wheels and brakes, batteries, and avionics packs for general aviation, commercial aviation and military customers. During the past 12 months, Aviall has logged 82,000 customer repairs. It also manages repair services for items that the company doesn’t routinely fix.

People often drop off products in need of repair at the site.

“We love it when a customer pulls up to the door—because that’s how we started,” said Dave Burch, manager for Aviall Dallas battery and wheel and brake. “Face to face with a customer is huge for us. That’s how they get to know us and we get to know them.”

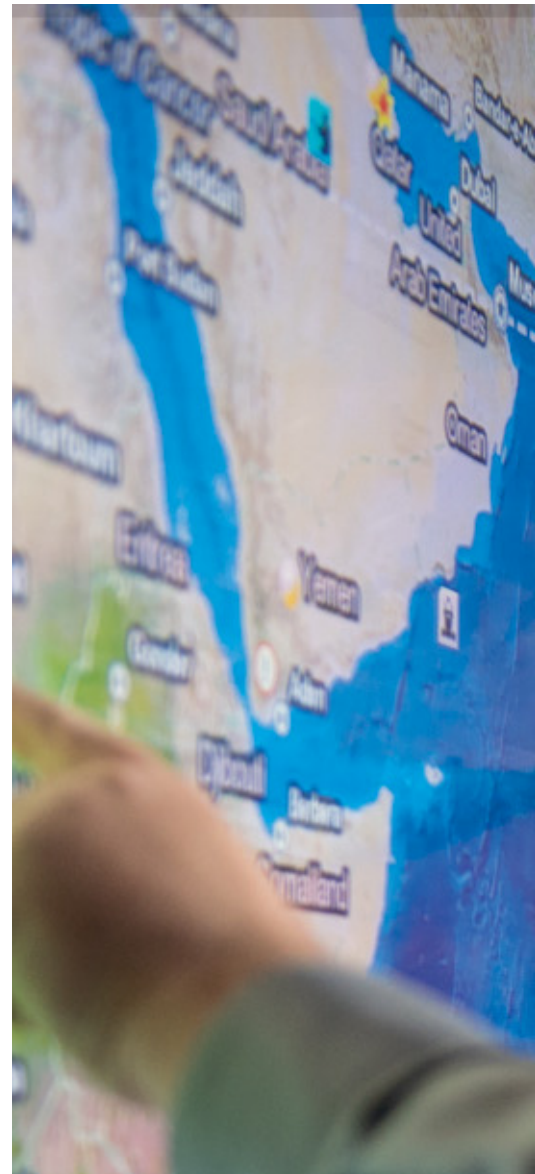
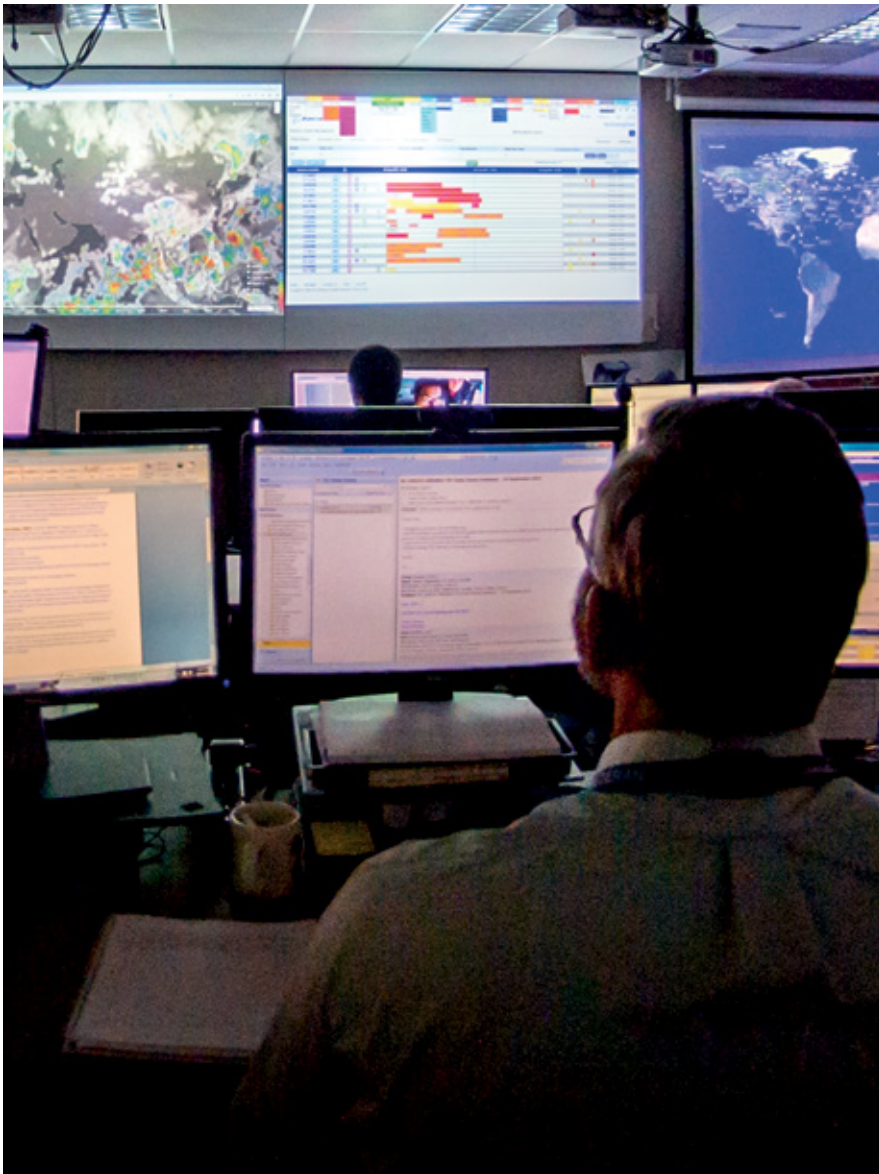
Similar to the warehouse, Global Repair Services is expanding. For example, Aviall once had four people making 1,000 hoses per month; nine now produce 4,500 hoses over the same time frame, including high-pressure hoses for the Bell Helicopter production line.

John Hooper, a former U.S. Air Force master sergeant who once worked on military jets, is the chief inspector and supervisor for the Global Repair Services battery station. He’s been with Aviall for 11 years. Batteries need to be checked and rechecked, and Hooper has helped streamline this process.

Hooper created the Battery Advanced Test System, or BATS, which enables employees to get a reading on all battery cells at once, rather than one at a time, a needed timesaver. Hooper and his colleagues take customer calls around-the-clock. They say they’ve never been busier at work. The Aviall-Boeing connection has them inspired and confident in what they do.

“When you know the company is focused on growth it’s very exciting,” Hooper said. “When you know Boeing has your back, it gives you a little more swagger.” ►

Photos: (Clockwise from top left) Tori Lindsay, a product assembly lead technician, rebuilds a part in the Global Repair Services center in Texas; Donald Wright inspects an aircraft wheel in the repair center. BOB FERGUSON | BOEING



‘BIG DATA’ moves needle for customers

Just outside of Philadelphia, software engineers, platform experts and mathematicians occupy a converted conference room. They use touch screens connected to a computer network. They review military flight data coming from around the world. They pinpoint parts maintenance needs and failures.

The V-22 Readiness Operations Center in Ridley Township, Pa., is Boeing’s latest entry into the world of data analytics, or big data. It is a services

area with almost unlimited potential, and is helping bring Global Services & Support and Commercial Aviation

Photos: (Above) The Operational Control Center in Everett, Wash., provides around-the-clock 787 Dreamliner fleet monitoring and support. BOB FERGUSON | BOEING (Right) Kelly Hill, left, and Steve Boggess are among several analysts who track data generated by 280 V-22 Osprey tiltrotor aircraft at the V-22 Readiness Operations Center in Ridley Township, Pa. FRED TROILO | BOEING









Services together in a “One Boeing” manner, according to its managers.

“We’ve had every major business unit from The Boeing Company speak to us or come to visit,” said Ed Apollo, V-22 Sustainment program manager. “The key message is: How do we replicate this across the enterprise?”

