



Frontiers

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DECEMBER 2013–JANUARY 2014 / Volume XII, Issue VIII



THE LEGACY CONTINUES

Boeing's long history in tankers takes another leap forward—the KC-46A



“To protect all aspects of a customer’s network from cyber threats, we tailor every solution—we have to be prepared for anything, 24/7/365.”

Sara Weisser
Cyber Engagement Center
Program Manager



ALWAYS ON GUARD: PROTECTING CYBERSPACE

Stories of
innovation
at Boeing



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26 TANKER POWER

A new chapter in Boeing's long history as the world's leader in military air refueling is unfolding at the Everett, Wash., factory, where the first KC-46A test aircraft for the U.S. Air Force is in production. The next-generation tanker, based on the proven 767 commercial platform, is being assembled by a "One Boeing" team of employees.

COVER ILLUSTRATION: THIS ARTIST'S CONCEPT SHOWS A KC-46A TANKER ABOUT TO REFUEL A BOEING F/A-18 SUPER HORNET USING THE HOSE AND DROGUE FROM ONE OF THE TANKER'S TWO WING REFUELING PODS. BRANDON LUONG/BOEING; AIRCRAFT GRAPHIC: CHUCK SCHROEDER/BOEING; SKY PHOTO: SHUTTERSTOCK

PHOTO: THE FIRST KC-46A TEST AIRCRAFT IS SHOWN IN THE PRODUCTION LINE AT THE EVERETT, WASH., FACTORY. BOB FERGUSON/BOEING



AD WATCH / The stories behind the ads in this issue of *Frontiers*.

Inside cover:



"Always on guard: Protecting cyberspace" is one in a series of innovation stories told by Boeing employees such as Sara Weisser. Learn more at www.boeing.com/stories.

Page 6:



This ad is derived from a new series of posters highlighting employees who are achieving quality improvements. More than 50 employee engagement teams across Commercial Airplanes posed and created taglines for their posters. A gallery of the posters can be found on the Boeing intranet at http://programs.ca.boeing.com/quality/new/order_posters.shtm

Pages 14–15:



Part of the "Boeing & Brazil. Endless Opportunities" campaign, this ad focuses on Boeing's 80 years in Brazil and the accomplishments made possible by this partnership. Translated, the text reads: *Boeing is proud to have been part of Brazilian life for 80 years. Today, more than 100,000 people fly in Boeing airplanes in Brazil, every day.*

Back cover:



This new ad congratulates the Indian Air Force on the recent delivery of C-17 aircraft and highlights Boeing's continued partnership with India. The ad appears in Indian trade publications.

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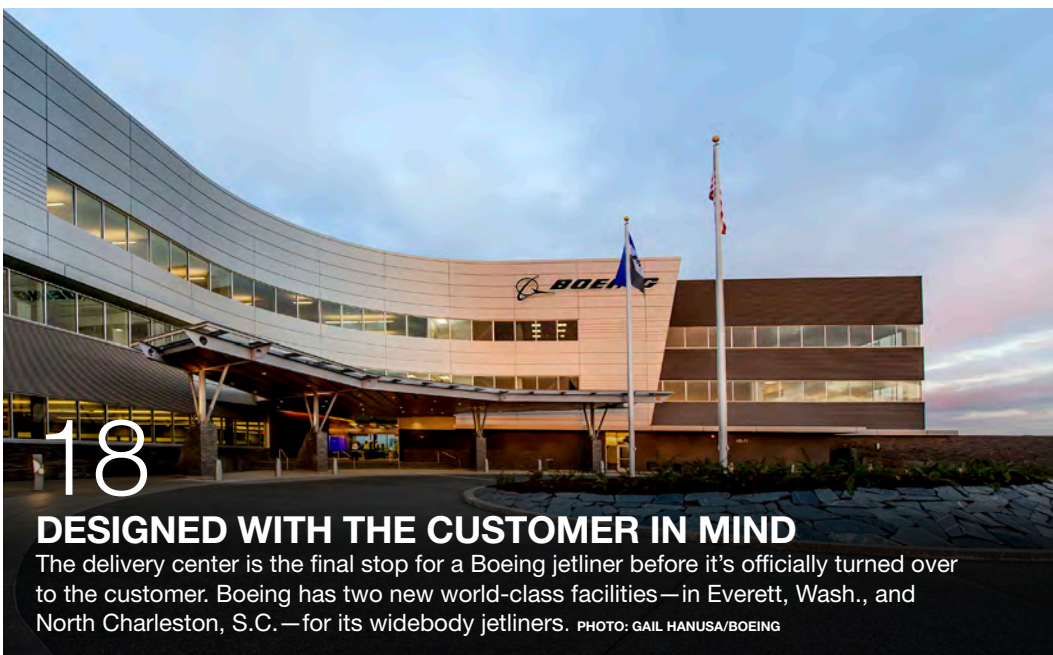
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12

HISTORICAL PERSPECTIVE

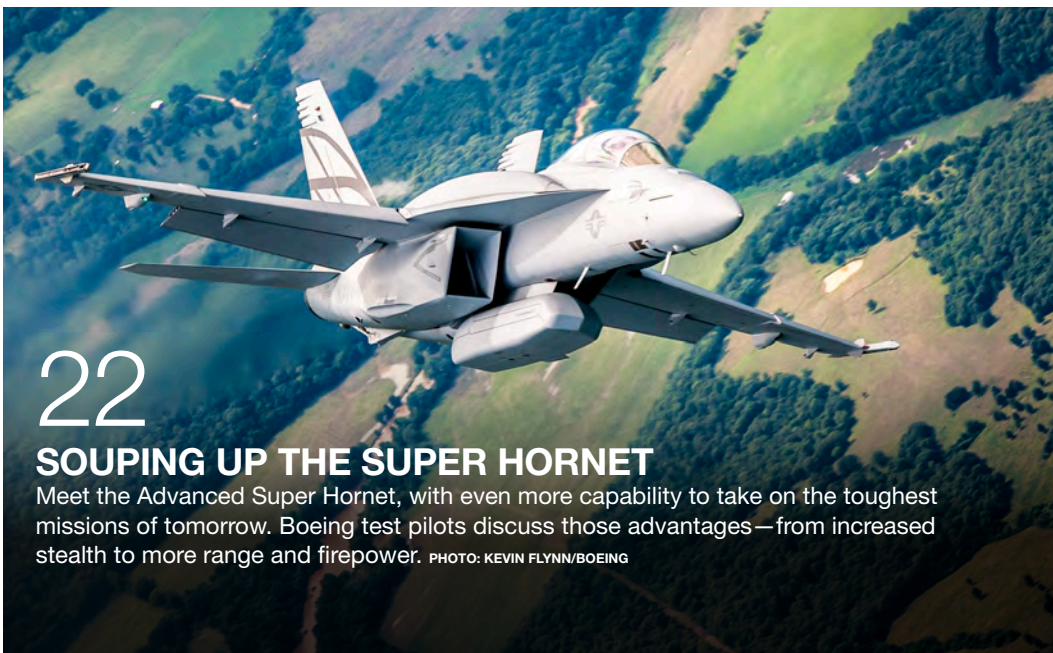
The Boeing Stratoliner, shown on its first flight in December 1938, was the first pressurized commercial airplane. It could comfortably fly passengers at higher altitudes and avoid bad weather. Even aviation pioneer Howard Hughes had to have one. PHOTO: BOEING ARCHIVES



18

DESIGNED WITH THE CUSTOMER IN MIND

The delivery center is the final stop for a Boeing jetliner before it's officially turned over to the customer. Boeing has two new world-class facilities—in Everett, Wash., and North Charleston, S.C.—for its widebody jetliners. PHOTO: GAIL HANUSA/BOEING



22

SOUPING UP THE SUPER HORNET

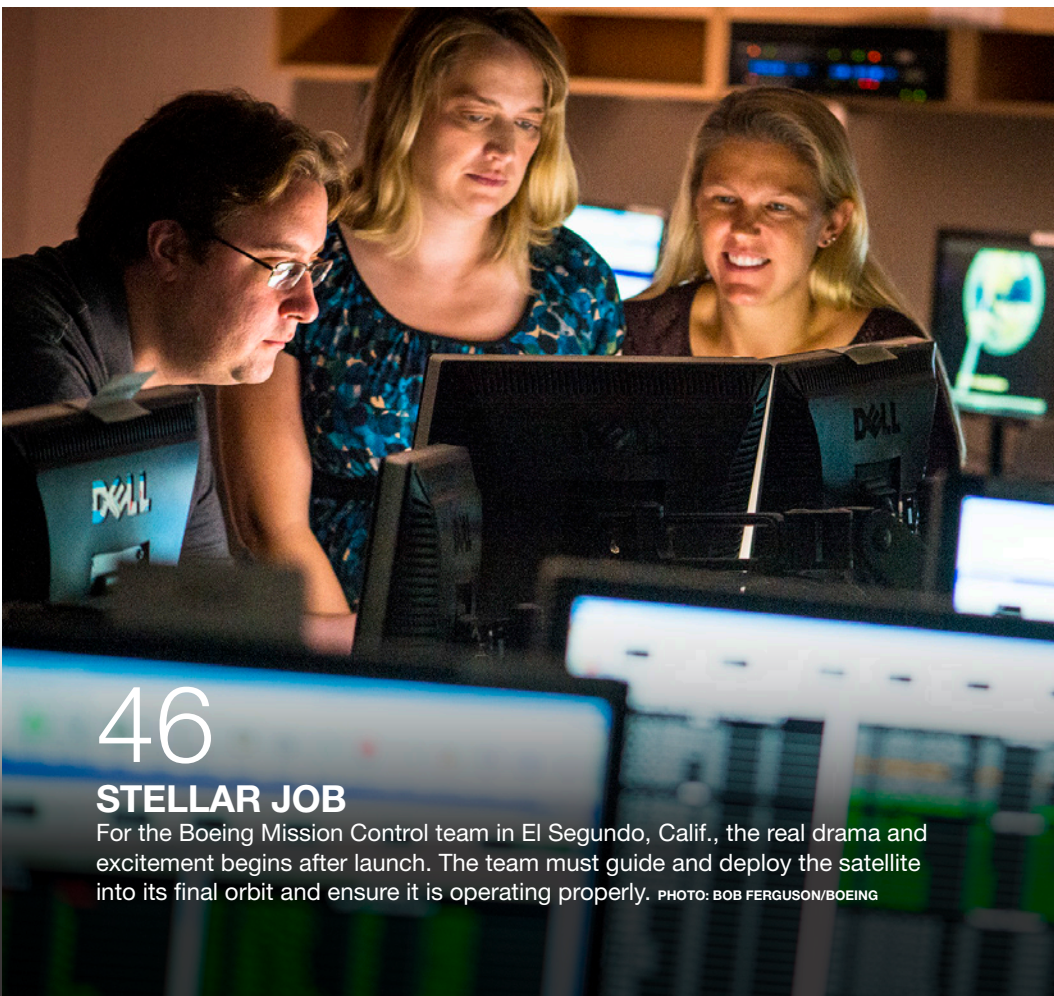
Meet the Advanced Super Hornet, with even more capability to take on the toughest missions of tomorrow. Boeing test pilots discuss those advantages—from increased stealth to more range and firepower. PHOTO: KEVIN FLYNN/BOEING



39

MADE WITH JAPAN

Boeing's relationship with Japan began 60 years ago. The country is a key market for Boeing commercial and military aircraft and Japan's three aerospace "Heavies" are major suppliers and partners. PHOTO: CHRISTOPHER JUE PHOTOGRAPHY



46

STELLAR JOB

For the Boeing Mission Control team in El Segundo, Calif., the real drama and excitement begins after launch. The team must guide and deploy the satellite into its final orbit and ensure it is operating properly. PHOTO: BOB FERGUSON/BOEING

Inside

07 LEADERSHIP MESSAGE

Boeing today faces significant challenges, from reduced defense spending to fierce competition on the commercial side of the business. But Roger Krone, president, Boeing Network & Space Systems, says the company has many advantages to address these challenges, including its most important resource—the Boeing workforce.

08 SNAPSHOT/ QUOTABLES

10 WHY WE'RE HERE

36 BUILDING A BETTER BOEING

52 MILESTONES

58 IN FOCUS



Advanced Developmental Composites
Non Destructive Inspection Team



Jason Klea

Mike Gilmore

Gina Barron

Quality is never
an accident.

Find it. Fix it. Never again.

Commercial Airplanes
.....
Quality is personal.



Tapping Boeing's potential

Boeing's competitive advantage is its people—who do 'amazing things'

Roger Krone

President, Boeing Network & Space Systems,
Boeing Defense, Space & Security



As we approach our second century, Boeing faces major challenges. On the defense side, we are seeing reduced spending, fewer new programs and the need to provide more affordable solutions for our customers. Boeing Commercial Airplanes faces fierce global competition as it ramps up production on existing models and develops the next generation of fuel-efficient aircraft. These challenges create a significant opportunity to extend our aerospace leadership.

Boeing possesses many advantages to address these challenges. We have a strong core business in both our commercial aviation and defense sectors that allows us to leverage the power of "One Boeing." We are transitioning from being a company that does business internationally to being a truly global company—nearly 60 percent of our revenue in 2012 came from outside the United States. The people of Boeing have created a tremendous portfolio of intellectual property and we are a leading technology innovator. Additionally, we are also taking aggressive action across the enterprise to reduce our costs and invest those savings in new products and capabilities.

All of these competitive advantages flow from one source—our human talent.

Within Boeing Defense, Space & Security, "People First, Customer Always" is one of our key strategic objectives. It advances an employee-focused culture, enabling personal and professional development, engagement, well-being, safety and community involvement as the building blocks for sustainable, long-term business success. Commercial Airplanes has a similar strategy.

Recently, we recognized three teams across BDS as "People First Champions." The teams—two from Boeing Military Aircraft and one from Phantom Works—comprise a diverse group of employees dedicated to finding new ways of meeting our customers' needs.

Whether focused on developing new tools to improve first-time quality, exploring new vertical-lift concepts, or identifying new maintenance and upgrade procedures for fighter aircraft, these People First Champions are empowered to collaborate and find solutions.

It is imperative we continue to move in this direction. First and foremost, Boeing leaders and managers must view themselves as being in the people business. They must work to create an open and honest environment where different opinions are valued, teams are diverse and employee engagement is embedded in everything that's done.

Similarly, employees have a critical role to play in Boeing's success. By executing flawlessly on current programs, employees help grow our core business and fuel expansion into new markets. We need employee input and ideas to reduce our costs and increase our competitiveness. Finally, we need employee involvement and support to improve workplace safety.

The possibilities are astounding: Our ability to adapt to changing markets, innovate, collaborate across the enterprise, and produce first-to-market products—such as the 787 Dreamliner and the 702SP (small platform) all-electric satellite—stem largely from our willingness to empower our employees to "do amazing things." Success stories such as these will drive new business and sustain jobs and career opportunities.

Oftentimes, we look at technology or productivity rates as the source of our competitiveness. While these factors are important, the true source of Boeing's competitive advantage is its workforce. An organization's true long-term competitive advantage is its ability to react and adapt to change. At Boeing, this capability is embodied in the strength of our greatest resource—our people.

Building a bigger, better Boeing—together—is something in which we can all take pride. ■

PHOTO: SALLY ARISTEI/BOEING

Star of Africa

Kenya Airways recently took delivery of its first 777-300ER (Extended Range), shown here as it taxied at Paine Field in Everett, Wash. The airline named the airplane Maasai Mara after a well-known game preserve in Kenya to which the airline flies tourists. Boeing delivered the new jet to GE Capital Aviation Services, which is leasing it to Kenya Airways. The carrier is scheduled to receive two more 777-300ERs in the coming months and has nine 787 Dreamliners on order. Boeing long-haul jets are key to Kenya Airways' goal of nearly doubling, to 115, the number of destinations it flies to by 2021. PHOTO: GAIL HANUSA/BOEING





“It can fly virtually any mission, anywhere on the planet from Canada.”