In operation for less than two years, the readiness center monitors 280 V-22 Osprey tiltrotor aircraft worldwide, receiving timely data reports on approximately 1,450 parameters per second of flight.

Center personnel have the tools to play back the flight online. They sift through data and apply different mathematical models, developing algorithms that spotlight trends and problems. Their expertise draws on a variety of sources.

“Boeing’s work in the intelligence community actually gave us insight into how we could use the data,” said Chris Raab, manager of Maintenance Analytics Systems. “Using it across the entire support process—from maintenance to the supply chain—in groundbreaking ways is how we’re significantly advancing V-22 support.”

With the ability to deploy software to monitor incoming data, the center can look for anomalies and emerging issues in the fleet, Raab said.

In one case, a military customer couldn’t pinpoint the cause of a persistent Osprey vibration, repeatedly swapping out parts without finding a solution. The center used its data to show a centrifugal force bearing was the problem and wrote an algorithm that predicted when bearing degradation would occur, thus preventing future parts and maintenance costs, plus the downtime of not flying the aircraft. Total savings according to the customer: \$20 million.

“From a safety standpoint, it is a real needle-mover with the customer,” said Carolyn Nichols, V-22 Sustainment director, about the readiness center.

Using the incoming data and corresponding analytics, the center can even address pilot capabilities—whether or not that person behind the control stick warrants added training in an area such as landings or other air maneuvers.

Airplane Health Management is another big-data service, one that monitors 2,800 Boeing airplanes in flight

worldwide, processes 10 million reports per month and has a data repository of nearly 7 billion records. Offered to customers through Commercial Aviation Services Digital Aviation and in operation for 11 years, Airplane Health Management also is used heavily by an Operational Control Center that supplies around-the-clock dispatch for 787 fleet support from Everett, Wash.

Eighty-one airline customers currently subscribe to the health management service, enabling them to access technical documents for solutions at any time through the myboeingfleet.com secure website and receive automated alerts that show maintenance trends that could prevent expensive operating disruptions. A canceled flight typically costs an airline \$100,000, explained Mike Hurd, Airplane Health Management program manager in Renton, Wash.

“In some cases, airlines have reduced unscheduled maintenance costs for specific systems by up to 90 percent,” Hurd said. “Whenever you use the data intelligence tool to reduce cancellations and downtime for maintenance, it’s a strong argument.”

Additionally, the system will be enabled for the KC-46 Pegasus tanker and used during the military aircraft’s development and testing phases. Information will be passed from Boeing to Boeing, rather than from Boeing to the customer, an arrangement facilitated by Commercial Aviation Services, according to Ken Coe, KC-46 tanker senior manager.

It was the best solution for the modified 767 and yet another example of the one-company approach, Coe said.

“Airplane Health Management allows us to present data in a format to analyze it and make it actionable to increase the operational capability of the KC-46 fleet,” he explained. “The sooner you fix a problem, the sooner you’re back up in the air.” ►

Photos: (Top) In the 787 Operational Control Center in Everett, Wash., analyst Mike Loyd reviews incoming data from all over the world.

BOB FERGUSON | BOEING (Bottom) Support staff personnel, from left, Steve Boggess, Chris Raab, Jeff Thompson and Kelly Hill look for trends in Osprey data reports at the V-22 Readiness Operations Center in Ridley Township, Pa. **FRED TROILO | BOEING**

SERVICE CALLS: Anytime, anywhere

Boeing's Airplane-On-Ground Operations team is always on call, awaiting difficult assignments, ready for anything.

Still, a trip to Houston in 2014 marked one of the team's most challenging projects, one that nonetheless came off without a hitch—the disassembling and reassembling of the 747 Shuttle Carrier Aircraft and transporting it through the large Texas city.

“It was not the biggest job I've done, but it was the most unusual,” said James Sloan, the Airplane-On-Ground, or AOG, team leader.

Part of Commercial Aviation Services, AOG's role is to expediently resolve complicated situations in a well-rehearsed and efficient manner, according to its managers. The overall team consists of 100 people who will go anywhere in the world to repair—or in this case, take apart and reassemble—a Boeing airplane.

In Houston, 21 AOG employees removed the wings, vertical stabilizer, engine nacelles and landing gear from the retired jet, used by NASA to transport space shuttles. With the aid of a team of contractors, they moved the 747 on trailers at night across eight miles (13 kilometers) of city roadways, from Ellington Field to Space Center Houston, where they put the airplane back together for permanent display.

Boeing mechanics had not previously pulled wings off of a jet

outside of the factory. Wading through all of the complexities, AOG needed four months to complete the entire job, which included weather delays.

“We did stuff that's never been done before,” Sloan said.

Work conditions for AOG jobs might involve harsh weather, political unrest or health risks, but team members are never put in harm's way. They're typically on the job 12 hours a day, seven days a week, until it is finished. They visit places many of them have never seen before.

Earlier this year, a 61-person AOG team traveled to Europe and repaired a 747 Freighter heavily damaged during a hard landing. It was the middle of winter. A local hangar could only fit the jet's nose, so a tent was erected around the targeted middle section of the airplane and heat was pumped into the improvised workspace.

Over 47 days, two fewer than planned, AOG personnel replaced 13 skin panels, plus stringers and landing gear, and reworked other areas of the airplane. AOG engineers in California designed the major repairs, permanent fixes that wouldn't require future inspections and added expense.

Said Craig Oppedal, the team leader: “It was as good as a new airplane when we were done.” ►



PUSHING THE FLIGHT ENVELOPE—on the

The box-like device stands 40 feet (12 meters) tall and weighs 29,000 pounds (13,150 kilograms). Five people fit snugly inside. Over an hour, they encounter any number of simulated situations that might occur in flight, such as severe air turbulence, electrical malfunctions, poor weather and collision avoidance.

Naval Air Station Jacksonville in Florida uses nine of these Boeing-

produced Operational Flight Trainers, soon to be 10. Another six will be installed next year at Naval Air Station Whidbey Island in Washington state.

The simulator prepares U.S. Navy personnel to fly the P-8A Poseidon, a highly modified military version of Boeing's 737 for maritime surveillance and patrol.

For P-8A crews seated at stations in the main cabin, Boeing supplies the

Weapons Tactics Trainer. The trainer allows crewmembers to practice locating enemy submarines and ships, use the radar and electronic support measures equipment, and implement weapons, among other functions. Jacksonville also offers a 40-foot piece of 737 fuselage for maintenance training purposes.

It's but one example of Boeing's push to expand services. In this case, the Navy



ground

customer employs Boeing personnel to provide a post-delivery support system for the militarization of the 737 flight simulator that it can't find anywhere else, said Derek Bernett, Boeing P-8A pilot-training devices manager.

"One of the best compliments we've received, when one of the first airplanes was delivered to Jacksonville, was the airplane flies just like the simulator," he

said. "Usually it's the other way around."

Boeing has delivered 30 P-8As to the Navy. At some point, NAS Jacksonville will operate 60 P-8A aircraft and put as many as 200 people in its 20 classrooms at once, Bernett said.

The Navy's P-8A crews receive 70 percent of their training on the ground, which is a huge cost savings, said Tom Shadrach, Boeing P-8A program manager. "It is great that this much is being learned in the simulators," Shadrach said.

The realism provided by the

software is a big reason that so much of the P-8A training is simulator-based. Safety is another factor, with flight personnel able to push limits with the trainers in ways that can't be practiced with the actual aircraft, according to Shadrach. ►

Photo: In 2014, Boeing's Airplane-On-Ground Operations team disassembled this 747 Shuttle Carrier Aircraft, moved it across Houston, and reassembled it for display at Space Center Houston. **FRANK LEYVA**



more valued, said procurement agent Debbie Veenstra.

“The scope of work we do is a little bit different, but not a whole lot has changed—we’re still an emergent work center able to rapidly take on projects big and small,” Veenstra said. “The attitude of the people who work here is we enjoy a challenge and the tough stuff.”

Employees still design, weld, paint and perform machine work like before, yet they’re more apt to produce a 787 Dreamliner galley or spacer for 777 landing gear rather than supply a C-17 antenna. However, the latter is not unusual, as out-of-production fleets still need to be supported.