– Calin Rovinescu, chief executive officer of Air Canada, on Boeing’s 787 Dreamliner. Air Canada is scheduled to receive six Dreamliners next year, as well as another 31 between 2015 and 2019. Vancouver Sun, Nov. 9

“It unlocks an incredible amount of fuel efficiency that other airplanes will never even come close to.”

– Bob Feldmann, Boeing vice president and 777X program manager, speaking to reporters before the Dubai Airshow about the airplane’s composite wings, which will span 233 feet (71 meters), or 22 feet more than the current 777. Boeing launched the 777X at the air show, with 259 orders and commitments from four airlines worth almost \$100 billion at list prices. It was the largest single commercial launch by value in the history of the industry. Bloomberg News, Nov. 17

“A tremendous example of what a V-22 is able to do.”

– A senior U.S. Marine Corps official, discussing how the Bell Boeing V-22 Osprey is helping provide emergency relief aid in the Philippines following Typhoon Haiyan. The V-22’s ability to land and take off like a helicopter but fly like a fixed-wing aircraft allows it to quickly serve remote, unprepared landing zones as well as established airports. Reuters, Nov. 18

“Any item—metal shavings, a rag or a tool—can end up as FOD and potentially damage the airplane.”

— Chris Wang

Get the FOD out of here!

737 mechanic has second set of eyes—for foreign object debris

By Kathrine Beck and photo by Marian Lockhart

Chris Wang, a 737 engine mechanic in Renton, Wash., is part of a Commercial Airplanes team working to eliminate foreign object debris, or FOD, that can damage airplanes. In this Frontiers series that profiles employees talking about their jobs, Wang describes his pride in building airplanes—and helping keep them safe.

I love that I'm working on the engine, a vital part of the airplane. As far as I'm concerned, it's the best mechanic job at Boeing.

We prepare the 737 engine for the airplane. It comes to us from GE and we install all the Boeing parts before the engine gets attached to the wing—hydraulic plumbing, exhaust nozzles, fuel lines. I love the flow and seeing the airplane in progress. From our shop I can see my colleagues hanging the engines on a 737 across the factory floor. I get to see most aspects of the build process, from the airplane fuselage coming off the train, to the airplane rolling out the door. We do four engines a day, every day.

But I'm also the shop's FOD and tool lead, and I help keep my shop compliant with Boeing standards. Any item—metal shavings, a rag or a tool—can end up as FOD and potentially damage the airplane.

I perform a lot of upkeep on toolboxes, making sure that everything is labeled and etched and that tools get put back so they don't become FOD. The tools are shadowed—they have foam cutouts, or special niches in toolboxes—so you can see right away when they're missing. If they are missing, we conduct a search to find the tool so it doesn't become FOD.

I have talked with the other mechanics about ways to make their jobs easier and better using items such as special FOD trays, or making trays to shadow their tools while working on the engine and being able to place those directly in the toolbox at the end of the day.

Another part of compliance is cleaning as you go and making regular sweeps. It's instilled in our shop: We need to pay attention, especially on engines, and we're constantly picking up stuff off the ground. If we see something, we

pick it up, and my job is to help encourage that.

Along with my shop-floor responsibilities, I'm working three days a week on loan with the Commercial Airplanes FOD team. We make regular FOD assessments at the Renton factory and the Boeing Field delivery center to ensure compliance with processes, rules and guidelines for FOD and tool control. We're a second set of eyes. We look at hundreds of toolboxes and take pictures of them. We write up our findings for managers so they can come up with plans to improve compliance. I've also participated with managers in FOD workshops to correct issues and put new processes in place to eliminate FOD.

Working on the FOD team allows me to see how FOD can affect other areas, not just the engine. I see every aspect of the build, from wing panel build-up to the airplane taking off on the runway. I take FOD personally. I want my family to be able to fly safely on these airplanes. I want Boeing to succeed.

To me it's all about pride in my job, pride in what I do and personal responsibility. When I see a 737 fly overhead, I love that I had something to do with that. ■

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Above the weather

Boeing's Stratoliner was world's first pressurized commercial airplane

By Mike Lombardi



Only 10 were built and Hollywood movie producer and aviation pioneer Howard Hughes bought one of them. But Boeing's Stratoliner changed commercial aviation.

For the first time, passengers could “fly above the weather” at high altitudes because of the airplane’s pressurized cabin. Or as a Boeing advertisement of the day proclaimed: “Blue skies, bright sunshine await you up above the winter clouds and snow ... up where 4-engine Boeing Stratoliners have opened a smoother skyway for over-the-weather travel.”

The Stratoliner, the world’s first pressurized commercial airplane, was born in the 1930s, during a time of rapid evolution in the science and technology of flight, beginning with dramatic advancements in aircraft structures. Wood and fabric gave way to metal, monoplanes replaced biplanes and, before the decade was out, another great innovation would revolutionize flight—cabin pressurization.

Throughout the 1930s, pressurization experiments were taking place in Europe as well as the United States, where the U.S. Army was testing cabin pressurization with a modified Lockheed Electra designated XC-45. Boeing researchers were also experimenting with the technology and made it workable with the innovation

“Blue skies, bright sunshine await you up above the winter clouds and snow ... up where 4-engine Boeing Stratoliners have opened a smoother skyway for over-the-weather travel.”

—From a Boeing advertisement about the Stratoliner

of a cabin pressure regulator.

In 1932, Boeing had introduced the fast, all-metal Model 247, considered the first modern commercial airliner. It was a leap ahead of the competition, but its success was brief, as Douglas Aircraft quickly developed a challenger with the DC-2 and followed with the legendary DC-3. Faced with being shut out of the commercial airplane market, Boeing had to design the next leap in air travel. Fortunately, Boeing had already developed the Model 299, a giant four-engine bomber that would become the B-17 Flying Fortress. The successful design of the B-17 became the basis for a new commercial airplane that would be that great leap: the Model 307.

The new airplane combined the wings and tail surfaces from the B-17 with a cigar-shaped fuselage purposely designed to be a pressure vessel. Not only would its size, four engines and long range be a market advantage, but the addition of cabin pressurization would allow Boeing to market an airplane that could fly passengers higher than 20,000 feet

(6,100 meters)—“above the weather.”

To reflect this capability Boeing named the Model 307 the Stratoliner. Orders for the plane came in from Pan American Airways and TWA. Hughes also ordered a Stratoliner for his attempt at a world speed record.

On New Year’s Eve in 1938, the Stratoliner prototype took off from Boeing Field near Seattle on its inaugural flight. Tragically, that prototype and a crew of 10 would later be lost in an airline demonstration flight. A second prototype flew June 20, 1939. Less than a month later, Hughes took delivery of the first production airplane.

Hughes wanted the Model 307 for an around-the-world flight that would break his own record of 91 hours 14 minutes set between July 10 and July 14, 1938, in a Lockheed 14. His Stratoliner was fitted with extra fuel tanks. But the attempt never happened due to the outbreak of World War II. Instead, Hughes transformed his Stratoliner into a “flying penthouse” and it was later sold to an oil tycoon.

The Stratoliner had a crew of five

and could carry 33 passengers in day flights and 25 at night, with seating that reclined or converted into berths. While most commercial passenger flights at the time were limited to 10,000 feet (3,000 meters), the pressurized cabin of the 307 allowed it to fly at more than 20,000 feet (6,100 meters) and maintain a comfortable temperature in the cabin.

But the Stratoliner’s success was short-lived. With the outbreak of war, Boeing turned to a maximum effort to build bombers and ended production after just 10 airplanes. During the war, Stratoliners were drafted into military service and made thousands of accident-free crossings of the Atlantic serving as VIP transports.

Only two Stratoliners remain: Howard Hughes’ personal Stratoliner is now a houseboat and continues to be a popular attraction in Florida; the last flyable 307, Pan Am’s Clipper Flying Cloud, was fully restored by Boeing and delivered in August 2003 to the National Air and Space Museum, where it is on display at the Stephen F. Udvar-Hazy Center in Chantilly, Va. ■

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PHOTOS: (Far left) Following a restoration by Boeing, the last flying Stratoliner, Pan American Airways’ Clipper Flying Cloud, flies near Mount Rainer in Washington state. (Insets, from left) On the left of the Stratoliner’s cabin were nine single seats that could fully recline for overnight flights; the right had four compartments with seating for six passengers each; for overnight flights, seating would convert to sleeping berths. **BOEING ARCHIVES**





ARRIVALS / CHEGADAS

VOZ	PREV	CONF	ORIGEM	POS	TPS	DESTINACAO
0-43	10-14	10-14	SAO PAULO	2D	0	NO. PARTO
710	10-15	10-19	CAMPINAS	1C	0	NO. PARTO
533	10-17	10-17	NATAL	3A	4	NO. PARTO
40						CANCELADO
311	10-21	10-23	UIABA	1B	1	CONFIRMADO
16	10-24	10-26	RECIFE	1A	1	PREVISTO
69	10-24		SALVADOR	2B	1	ATRASADO
450	10-25	10-25	BELEM	2C	1	PREVISTO
668	10-26		PORTO ALEGRE	3E	2	ATRASADO
04			SAO PAULO			CANCELADO

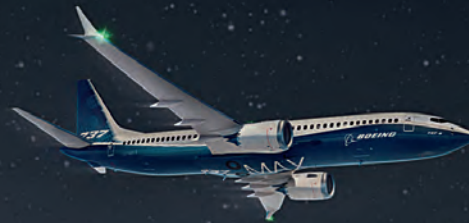


BOEING E BRASIL. OPORTUNIDADES INFINITAS.

A Boeing tem orgulho de há 80 anos fazer parte da vida dos brasileiros.
Hoje mais de 100 mil pessoas voam em aeronaves Boeing todos os dias.
Mais que aviões, a Boeing produz encontros.



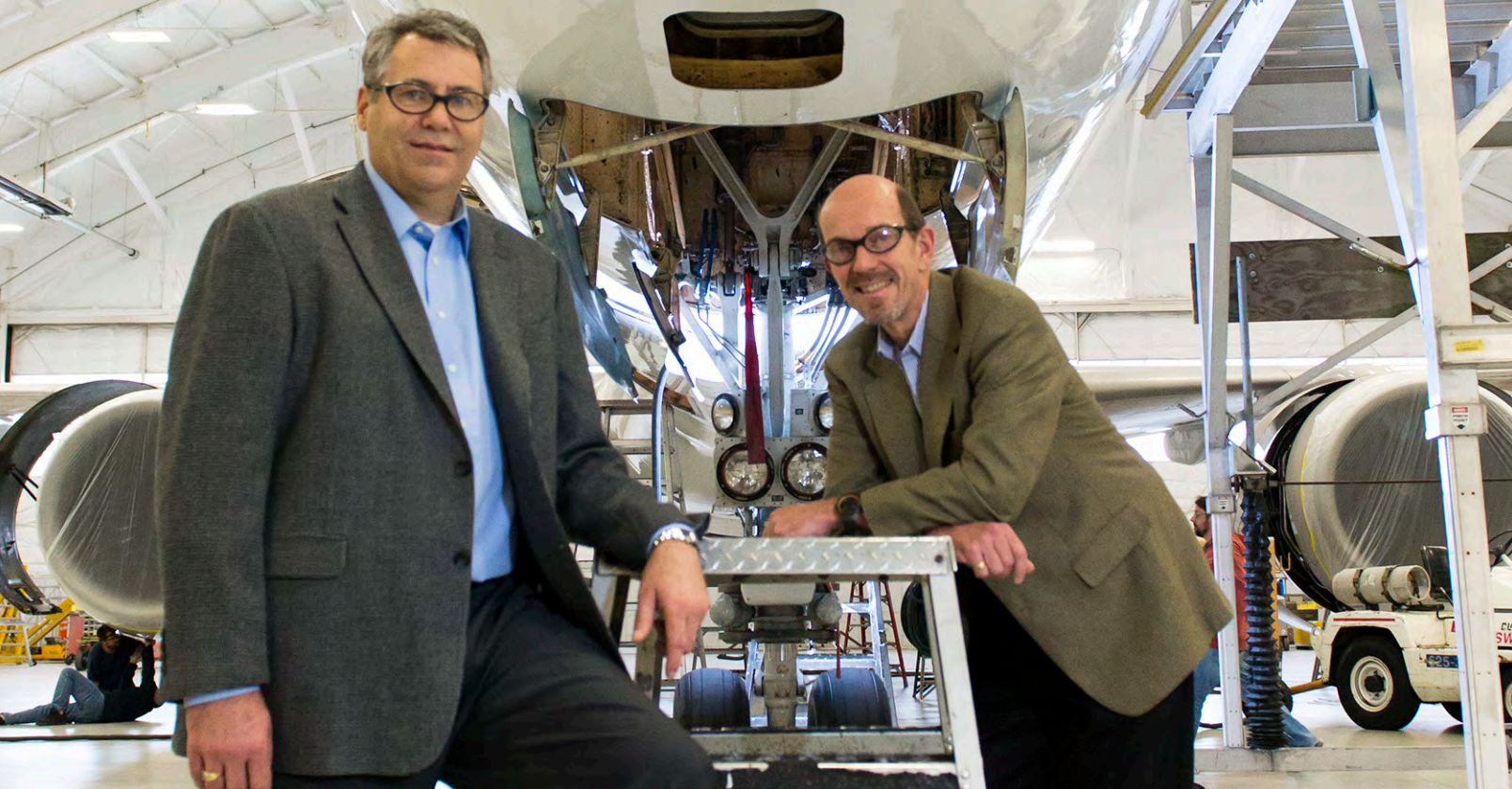
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Plane dealing

Boeing aircraft traders employ used airplanes to create a competitive advantage

By John Kvasnosky



Renowned for its commercial airplane products, Boeing is the first stop for many buyers looking for a good, previously owned jetliner.

And Frank Duckstein may be Boeing's best-known used-airplane salesman.

"That's the amazing thing about our brand. People call and say, 'I want to deal with you, Boeing.' They know us as the company that solves aviation problems," said Duckstein, who has spent 13 years with Boeing Capital Corp., the company's aircraft leasing arm.

Duckstein is part of a cadre of employees who trade in the global used-airplane market.

These marketing and technical specialists wheel and deal in the airplanes comprising Boeing Capital's portfolio

of leasing aircraft and planes taken as trades-ins by Boeing Commercial Airplanes.

Trading in used airplanes can make all the difference in Boeing keeping the customer from going with the "other guy," according to Duckstein, who answers the trading phone and emails and generates the company's online used-airplane listings that appear on Boeing.com.

"It takes a big Rolodex to be good in this business," Duckstein explained.

He and colleagues yearly handle numerous transitions of Boeing-leased jetliners from one operator to another or, depending on aircraft age or market factors, sales to new owners or airplane recyclers.

In 2013, for example, Boeing Capital

accelerated transferring four remaining 717-200s to new European low-cost carrier Volotea and began delivering additional leased 717s to Australia's QantasLink, which will get five by mid-2014.

Boeing's largest block of leased 717s also began moving from Southwest Airlines, which inherited them in its AirTran acquisition, to rival Delta under a sublease that allowed Southwest to keep an all-737 fleet.

"Solving Southwest's problem and not having Delta go to another manufacturer provides both airlines with long-term Boeing solutions," said Mike Cave, Boeing Capital president. "We enabled an outcome that was win-win for both carriers and Boeing."

Boeing Capital also placed two

of its MD-11 converted freighters with a United Kingdom-based cargo firm flying in Africa despite a soft global cargo market.

With the exception of one remaining MD-11 freighter, as of late 2013 all of Boeing Capital's more than 240 portfolio airplanes are committed to customers.

Sometimes Boeing's used airplanes can help customers out in a pinch or longer.