The Quick Response Center workforce stands right around 100 employees, though it continues to trend upward during the current growth spurt. The center is open every day; employees receive cross-training to handle all the different jobs. New hires include people who specialize on the commercial side.

“When CAS took over they brought in a lot of new people, adding to our highly skilled team,” machinist Drake Spencer said. “Between all of the new people and the people already here, everyone works together. It’s pretty awesome.”

The center offers support to every Boeing platform. As a buyer in the new workplace, Veenstra obtains raw materials that are dual-certified for commercial and defense use to speed production times. The center continues to fill an important need; it just has more customers now.

“Our shop is one of the best examples of what Boeing does well,” Veenstra said. “Our team consists of everyone necessary to build a part, resolve an emergent need and provide outstanding customer service to all Boeing programs.” ■

DANIEL.W.RALEY@BOEING.COM

Photos: (Left) Procurement agent Debbie Veenstra orders raw materials that are dual-certified for use on commercial and defense jobs at the Quick Response Center in Huntington Beach, Calif. (Right) Quick Response Center employee Terry Dobson inspects welds on a newly made part. BOB FERGUSON | BOEING

ONE-STOP shop

Boeing’s Quick Response Center in Huntington Beach, Calif., is a busy place. Phones ring nonstop. Employees scurry to make airplane parts. Everyone hustles to get shipments out the door on time.

What’s new is the building’s name—BDS was dropped from the original designation—and a notable shift in the customer base from predominantly defense work to a mix of commercial and military jobs.

Last March, the center reopened

under the aegis of Commercial Aviation Services, taking over for Boeing Defense Space & Security, a switch necessitated by the approaching closure of the nearby C-17 production line in Long Beach.

Rather than shut down as well, the center was reinvigorated by CAS with new machinery and more employees. Boeing saw this as an opportunity to expand for both commercial and defense needs, making a much-needed services component even





Boeing has a huge and long-term partnership with the UAE, a key growth market

BY ERIC FETTERS-WALP | PHOTOS BY TIM REINHART

The 2015 Dubai Airshow in the United Arab Emirates runs Nov. 8–12 and Boeing, which has a strong relationship with the UAE, will again have a major presence at the show.

With two used Boeing 727s and a couple of leased airplanes, Emirates airline kicked off service 30 years ago from Dubai in the United Arab Emirates to nearby India and Pakistan.

That modest launch in 1985 didn't hint at the airline's eventual emergence as one of the world's largest long-haul carriers with a reputation for top-flight service. Emirates' fleet now consists of more than 230 jetliners, including

Soaring together

the single-largest fleet of 777s in the world, which fly to at least 80 countries, according to the airline. In the meantime, Etihad Airways has emerged as a fast-growing competitor, and low-cost carrier flydubai has ramped up operations with an all-Boeing fleet of 737s.

All together, the three airlines operate more than 3,600 flights a week from Dubai and Abu Dhabi to destinations within the Middle East and much farther away, making the UAE a top global aviation hub. Because of that growing demand for commercial aviation in the nation, as well as its security needs, the UAE has developed a close partnership with Boeing's commercial and defense businesses.

"The UAE is a massive market for Boeing, and we've known this from the start," said Bernie Dunn, president of Boeing Middle East, North Africa

and Turkey. "We've been operating here for over three decades. In that time, we not only have been able to support the country in its efforts to become an aerospace hub but also are working to develop local manufacturing capabilities here, which brings the country's aerospace efforts full circle. We are pleased we are able to be part of such a significant transformation."

The UAE, a federation of seven emirates that formed in the early 1970s, is the world's eighth-largest oil producer. That sector initially powered the nation's economy and development, but government officials have focused on creating industries that will sustain growth for years to come. As a result, 69 percent of the UAE's gross domestic product of \$419 billion last year came from activity outside the oil sector, according to government statistics.

"They've been working hard to take petro dollars and invest them into building the industrial and manufacturing sectors there," said Marc Allen, president, Boeing International. He noted that UAE government and business leaders are focused on long-term sustainment of job growth, especially because 95 percent of the population is under 55 years old. "Boeing's making every effort we can to be part of the solution there."

Tourism and aviation so far have played starring roles in the UAE's economic diversification. Dubai International Airport ranked sixth in the world in overall passenger

Photo: The sun sets behind the Sheikh Zayed Mosque, the United Arab Emirates' largest mosque, in this view from Boeing's office in Abu Dhabi.



traffic last year, serving 70 million passengers, according to Airports Council International. The council also noted that the airport surpassed London Heathrow as the busiest hub for international passenger traffic. Meanwhile, traffic at Dubai's second major airport is growing as well, and Abu Dhabi International Airport reported a record 2.1 million passengers used that airport in July—23 percent more than a year ago.

“The UAE, like the entire Gulf region, is situated in a central spot for growth and the gateway to Asia,” Allen said, “and we see this as a huge partnership for the long term.”

Dubai, Abu Dhabi and the surrounding area have long been centers of trade and finance, and the UAE is the single-largest export market for U.S. goods and services in the Arab world, according to the United Arab Emirates Trade & Commercial Office in Washington, D.C. In return, UAE financiers have invested in the U.S. and elsewhere for three decades. Boeing Capital Corporation, the company's investment bank, has taken notice, working closely with Middle East financiers to double the region's support for Boeing aircraft deliveries in just the past few years, Allen said.

Since 2006, Boeing Capital also has hosted annual airline planning seminars for financiers in the UAE and neighboring countries, and its regional financiers and investors' conference has become an annual event. Additionally, Boeing's finance subsidiary is exploring

opportunities for Islamic financing in the aviation sector, said Tim Myers, president of Boeing Capital.

Boeing also plays a significant role in preserving the UAE's security. The nation's military forces operate Apache and Chinook helicopters, as well as a small fleet of C-17 Globemaster III heavy-lift aircraft. Dubai-based Thuraya Satellite Telecommunications uses three Boeing-built satellites to support its mobile voice and data services. International sales now represent roughly 30 percent of Boeing Defense, Space & Security's business, with a sizable portion of that coming from the Middle East, said Paul Oliver, Middle East and Africa regional vice president, International Business Development.

“We see continued opportunities for growth, and we continue to work closely with the United Arab Emirates and other government and defense forces in the region, who play a key role in enhancing security in the region,” Oliver said.

In addition, Boeing Defense, Space & Security is collaborating with companies within the UAE to provide a number of services. For example, Abu Dhabi-based Advanced Military Maintenance, Repair and Overhaul Centre and BDS have teamed since 2011 to ensure the operational readiness of UAE military aircraft. Boeing subsidiary Insitu and Abu Dhabi Autonomous Systems Investments have worked together to provide support for unmanned aircraft systems sold in the region.

Partnerships between Boeing and



UAE organizations extend into the industrial and academic sectors as well. The most notable of these is Boeing's long-term cooperation with Mubadala Development Co. to develop the nation's aerospace manufacturing capabilities. Boeing and Mubadala Aerospace's Strata Manufacturing are in the middle of a 10-year contract to produce commercial composite aerostructures for the 777 and the 787 Dreamliner. Strata also will be a future supplier of the 787 vertical fin.

"Boeing has made great strides over the past five years to advance our industrial and strategic relationships

in the UAE because this supports Boeing's production system and access to our second-largest international commercial market," said Jay Campbell, managing director of International Strategy and Business Development for Commercial Airplanes. "Throughout this journey, we continually look to develop the UAE's aerospace industry in ways that reach mutually beneficial goals for Boeing and our partners."

Meanwhile, Boeing collaborates with Masdar Institute of Science and Technology, Etihad and others through the Sustainable Bioenergy Research Consortium, which has made research

breakthroughs in sustainable aviation biofuel development. At Khalifa University, UAE University and the Higher Colleges of Technology, Boeing supports engineering programs, mentorships, projects and research.

With rapid economic expansion in the UAE and the surrounding region, Boeing's Global Corporate Citizenship and University Relations efforts have focused on workforce development—specifically helping students build fundamental skills in science, literacy and math, as well as 21st-century skills like collaboration, communication, creative problem-solving and critical thinking. Boeing annually chooses Emirati students for its International Business Intern Program, which allows the students to work for six months at Commercial Airplanes offices in Renton, Wash.