A 767-300ER (Extended Range) was deployed on short notice this summer to Ethiopian Airways as "interim lift" after one of its new 787 Dreamliners was damaged at London's Heathrow airport.

"It took less than two weeks from when we got the request until the plane was in Addis Ababa," said Thomas Hansen, who leads Boeing Capital's asset management group responsible for aircraft redeployments. "There were modifications involved, and the customer and outside companies helped us make it happen."

Trading also takes place when Commercial Airplanes accepts used planes in sales campaigns where Boeing faces aggressive competition.

"The trade-in business is cyclical, and it's been busier lately," said Michael Murray, who has supported the aircraft trading process at Commercial Airplanes for 12 years.

"A lot of customers want to take

advantage of the new technology and fuel-efficient products we have available and are asking us to take care of their older planes," he said. "It's a competitive advantage that we're willing to do so."

Boeing aircraft traders have placed used airplanes at some of the world's largest airlines as well as new startup carriers.

"Having Boeing's capabilities and portfolio involving used airplanes has advantaged us in the marketplace," said John Wojick, vice president of Commercial Airplanes Sales. "Whether it's taking trade-ins or providing customers interim lift to allow us to respond quicker than we can deliver new planes, our portfolio helps keep customers at Boeing."

In an effort to maximize the company's trading expertise, Commercial Airplanes and Boeing Capital will consolidate the traders into a single management team starting in January and based at Boeing Capital.

"We're bringing together two groups that have demonstrated a genuine competitive advantage for Boeing," Cave said. "We're going to have the capacity to deal with the current surge and perhaps to do even more. The synergies created will allow all of us to do more for less." ■

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"It takes a big Rolodex to be good in this business."

— Frank Duckstein, Boeing Capital

PHOTOS: (Left) Frank Duckstein, left, and Michael Murray, both with Boeing Capital Corp., inspect a used Boeing 757 at an Everett, Wash., aircraft maintenance facility. ED TURNER/BOEING (Below) The first 717-200s in Delta Air Lines livery are seen here after their transformation from being part of AirTran's fleet. DELTA AIR LINES



Special delivery



When a commercial jetliner rolls out of a Boeing factory, just one stop remains before the airplane flies away—the site’s delivery center, where Boeing employees prepare the airplane for the handoff to the customer.

Boeing has designed and recently completed state-of-the-art facilities at Everett, Wash., and North Charleston, S.C., to accommodate the stepped-up pace of widebody airplane deliveries. With their sweeping designs and expanded amenities, these new centers are among the crown jewels of Boeing facilities.

The 180,000-square-foot (16,700-square-meter) Everett Delivery Center opened in April to replace a center built in the late 1960s. Every model assembled at Everett—747, 767, 777

and 787—passes through it.

Boeing South Carolina opened a 58,000-square-foot (5,400-square-meter) facility in November 2011 to deliver 787 Dreamliners built at the North Charleston site.

More than simply gateways for an airplane’s entry into service, the centers are ambassadors for Boeing, providing opportunities to strengthen relationships with customers.

“Airline customers genuinely appreciate the amenities that have been incorporated into both delivery centers,” said Jack Callaghan, who manages facility-related requirements at the Everett center and supported development at both sites.

A case in point is JetStar, part of the Qantas group, which was at the Everett center this fall to take delivery of its first 787.

“Airline customers genuinely appreciate the amenities that have been incorporated into both delivery centers.”

— Jack Callaghan, Everett Delivery Center project manager

PHOTO: Sweeping curves create an open, “embrace the plane” concept at the Everett Delivery Center. GAIL HANUSA/BOEING

Boeing's innovative new delivery centers were designed with the customer in mind



Scott Collins, manager of Fleet Projects for Qantas, said the “state-of-the-art facility” had the flexibility to meet the needs of the owner and operator, as well as its regulator, Australia’s Civil Aviation Safety Authority.

“It also provided a spectacular place for our official delivery ceremony and to launch our first delivery flight with over 50 media and VIP guests on board back to Australia, providing them an unforgettable experience,” Collins said.

Delivery centers complete the final stage of airplane acquisition. After leaving the factory, each plane moves to the delivery center and enters the preflight and delivery process, which includes painting and weighing, initial fueling, engine runs, heavy checks and then a “B-1,” or first flight. These are followed

by a customer walk-through of their new airplane, a customer acceptance flight, “ticketing,” or Federal Aviation Administration and government certification, and the actual aircraft delivery.

While Boeing delivers hundreds of commercial airplanes every year, each one is special to the company and the customer. The new delivery facilities are center stage for the ceremony, pomp and celebration that often attend major deliveries.

“It’s a place for business, but it’s also a place for celebration,” said Adam Daniels, Site Services project administrator, who was part of the Shared Services Group team that managed construction of the North Charleston center.

The architecture of both delivery centers rises to the occasion with

regionally themed designs and extensive use of glass, designed to create an open, “embrace the plane” concept. Although the Everett center is three times larger than the North Charleston facility, both offer expanded food and event facilities and boarding bridges that provide customers direct airplane access.

“The covered entryways, event space and direct access to their airplanes—in any kind of weather—really resonates with customers, making our ability to meet and exceed their expectations that much easier,” Callaghan said.

Apart from the glamour and pomp, deliveries are high-stakes business transactions. Customers expect their airplanes on time and without delays

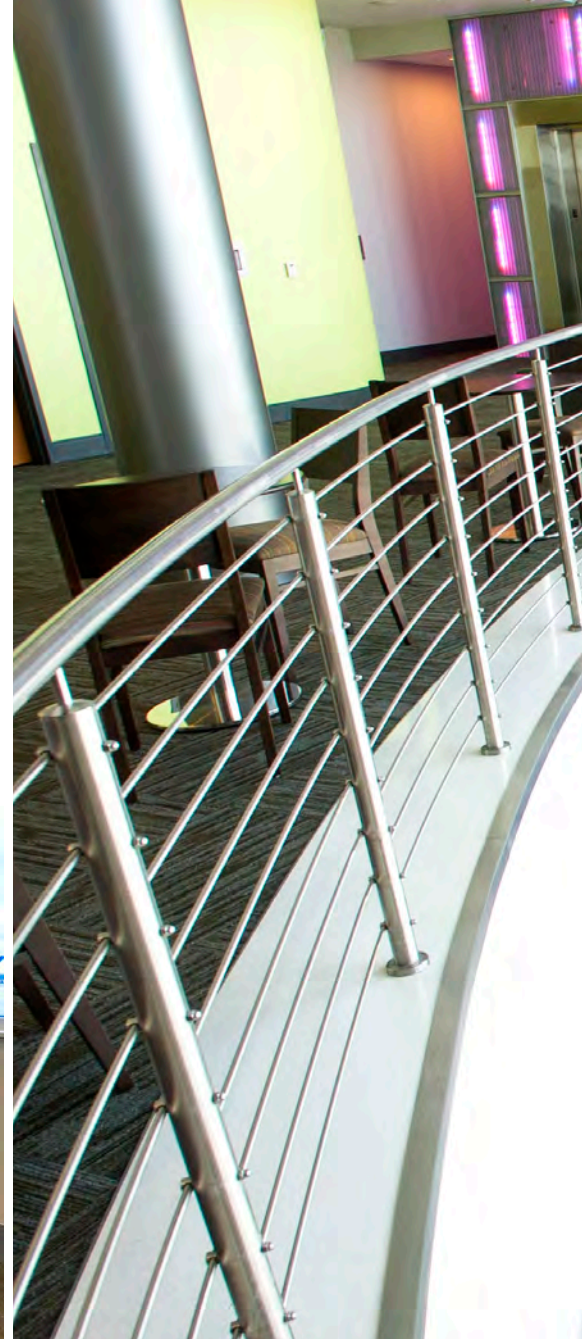
that can hamper entry into an airline's fleet operations. To facilitate that, the centers operate around the clock and provide on-site security screening so departing airplanes can fly directly to an airport, pick up paying passengers and freight, and immediately generate revenue for the airline.

"Our team knows and understands the competitive landscape and the reputational stakes," said Tom Maxwell, vice president at the Everett Delivery Center. "That means delivering planes on time and exceeding customers' expectations for quality and performance—all while keeping a prominent focus on safety each time a team member steps on the flight line."

Or as J.T. Duncan, a flight-line lead mechanic at Boeing South Carolina, explained: "It takes a team of dedicated professionals to get the airplanes ready for our customers. As customers familiarize themselves with our facility, our team and our capabilities, they will see that our commitment is strong and consistent with the high levels of support they've come to expect from Boeing." ■

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PHOTOS: (Below, from top) Expansive glass brightens the interior of the Everett Delivery Center; the Everett center's second-floor reception area. **GAIL HANUSA/BOEING** (Right) Boeing South Carolina's new delivery center features a three-story atrium. **ALAN MARTS/BOEING**



THE 'BEST OF BOEING'

Sweeping curves and light-filled spaces lend sophistication to Boeing's new delivery centers, but they posed challenges for the project teams that oversaw fire, security and construction issues under tight deadlines.

In Everett, Wash., the fast-paced schedule was a constant source of pressure. But Pam Turk, the Everett Site Services project manager, also had to resolve how to fit mechanical and electrical systems into the Everett Delivery Center's uniquely shaped space.



“A major design element was the idea of compression and expansion through the use of curves and finishes,” she said. “The team had to rely on 3-D modeling to identify situations where system interference would likely occur in construction. The modeling facilitated prefabrication of many components to meet the aggressive construction schedule.”

At Boeing South Carolina, teams tackled how to install fire suppression systems in the facility’s three-story atrium, which initially appeared to conflict with building codes related to smoke evacuation systems in the event of a building fire.

The South Carolina project was

managed by a six-person team from Site Services, part of Boeing’s Shared Services Group. A team of about 10 managed the Everett project, which took just under two years from initial approval to grand opening.

At both sites, Security & Fire Protection, also part of the Shared Services Group, worked to ensure that required security elements would not detract from the customer experience. As with commercial airports, Boeing deliveries—passengers and cargo—are subject to U.S. Transportation Security Administration (TSA) standards. Designers integrated security elements into the layout so they would appear seamless.

“As you go through security and get

ready to board, the airplane is never out of sight. This is all part of the flow and it helps reinforce positive perceptions for our customers,” said Daniel VanZanten, project manager for Supply Chain & Aviation Security Compliance.

Added Kirsten Provence, senior manager for the security compliance group: “We’ve created a place that showcases the best of Boeing and also meets rigid government and TSA requirements.”

Ultimately, however, it’s all about the building making the experience—not about the building itself. Whether in Everett or North Charleston, customers can expect the new centers to deliver comfort and convenience as they prepare to accept their new airplanes. ■



“We always want to be not one step ahead of the enemy but five steps ahead.”

— John Tougas, F/A-18 Super Hornet test pilot

PHOTO: Steve Schmidt, F/A-18 Super Hornet test pilot, seated in the cockpit, flies for Boeing Test & Evaluation. He participated in the recent flight-test program for the Advanced Super Hornet, which is shown here at Boeing's St. Louis site where the Super Hornet is built.



MORE STEALTH, RANGE... FIGHTER

Pilot talk—what the Advanced Super Hornet means for tomorrow’s warfighters

By James Wallace and photos by Ron Bookout

Boeing test pilots “Sting” and “Bull” had just put the company’s Advanced Super Hornet through a series of maneuvers in the skies near St. Louis and, back on the ground, were engaged in pilot talk, discussing what the updates will mean for warfighters on the first day of battle, before enemy radar and other threats are degraded or destroyed.

More stealth, more range, more mission flexibility, more weapons—just some of the advantages, they explained.

“What we’ve done is really advance the stealth capability of the Super Hornet and give it that first-day-of-war capability. It can go farther into enemy territory without being detected,” said Steve Schmidt, call sign “Bull.”

And bring much more to the fight,

added Mike Wallace, call sign “Sting.”

Wallace and Schmidt are F/A-18 Super Hornet test pilots with Boeing Test & Evaluation, part of Engineering, Operations & Technology.

Since that first flight back in early August, the Advanced Super Hornet demonstration aircraft has completed a flight-test program totaling 27 flights and more than 40 hours in the air, first in St. Louis and later for additional testing at the U.S. Navy’s Patuxent River, Md., flight-test facility.

Built in St. Louis, the F/A-18E/F Super Hornet is the mainstay carrier-based fighter of the U.S. Navy. More than 600 are in operation with the Navy and U.S. allies around the world. The Advanced version is not a new aircraft

type, but a suite of enhancements that can be ordered a la carte by customers for new Super Hornets or retrofitted onto existing aircraft. They also can be added to the EA-18 Growler, the electronic warfare version of the Super Hornet.

The aircraft used for the testing was a factory-fresh, two-seat F/A-18F on loan from the Navy that was modified with several of the Advanced Super Hornet options, including conformal fuel tanks, an enclosed weapons pod and other enhancements that make the Advanced Super Hornet less visible to enemy radar.

Last month, Wallace, Schmidt and two other test pilots with Boeing Test & Evaluation, all of whom who flew many of those test flights, spoke with *Frontiers* about the Advanced Super Hornet and

what its new capabilities mean for potential domestic and foreign customers—and for military fighter pilots. All four were military fighter pilots before they joined Boeing.

“We always want to be not one step ahead of the enemy but five steps ahead,” explained John Tougas, who, like Wallace and Schmidt, is an F/A-18 Super Hornet test pilot. Tougas was designated lead project pilot for the Advanced Super Hornet flight tests, responsible for test planning, test hazard analysis, and test execution and data collection, including flying some of the missions.

“Right now, today’s Super Hornet is five steps ahead of the enemy with its capability,” Tougas said. “What the Advanced Super Hornet does is keep that future-generation naval aviator, when they finish flight school, still five steps ahead of the enemy.”

Tougas spent 20 years in the U.S. Navy before joining Boeing in 2009. He was a Navy test pilot and flew both the Hornet and Super Hornet. He keeps in touch with some of his old Navy buddies who fly Super Hornets. When they recently asked him about the capabilities of the Advanced Super Hornet, Tougas said, he told them: “You know how you can kick butt in the Super Hornet? Well, you will still be kicking butt in the future with the Advanced Super Hornet.”

Ricardo Traven, Boeing’s chief test pilot for the F/A-18, also flew Hornets in the military, only for the Canadian Air Force, which is now considering whether to buy the Super Hornet or the F-35, which maker Lockheed Martin has touted for its stealth.

“The Super Hornet is a lot stealthier than people give it credit for. Much stealthier,” Traven said.

The new conformal fuel tanks merge into the Advanced Super Hornet’s fuselage, reducing its radar cross section even further. The enclosed weapons pod also reduces the aircraft’s visibility to radar. Weapons that traditionally would be hung under the Super Hornet’s wings can be stored, and launched, from the aerodynamic pod. The Advanced Super Hornet also has other enhancements that reduce its radar cross section.

Tests show the radar “signature” of the Advanced Super Hornet, when scanned head-on, is more than 50 percent less than the current

Super Hornet, according to Boeing.

“As threats evolve so do we. It’s not all about the radar cross section, but that’s a piece of it,” Traven said, adding that the reduced radar cross section of the Advanced Super Hornet is “something that the U.S. Navy as well as potential foreign customers will be looking at.”

But increased stealth is only one advantage the Advanced Super Hornet has, according to the Boeing pilots who have been testing it.

Schmidt, who flew F-14 Tomcats off Navy carriers and Hornets in Navy test pilot school, noted that Super Hornets operating from a carrier often need to carry a centerline fuel tank for additional range. But the Advanced Super Hornet can use that same space for the enclosed weapons pod because of the extra fuel in the conformal fuel tanks.

“It essentially frees up a weapons station,” he said. “It also gives them the capability to fly farther, to extend the combat radius.”

And for customers who operate the Growler, the conformal fuel tanks will eliminate the need to carry wing-mounted fuel tanks. Instead, the Growler can carry additional electronic warfare equipment.