"The internship introduced us to the company and allowed us to understand the opportunities present in international markets, like back home in UAE," said Amna AlRedha, who first joined Boeing through the internship program and now is a full-time Community Engagement analyst in Dubai.

As the United Arab Emirates' transformation and investment in its economic future continues, Boeing looks to remain a strong partner in areas beyond selling airplanes and military products, Dunn said. ■

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To read more about flydubai, see Page 51.

As part of its centennial, Boeing is underwriting *Above & Beyond*, a traveling aerospace exhibit, which opens at Children's City in Dubai this month. For more information, visit boeing.com/100.

Photos: (Far left) Ahamed Dawood, who works with Shared Services Group International Business Support in Dubai, looks out from the observation deck of the city's Burj Khalifa, the tallest building in the world. (Left) Sharifa Al Boainain is a research engineer at Masdar Institute of Science and Technology in Abu Dhabi. Boeing has partnered with Masdar for research into sustainable biofuels for aviation.





VETERAN TEA

BY JAMES WALLACE

Whether in peacetime or in war, at home or abroad, they have served their country with pride and honor. Some answered the call to duty many years ago, serving in Korea and Vietnam, and later during two Gulf wars. Others answered the call more recently. Some still serve, in the Reserves or National Guard.

John Oncay enlisted in the U.S. Army two days after graduating from high school in June 1954. Almost a half-century later, Edwin Galan signed up to be a U.S. Marine after the 9/11 attacks in 2001. Kim Knoch joined the Army in 1975. She was 18 and wanted to see the world. Frank Einsetler served in the U.S. Air Force on a B-52 bomber and flew combat missions over Iraq.

They are among some 22,000 men and women who work at Boeing today and served their country in the military.

As veterans they brought with them to Boeing not only specialized skills they learned in the military but diverse perspectives and character traits such as discipline, leadership and teamwork.

Boeing works diligently to recruit veterans and make it easy for them to match their skills and experiences to the work the company does, said Tony Parasida, senior vice president of Human Resources and Administration.

Since January 2011, as part of the White House–led “Joining Forces” initiative, Boeing has hired and trained more than 6,000 veterans.

“We want veterans on our team because they bring specialized leadership, integrity, and critical skills and perspective from their unique military experience,” Parasida said. “Veterans are a crucial part of Boeing’s workforce strategy because our business demands that we maintain an active, diverse and skilled

pipeline of talent to build our future for years to come.”

Boeing veterans say they draw on their military service, experiences and training in their Boeing jobs.

“I learned valuable skills that would later help me in my Boeing career,” said Marine veteran Galan, a planning production specialist with Commercial Airplanes in Bothell, Wash. “Skills such as attention to detail, first-time quality, work ethic and leadership, to name a few, have determined my success with the Quality organization.”

An avionics technician with the Marines, Galan was deployed twice to Iraq and helped keep Cobra and Huey helicopters ready to fly.

“After leaving the military,” Galan said, “I knew I wanted to work for a company that takes care of its veterans, but also builds products that have the capability to impact people’s everyday life ... there was no question

AN M

Boeing was the perfect fit for me.”

After he enlisted in the Army in 1954, Oncay was sent to drafting school at Fort Belvoir, Va., and he subsequently spent most of his time in the military in operations. Among his posts was Korea, in 1955–56.

Oncay, with Site Services in Philadelphia, is finishing his 52nd year at Boeing.

“My destiny has been operations,” he said, “and I found my future with Boeing, doing what’s needed, when it’s needed. So many opportunities, so many great people, so much to do. Jump in, the water’s fine!”

When she enlisted in the Army in 1975, Knoch saw it as an opportunity to possibly travel. And she did. “It opened my eyes to other cultures, not just abroad but here in the United States. I learned to appreciate diversity.”

Today, she’s an engineering technical

specialist on the 747, 767 and 777 programs in Everett, Wash.

A highlight of her military service, Knoch said, was a two-week basic mountaineering course in Alaska. “It was the adventure I had been looking for—climbing, building rope bridges, crossing glaciers. It was hard work, but I proved to myself I was capable of accomplishing anything.”

The relentless training Einsetler received in the Air Force has served him well at Boeing, he said.

“Implementing quality training is now one of my job responsibilities at Boeing,” said Einsetler, a test engineer with Boeing Test & Evaluation in Huntington Beach, Calif.

He served in the U.S. Air Force from 1989 through 2001, mostly as an electronic warfare officer on B-52 bombers. Einsetler and his crew flew missions over Iraq during Operation Desert Fox in December 1998.

“In the B-52, I remember looking up often at an open area above my equipment panel,” Einsetler recalled. “There was a small black Boeing decal on a section of the aircraft structure. That decal always reassured me that I was in a sound aircraft from a great company. The importance of Boeing product quality has stuck with me ever since.”

On the following pages are six more Boeing veterans who share their stories of military service to mark the U.S. Veterans Day holiday in November—known as Remembrance Day and Armistice Day in other countries. ►

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To learn how Boeing supports veterans in the community and in their careers, visit boeing.com/veterans.

BRANCH:

Royal Air Force in United Kingdom

LOCATION:

Williamstown, Australia

TEAM:

Boeing Defence Australia

Simon Ekins

AEW&C mission crew instructor

During his 23 years with the Royal Air Force in the United Kingdom, Simon Ekins served as a crew member on Airborne Warning and Control System aircraft. That experience, he said, helped him become a mission crew instructor with Boeing Defence Australia, where he teaches Australian aircrew how to operate the country's Wedgetail aircraft.

Based on the 737 commercial platform, Boeing's Wedgetail Airborne Early Warning & Control, or AEW&C, aircraft is now fully operational and able to support ongoing operations of the Royal Australian Air Force. Australia has a fleet of six.

"It's a unique aircraft, both in combat and peacetime environments," Ekins said. "I love my work and enjoy the camaraderie, which is often missing when military personnel leave the service. Luckily, I have an excellent team of like-minded working people from all walks of life."

After his air force career in the United Kingdom, which included service in Bosnia, both Gulf wars and Afghanistan, Ekins emigrated to Australia in 2008 and joined Boeing.

As a veteran, November holds a special place for Ekins.

"Remembrance Day in November means a lot to me," he explained, "as my great-grandfather served in World War I in the first battle of the Somme, and my grandfather served in World War II as rear gunner on Lancaster bombers. My thoughts are with all those serving, and those who have served in the past, to fight for all our freedoms." ▶





BRANCH:

U.S. Marine Corps

LOCATION:

Seal Beach, Calif.

TEAM:

Defense, Space & Security

Vernon Wright

Computer security specialist

After serving 22 years with the U.S. Marine Corps, Vernon Wright marked his third year at Boeing in August. He retired from the Corps as a gunnery sergeant, thus the nickname “Gunny” Wright. His tours of duty included supporting Operation Enduring Freedom in Afghanistan in 2011 as a communications logistical chief.

Wright said he started thinking about a job with Boeing as he neared retirement from the Marine Corps.

“I knew about Boeing’s support for our military,” he said, “and thought how honorable it would be to continue to serve my military brethren by supporting them through Boeing’s defense and security programs.”

Boeing initially hired Wright as an industrial security specialist, but he later applied to be a computing security specialist—and got the job. Wright said he spends much of his time working on programs he can’t talk about with the

Experimental Systems Group, part of Defense, Space & Security.

“I owe a large part of my personal and professional growth to my military experience,” Wright said. “I frequently get asked what I did before I joined Boeing and I proudly say I served in our military for more than 20 years. The response I generally get is, ‘Thank you for your service.’ My response usually is, ‘Well, thank you, but I’m not done serving yet.’” ▶



BRANCH:
U.S. Air Force

LOCATION:
Seattle

TEAM:
Commercial Airplanes

Rebecca Jabouri

Systems engineering integrator

Standing watch as the “officer of the deck” on a nuclear-powered aircraft carrier while at sea helped prepare Rebecca Jabouri for the various jobs she has undertaken at Boeing, according to the former U.S. Navy surface warfare officer.