It all adds up to a jet fighter that can meet future threats—and bring pilots home from harm’s way, said Wallace, who flew Hornets for the Navy before he joined Boeing 12 years ago.

“Compared with the Hornet that I flew in the fleet, the Super Hornet is so much more advanced with all its avionics and warfighting systems,” Wallace said.

“And now the Advanced Super Hornet upgrades will give the Super Hornet even more expanded strike capability to go up against some of the most formidable surface-to-air threats and air-to-air threats that exist now and in the future. It is extremely important for the Navy to have this capability.”

Boeing used its own funds to develop the Advanced Super Hornet prototype—in only about 10 months. The conformal fuel tanks were designed and manufactured by partner Northrop Grumman, which, like Boeing, used company funds.

The Advanced Super Hornet is a great example of Boeing’s ability to rapidly prototype a new product, whether it be a

satellite or jet fighter, Traven explained.

“Everything from ‘A’ to ‘Z’ was an exercise in challenging the old ways of doing business and finding new and innovative ways of producing a variation to a product for our customers,” Traven said.

Traven was part of the Boeing team that developed and tested the Super Hornet. So was Wallace.

“Right now, the Super Hornet is an incredible strike fighter that operates off the carrier on a daily basis, day and night around the world,” Wallace said. “These enhancements will give it even better capability to do first-day-of-the-war scenarios, but you’re going to maintain that flexibility to come back to the hard work of carrying lots of bombs externally under the wing or payload under the wings ... There are very few other fighter airplanes in the world that can do that and land on the aircraft carrier.” ■

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PHOTOS: The Advanced Super Hornet, as shown in these night shots, has an enclosed weapons pod underneath the fuselage and conformal fuel tanks blended into the top of the fuselage. Together, with other stealth enhancements, they give the upgraded fighter extended range and make it less visible to enemy radar.





SOUPING UP THE SUPER HORNET

With the Advanced Super Hornet, customers can select from a suite of enhancements that can be retrofitted to existing F/A-18 Super Hornets or included on new ones. These options are also available for the Growler, the electronic warfare version of the aircraft.

INTERNAL INFRARED SEARCH AND TRACK

Embedded in a low-profile configuration within the aircraft, this feature offers long-range detection of threats without the use of radar.

CONFORMAL FUEL TANKS

Add up to 260 nautical miles (300 miles, or 480 kilometers) of combat range.

ENHANCED ENGINES

Additional thrust of 20 percent, resulting in significant acceleration and maximum speed increases, as well as improved fuel consumption.

ENCLOSED WEAPONS POD

Allows the aircraft to carry an internal weapons mix in a stealthy configuration. The pod can be added or removed on the carrier deck as needed.

STEALTH ENHANCEMENTS

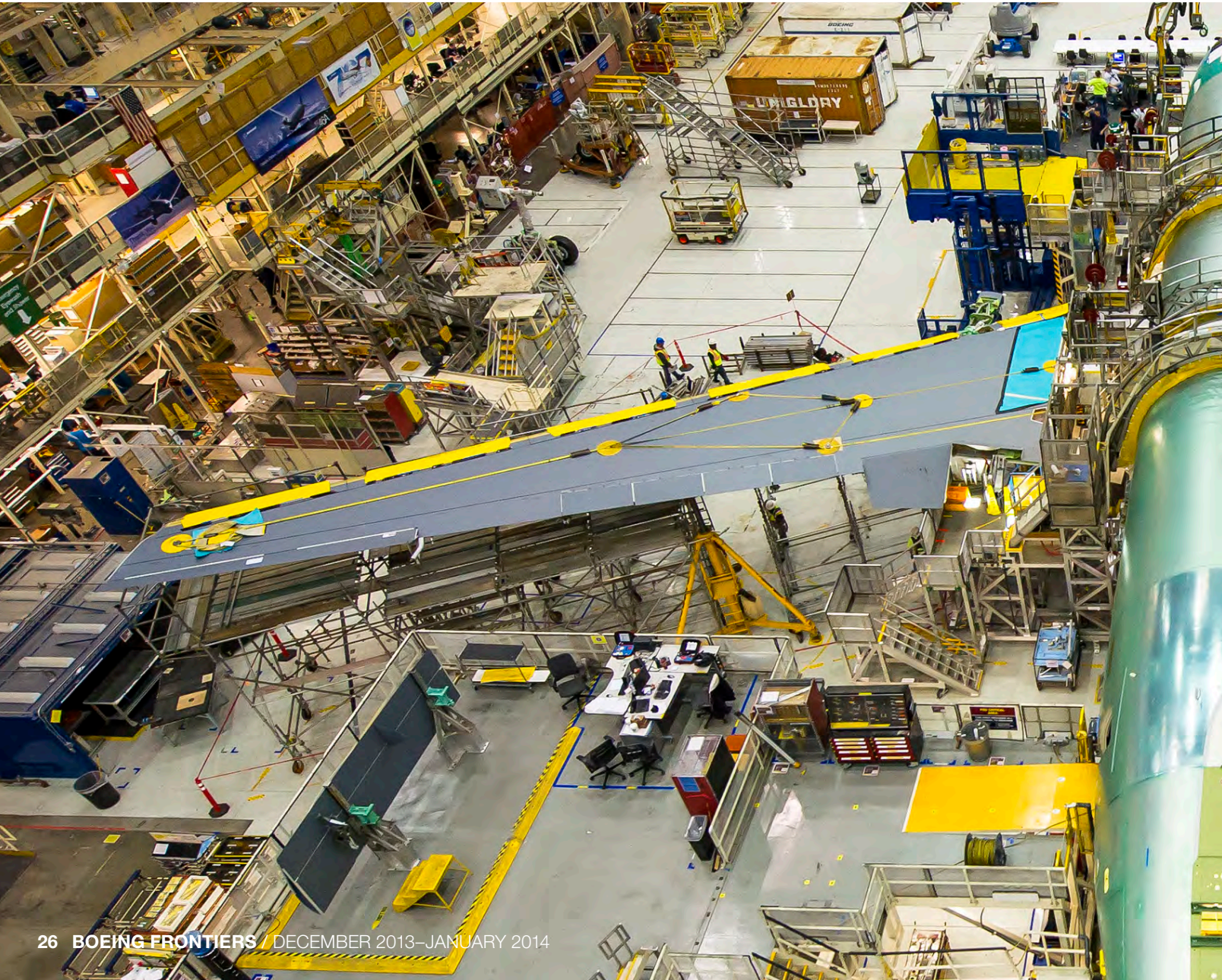
Conformal fuel tanks and an enclosed weapons pod, along with other enhancements, make the aircraft even less visible to enemy radar.

NEXT-GENERATION COCKPIT

Includes a large 11-by-19-inch (28-by-48-centimeter) touch-screen display.



Pride on the tanker line



First KC-46A test aircraft takes shape in final assembly

By Eric Fetters-Walp

With three major fuselage sections moved into the 767 Final Body Join area of the Everett, Wash., factory, Kyle Babcock drilled the first few rivet holes to begin joining the forward and aft sections.

It's something he does routinely, but on the morning of Nov. 14, this task had special significance. The sections he began riveting together are part of the first test aircraft for the U.S. Air Force's next-generation aerial refueling tanker, the KC-46A.

"It's awesome. I'm so happy we were able to land the contract and further the company's future with this airplane," said Babcock, a leader for the 767 program's upper structures team.