“On the bridge of a ship, you need full situational awareness,” she explained. “You can’t be focused on just one system or task. And at Boeing, actively seeking opportunities to engage various functions and teams outside my immediate team helps make me a better and more efficient employee.”

Before she recently transferred to St. Louis, Jabouri was in Seattle with Commercial Airplanes and worked on the 787 and Dreamliner programs. In St. Louis she is working with the F-22 program as a project manager.

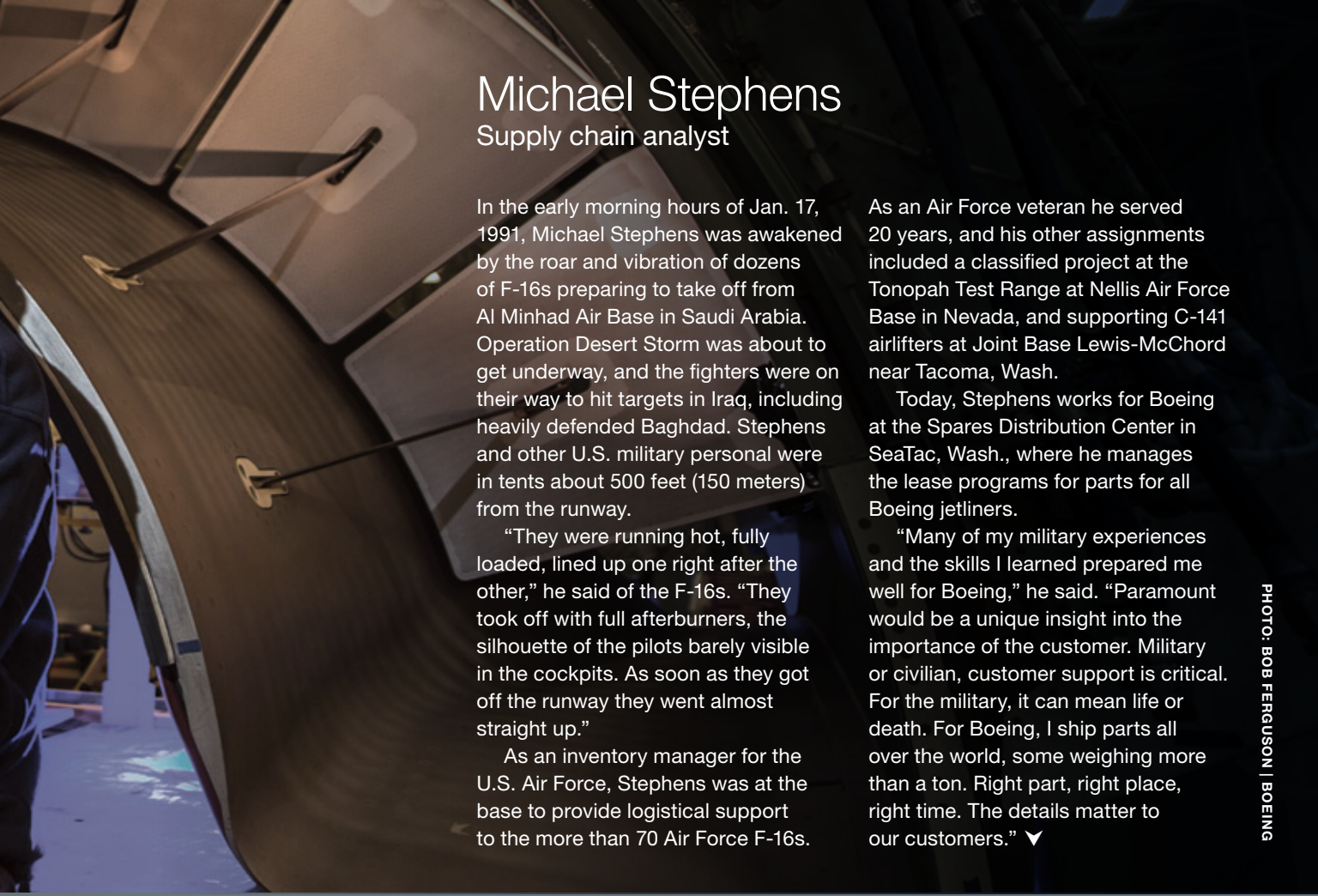
Jabouri graduated from the U.S.

Naval Academy in 2005 and was on active duty until 2010. She has been a Navy Reserve officer since.

Among the highlights of her time at sea with the Navy, she said, was earning her qualifications to lead bridge watch teams on two of the largest commissioned ships in the fleet. The officer of the deck is the direct representative of the captain, with responsibility for the ship and supervising all ship functions and maneuvers, she explained. “One small mistake or momentary distraction can be disastrous.”

Whether on the bridge of a ship, or in her Boeing office, she added, it’s “Systems Thinking 101.”

“Each system on an aircraft carrier is potentially part of a larger system or function ... and it’s the same at Boeing,” Jabouri said. “You have to always be mindful of the big picture.” ▶



Michael Stephens

Supply chain analyst

In the early morning hours of Jan. 17, 1991, Michael Stephens was awakened by the roar and vibration of dozens of F-16s preparing to take off from Al Minhad Air Base in Saudi Arabia. Operation Desert Storm was about to get underway, and the fighters were on their way to hit targets in Iraq, including heavily defended Baghdad. Stephens and other U.S. military personnel were in tents about 500 feet (150 meters) from the runway.

“They were running hot, fully loaded, lined up one right after the other,” he said of the F-16s. “They took off with full afterburners, the silhouette of the pilots barely visible in the cockpits. As soon as they got off the runway they went almost straight up.”

As an inventory manager for the U.S. Air Force, Stephens was at the base to provide logistical support to the more than 70 Air Force F-16s.

As an Air Force veteran he served 20 years, and his other assignments included a classified project at the Tonopah Test Range at Nellis Air Force Base in Nevada, and supporting C-141 airlifters at Joint Base Lewis-McChord near Tacoma, Wash.

Today, Stephens works for Boeing at the Spares Distribution Center in SeaTac, Wash., where he manages the lease programs for parts for all Boeing jetliners.

“Many of my military experiences and the skills I learned prepared me well for Boeing,” he said. “Paramount would be a unique insight into the importance of the customer. Military or civilian, customer support is critical. For the military, it can mean life or death. For Boeing, I ship parts all over the world, some weighing more than a ton. Right part, right place, right time. The details matter to our customers.” ▼

PHOTO: BOB FERGUSON | BOEING



BRANCH:
U.S. Navy

LOCATION:
St. Louis

TEAM:
Defense, Space & Security

BRANCH:
U.S. Air Force

LOCATION:
Heath, Ohio

TEAM:
Defense, Space & Security

Mike Penrose

ICBM Quality specialist

When Mike Penrose joined the U.S. Air Force in 1989, he had thoughts of maybe getting to see the world. Instead, he got to see a lot of remote Wyoming, where he was stationed at Francis E. Warren Air Force Base as an intercontinental ballistic missile, or ICBM, technician.

Located a few miles from Cheyenne, the base is one of the country's strategic missile sites, and Penrose began his Air Force career maintaining the MX ballistic missile system, also known as the Peacekeeper. The Peacekeeper system was eventually disbanded, leaving the Minuteman as America's mainstay ICBM.

Penrose was also involved early on at the Wyoming base helping ensure U.S. compliance with the Strategic Arms Reduction Treaty, or START. That treaty with the former Soviet Union, which was signed in 1991, required both nations to reduce their arsenals of nuclear warheads

and the missiles and bombers capable of delivering such weapons.

"After performing field maintenance, I spent time as an instructor, teaching missile maintenance, safety equipment maintenance and vehicle maintenance," Penrose said. "We lived by the saying 'green time is prime time,' meaning we were proud to serve to ensure our ICBMs stayed on strategic alert, ready to defend our country 24 hours a day, 365 days a year."

When he retired from the Air Force after 20 years, Penrose joined the Boeing team in Cheyenne to upgrade ICBM silos.

Today, he works on the Minuteman III guidance system at the Boeing site in Heath, Ohio.

"The Air Force taught me service before self, personal reliability and quality in everything you do," Penrose said. "It's the same at Boeing, being part of the team on a missile navigation system that supports our national defense." ►

Renee Nadeau

Supply chain management analyst

BRANCH:
U.S. Army

LOCATION:
St. Louis

TEAM:
Defense, Space & Security

In 1974, Renee Nadeau was not among the last women to join the Women's Army Corps, or WAC, but the Army organization that had been formed during World War II soon would be disbanded and all female soldiers integrated with male units.

Nadeau still has the official WAC insignia, Pallas Athena, that was issued to her. In Greek mythology, Pallas Athena was considered the goddess of wisdom and victory. The Greek city of Athens was named after Athena.

After attending signal school and learning radio teletype and Morse code, Nadeau was stationed in Wurzburg, Germany, with an infantry signal battalion. "We spent a lot of time out in the field providing

communication support," she said.

She served in the Army Reserves from 1980 to 1986, when she joined McDonnell Douglas as a tools and parts specialist. After Boeing and McDonnell Douglas merged in 1997, Nadeau obtained her master's degree in business. She is now a production control analyst supporting the receiving, storing and kitting of parts for the Chinook, F-15, F/A-18 and AV-8B Harrier.

"I am very proud of my service in the U.S. Army and Boeing," said Nadeau, a member of the St. Louis Veterans Task Force. Last year she began volunteering in the St. Louis USO (United Service Organizations).

"It is extremely rewarding," she said, "to provide comfort to the young recruits heading to destinations all over the world." ■

PHOTO: BOB FERGUSON | BOEING



Journey OF THE Osprey



Behind the scenes: Final assembly of Bell Boeing V-22 Ospreys at Bell Helicopter in Texas

BY STEPHANIE WEINER | PHOTOS BY FRED TROILO

It's early morning when a truck rolls out of the Boeing factory in Philadelphia, bound for the Texas Panhandle and transporting what looks like a giant cocoon.

Inside that cocoon is a V-22 Osprey fuselage.

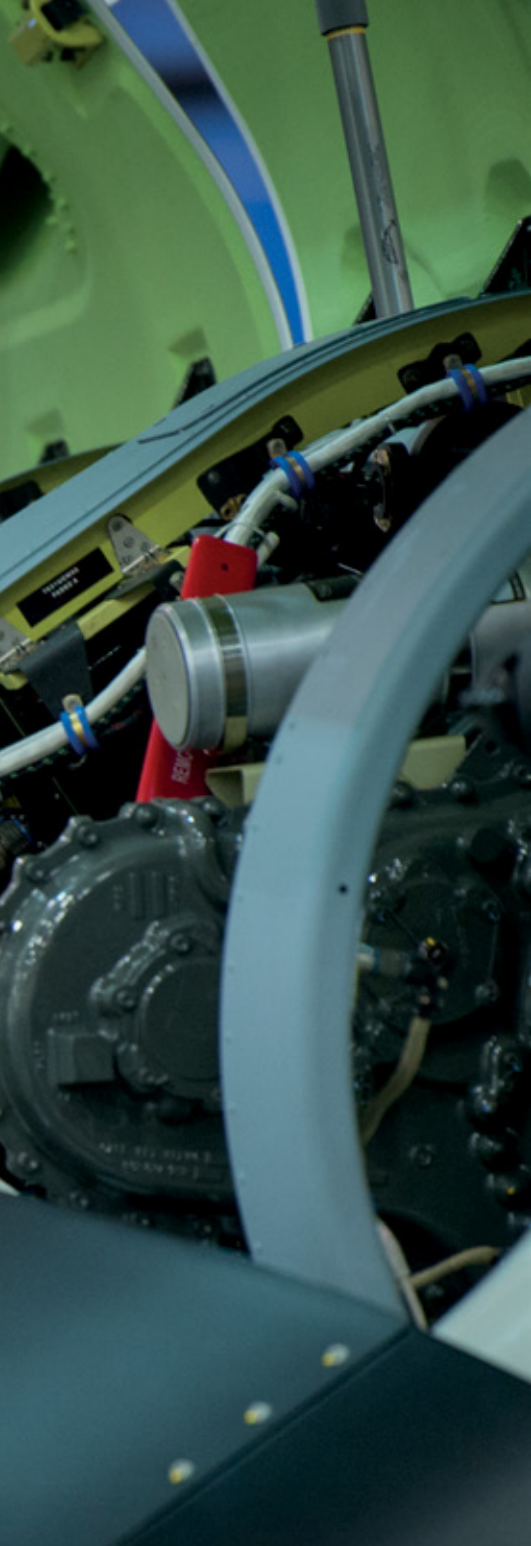
It's a journey that each Osprey takes before it becomes a fully assembled aircraft, ready for flight, at the Bell Helicopter factory in Amarillo, Texas.

The transformation begins at Boeing's Ridley Township site near the banks of the Delaware River in Pennsylvania, where employees assemble the fuselage and equip it with avionics, electrical wiring and

hydraulic tubing. From there, the Osprey's first mission is a three-day, 1,600-mile (2,600-kilometer) road trip. Arriving at Bell Helicopter near the Amarillo airport, the Osprey continues to develop with the addition of wings, empennage and rotors.

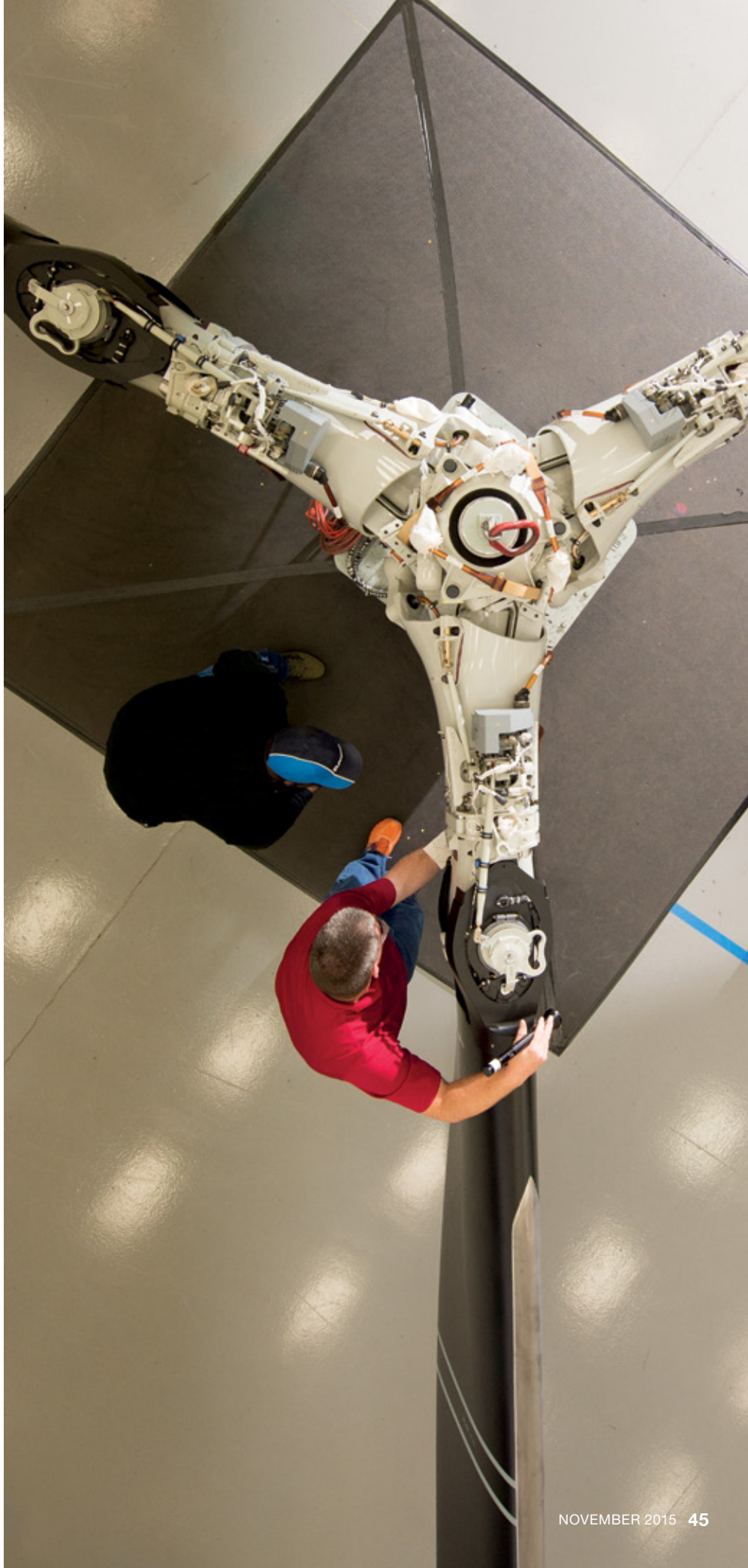
The V-22 is manufactured under a 50-50 alliance between Bell Helicopter and Boeing. In Amarillo, nine Boeing employees work side by side with the Bell team.

"We're on the front lines of the



V-22 program at Bell,” said Dan Hagan, Boeing V-22 Technical

Photos: (From left) Bell Helicopter employees Thomas Grusecki, assembler mechanic, and Michael Hsu, lead assembly inspector, inspect fuel line connections from the safety of a factory maintenance stand; George Carr, top, a Boeing engineer, and John McBride, a Bell production specialist, check the rotor assembly installation to ensure blade-fold operation works as designed.





Support Engineering.

Final assembly teams at Bell Helicopter also complete and ensure the critical connections between wing and fuselage systems. They install windows, flight surfaces and subsystem components. Functional testing follows.

“It’s an incredible journey and a symbol of the strong ties between our two companies,” said Kristin Robertson, vice president of Boeing Tiltrotor programs and program director of Bell Boeing.

The Osprey is operated by the U.S. Marines as well as the U.S. Air Force Special Operations Command. Japan has ordered the Osprey and several international customers have expressed interest in the unique aircraft, which can take off and land like a helicopter but fly fast like a fixed-wing aircraft. In addition to its increasing assault support role with the U.S. military, the Bell Boeing V-22 often is called upon to perform humanitarian missions around the world. More than 280 Ospreys have been built.

After completion of flight testing at the Bell factory in Texas, the Osprey is delivered to the customer—the final step in a metamorphosis that begins halfway across the country. ■

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Photos: (From top) At Bell Helicopter, Boeing engineer George Carr inspects a V-22 Osprey’s pitot static tube, which measures airspeed, prior to flight tests and delivery; functional testing of the rotors involves stowage of rotor blades, nacelle tilt and empennage rotation.



Spreading its wings

flydubai continues rapid expansion with all-Boeing fleet

BY SAFFANA MICHAEL

With its vivid blue and orange livery, flydubai's growing fleet of Boeing jetliners creates a striking presence at Dubai International Airport in the United Arab Emirates. The blue represents the waters of the Arabian Gulf and orange symbolizes the warm hospitality of its people.

"These attributes are particularly true to Dubai and we were keen to see them reflected in the approach and services we offer to our customers," said Ghaith Al Ghaith, the Dubai-based airline's chief executive officer. "We remain focused on our long-term strategy to open up new routes by expanding opportunities for travel, maintaining efficient operations across our network and continuing to deliver a better customer experience."

In just six years, flydubai has spread its wings to more than 96 cities in 45 countries, providing more than 1,600 departures across its network in the Middle East, Africa, Central Asia,

Europe and the Indian subcontinent. The all-Boeing airline also has opened up routes to 67 destinations that previously lacked direct air links to Dubai. In 2014 alone, flydubai launched 23 new routes, and so far in 2015, it has announced 18 new routes.

The partnership with Boeing began in June 2008 when flydubai ordered 50 Next-Generation 737-800s during the Farnborough International Airshow. In September the airline took delivery of its 50th airplane from Boeing, a 737-800.

At the 2013 Dubai Airshow, flydubai reiterated its strong commitment to Boeing and its jetliners when it ordered 75 737 MAXs, with purchase rights for a further 25 to support its continued growth. The new fuel-efficient 737 MAX is scheduled to be delivered to customers starting in 2017. The order also included 11 Next-Generation Boeing 737-800s, which Boeing expects to deliver in

the first quarter of 2016.

"Boeing's Next-Generation 737-800s, with their fuel efficiency and reliability, have enabled flydubai to sustain the high-frequency traffic within our network," Al Ghaith said. "The aircraft has become the foundation for flydubai's rapid growth and we look forward to receiving the 737 MAX 8 to further expand our network and operations."

Said Ray Conner, Boeing Commercial Airplanes president and CEO: "We are extremely proud of our partnership with flydubai, and the confidence and trust it continues to place in Boeing's present and future single-aisle airplanes." ■

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To learn more about Boeing in the United Arab Emirates, see Page 36.

Photo: A row of flydubai's Next-Generation 737-800s in the late-day sun at Dubai International Airport. FLYDUBAI





Return to greatness

Following a 17-year recovery and restoration effort by hundreds of volunteers, a Boeing B-29 bomber nicknamed “Doc” gleams in the sunrise in Wichita, Kan. Engine runs began last month. The B-29 Superfortress was one of the most technologically advanced aircraft of World War II, with a pressurized crew cabin for high-altitude flying and remotely controlled gun

turrets. Boeing built nearly 2,800 B-29s in Wichita and at the Renton, Wash., factory, and Bell and Martin built some 1,200 more. Only one other B-29 is airworthy today. For more on Doc’s return to flight, visit b-29doc.com/docs-story. For more on Boeing bombers, visit boeing.com/bds/strategicairpower.

PHOTO: STEVE JANTZ | DOC’S FRIENDS

Looking at everything

From the 737 to the Dreamliner, engineer John Roundhill helped Boeing set the course

BY DAN RALEY

As Boeing approaches the start of its second century in July 2016, *Frontiers* visits with some of the men and women who have helped make Boeing a global leader in aerospace.

Dozens of model airplanes fill the display case in the lobby of The Boeing Company's BOMARC building in Everett, Wash., a place where retired engineer John Roundhill still finds great comfort.

"This wall is my life," Roundhill said, gesturing toward the rows of miniature jets.

Among them, arranged from left, in order of their variants, are the 737, 747, 757, 767, 777, 787 Dreamliner and Sonic Cruiser, all airplanes that Roundhill had a hand in developing.

The Seattle native enjoyed a storied Boeing career, one that began as a University of Washington undergraduate student entrusted with making changes in drawings for fighters, the Minuteman missile, the lunar orbiter and other programs. Once he joined the company full time in 1968, as an engineer supporting the 747-100 engine analysis, Roundhill was well-prepared from a technological standpoint—a situation that amuses him now, considering how the world has evolved.

"Bert Welliver, chief of propulsion research, asked, 'Do you know how to program a computer?' and I said yes," Roundhill recalled. "Computers were new back then and I was one of the first geeks."

Roundhill turned out to be a trend-setter in many respects, according to Matt Bueser, 777X director of program management. Roundhill worked on new engine ideas, using larger fans to make them quieter. He helped find ways to test those same engines on the ground, which proved a huge

cost-saver. He worked closely with legendary Boeing engineer Joe Sutter, absorbing his substantial product development knowledge.

At one point, Roundhill held simultaneous jobs for the Commercial Airplanes Product Development and 767 programs. This required him to drive daily to Boeing's two main production factories in Everett and Renton, Wash., which were 35 miles (55 kilometers) apart.

Where he excelled, though, was in management leadership positions in Commercial Airplanes Product Development, a group that analyzed all proposed airplanes, beginning in 1984. He was put in direct contact with the customer for the first time. Roundhill said he learned how to listen to people's needs. He discovered how to build long-term relationships.

Roundhill was prepared for this role by, among others, the late Dick Taylor, who held many roles for Boeing and was known as the "father of the 737 and ETOPS." Great attention to detail was emphasized. "Dick taught me to look at everything, at every option," Roundhill said. "Dick and I would just sit and talk. He would say, 'What are you thinking about? We work on a few things, but you have to be thinking about everything—the customer will ask.'"

This approach came in handy in 1988 when Boeing considered plans to stretch the 767. Then—Boeing president and CEO Frank Shrontz asked if anyone had considered building a new airplane instead. Roundhill gave an affirmative response. Shrontz asked when he could see the data. Three months later, Roundhill said, he made a well-received presentation for what would become the 777.

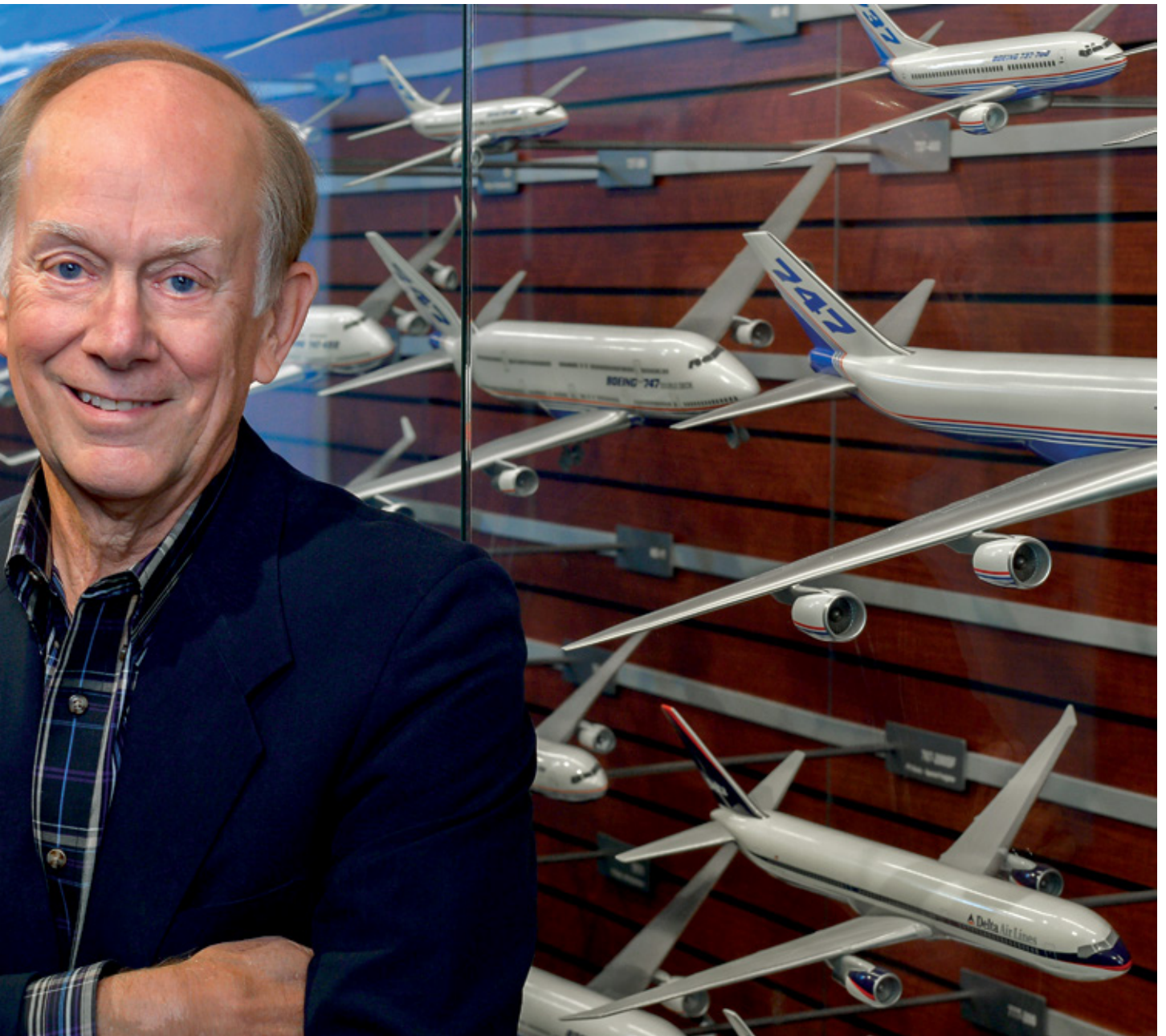
In meeting hundreds of people from the airlines, Roundhill was enthralled



by the deal-making process, which could happen in the most unexpected manner. One night over dinner in 1997, he recalled, a customer felt so comfortable with the way things were headed that he impulsively wrote an agreement for a 777 specification on a wine cork and had everyone sign it.

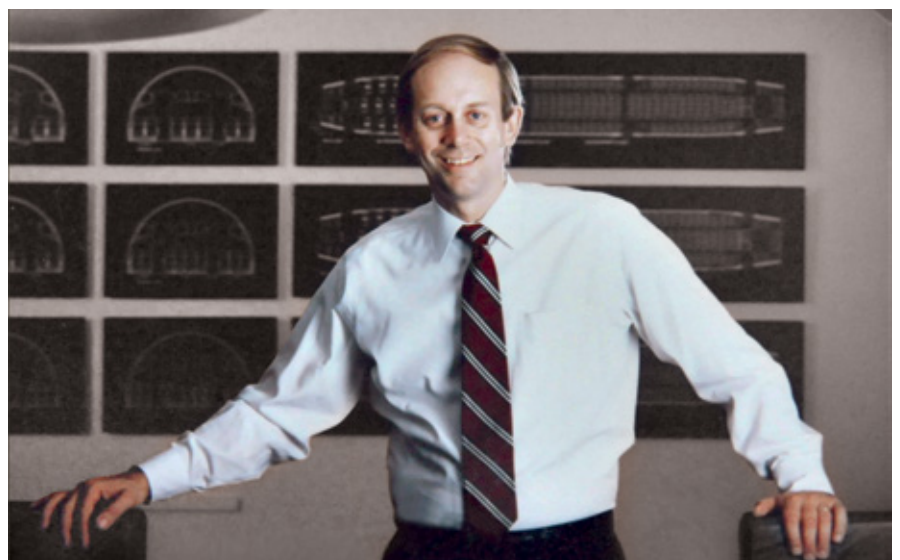
Roundhill, insightful and straightforward in approach, made his biggest impact on the company by building and maintaining those long-standing customer relationships, according to Bueser.

"I have never met anybody who had the ability like John to go out and talk with customers and understand



what their needs were, and then come back to Boeing and translate it into market strategy that we could go out and execute,” Bueser said. “The trust our customers had in him was incredible. To me, that was the big thing John brought to the company—he was really a master. We continue

Photos: (Above) Former Boeing engineer John Roundhill sees the evolution of his career represented in the airplane model case in the BOMARC building in Everett, Wash. **MARIAN LOCKHART | BOEING** (Right) At one time, Roundhill held two jobs simultaneously for different Boeing commercial jetliner programs. **COURTESY OF JOHN ROUNDHILL**





to look for folks like him.”

For all the inroads made on his watch, Roundhill dealt pragmatically with the projects that didn’t get off the ground. He was heavily involved in the Sonic Cruiser, an airplane that was never built.

When pressed whether they preferred something 20 percent faster or 20 percent more efficient, airlines chose the latter, which led to the development of the 787 Dreamliner.

“I learned that until you agree on what the plane is, you don’t have a plane,” Roundhill said. “You’re emotionally disappointed, but there

were reasons it didn’t happen. You start working on the next one.”

He retired from Boeing in 2002, which was somewhat of a misnomer. He was gone only six months when Boeing leadership asked him to return as a consultant. It’s another way for the company to pass its engineering knowledge from one generation to the next, something Sutter and others had done after formally retiring. It also was an effective manner to solve a pressing issue with broader resources in play.

Roundhill has provided input for the 737 and 787 programs. He’s

been asked to weigh in on issues facing some of the newer jets. He’s quick to point out that he’s strictly an adviser, not a boss.

“We’re not in charge again,” Roundhill said. “It’s not like we come in and say how to do it. What we do is review the plan and we ask, ‘Have you thought about doing it this way?’” **100**

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Photo: John Roundhill, left, worked closely with famous Boeing engineer Joe Sutter on the 747. COURTESY OF JOHN ROUNDHILL