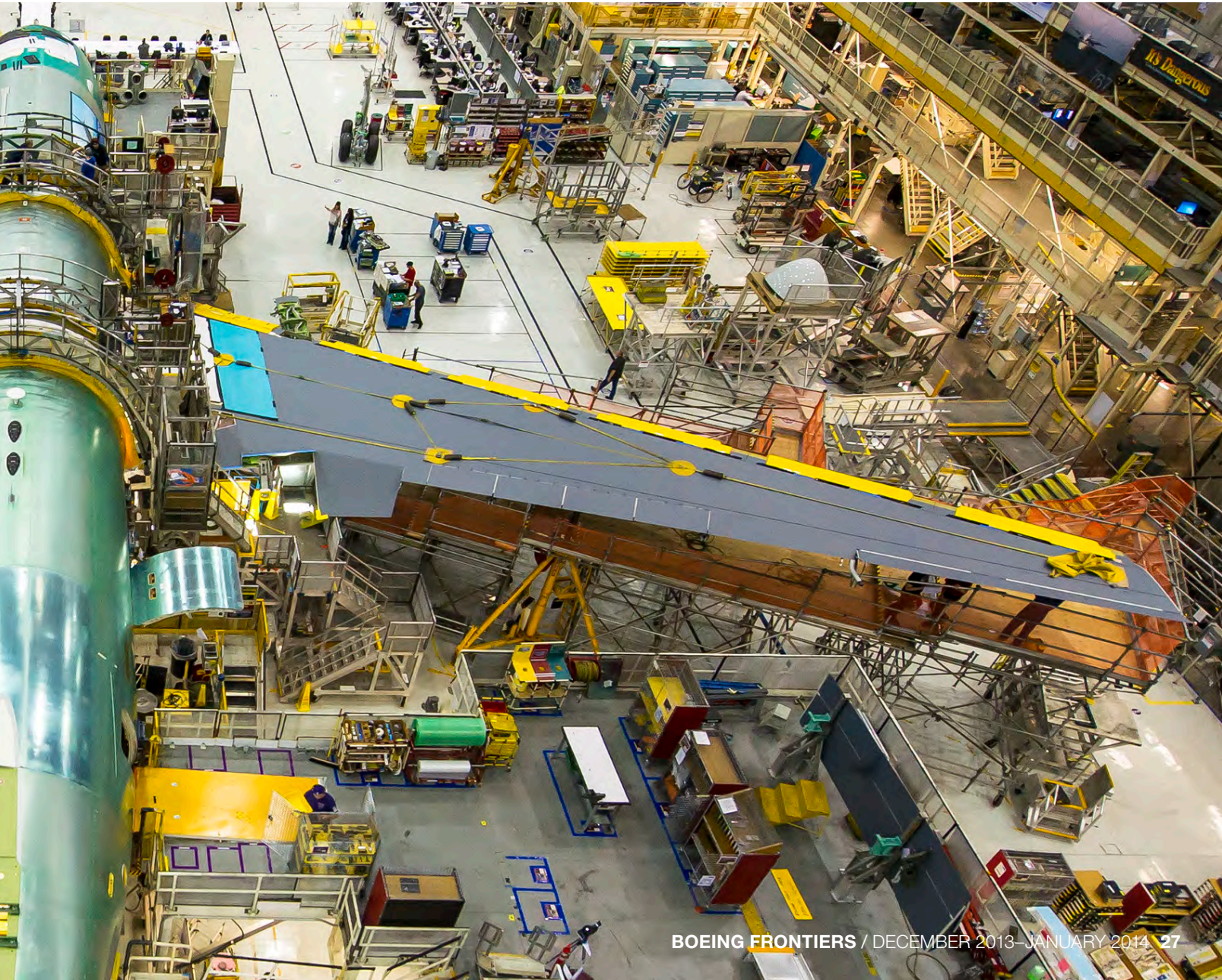
The aircraft being assembled in Everett are derivatives of Boeing's 767 jetliner, which will eventually be finished as aerial refueling tankers at Boeing Field in Seattle. Boeing will build 179 tankers for the U.S. Air Force between now and 2027 if all options under the current contract are exercised.

Following a prolonged contract bidding process, years of planning and five months of production work, the entry of the first next-generation tanker into final

"It's pretty amazing. It's a great airplane, and I think we'll sell these for years and years."

– Steven Olson, mechanic,
Tool Engineering

PHOTO: The first KC-46A test aircraft is shown in the production line at the Everett, Wash., factory. The wings had not yet been joined to the fuselage. BOB FERGUSON/BOEING







“Boeing has met every contractual milestone to date.”

– Tom Lockhart, U.S. Air Force deputy program executive officer for Tankers

assembly is an important milestone. It also means that the program—jointly run by Boeing Defense, Space & Security and Commercial Airplanes—still has much work ahead.

But Boeing remains on schedule to meet its commitments, Tom Lockhart, U.S. Air Force deputy program executive officer for Tankers, said recently.

“Boeing has met every contractual milestone to date,” Lockhart said at the annual Airlift/Tanker Association conference in Orlando, Fla. “A big part of the development program’s success can be credited to the tight focus the U.S. Air Force and Boeing are maintaining on controlling costs and requirements growth.”

Maureen Dougherty, Boeing Defense, Space & Security vice president and KC-46 program manager, attributes that to the strength of the team, which in addition to experts from across Boeing includes the KC-46 System Program Office in Dayton, Ohio, and a global network of suppliers.

“It’s a hugely diverse group, but each of us is working under one plan for one mission,” Dougherty said. “Everything we do is about putting a much needed capability into the hands of the warfighter on time.”

Lockhart said the development phase is now about 45 percent complete, with three test aircraft in production and the fourth set to begin assembly at the Everett factory in January.

The KC-46A tanker continues Boeing’s long legacy in providing the Air Force and international forces with aerial refueling capabilities. The KC-135, which first flew in 1956 and has been updated through its long history of service, still makes up the backbone of the Air Force’s tanker fleet, with more than 400 in active service, according to various estimates. The larger KC-10 Extender tanker was produced by heritage company McDonnell Douglas in the late 1970s and ’80s. The U.S. Air Force has an active fleet of 59 KC-10s today.

The KC-46A is based on Boeing’s proven 767 platform, with more than 1,060 jetliners, freighters and tankers delivered to date. The new tanker design calls for it to carry more fuel, three times more cargo pallets and more passengers than the KC-135. The flight deck will feature pilot displays that debuted

PHOTO ILLUSTRATIONS: (Top) This artist’s concept depicts an F-15 fighter being refueled by the KC-46A tanker using the advanced fly-by-wire refueling boom. (Insets, from far left) The Air Refueling Operator System is located on the flight deck and includes 24-inch displays with 3-D refueling pictures, and a dual instructor station with independent control sticks; the tanker’s state-of-the-art flight deck includes four 15-inch electronic displays like those used on the 787 Dreamliner. **BOEING**

PHOTO: (Near left inset) Boom mechanic Jack Nguyen works in Seattle on the second boom being assembled for the KC-46A tanker. **BOB FERGUSON/BOEING**

Fill 'er up

CONFIGURATIONS FOR BOEING'S KC-46A TANKER:

1 Air refueling **2** Cargo and passenger transport **3** Aeromedical evacuation



TOTAL FUEL CAPACITY:
31,220 gallons
(118,180 liters)



ADVANCED FLY-BY-WIRE REFUELING BOOM
OFFLOAD RATE PER MINUTE:
1,200 gallons
(4,542 liters)—modernized KC-10 boom design



CENTERLINE DROGUE SYSTEM
OFFLOAD RATE PER MINUTE:
400 gallons
(1,514 liters)



WING AIR-REFUELING PODS
OFFLOAD RATE PER MINUTE:
400 gallons
(1,514 liters)

This Boeing illustration shows the view from inside the cockpit of a Boeing F/A-18 Super Hornet being refueled by a KC-46A tanker using the wing refueling pod.



with the 787, as well as aircraft health monitoring systems.

The tanker also will have defensive systems and self-protection features such as cockpit armor to defend against threats and protect the crew.

In short, it's not quite like any other 767 built so far.

"It's a completely different animal to tackle in both its systems and structures, but we've overcome everything so far," said Brian Miller Jr., a manager for Seal, Test & Paint for the 767 program. "I look forward to building the tanker for many years to come."

While the first test aircraft moves through final assembly, and the second and third aircraft advance toward that stage in Everett, a smaller team near Boeing Field in Seattle has started assembling the second refueling boom for the program.

"This is what the tanker's all about—the boom," said Ron Bryant, the boom shop's manager for Boeing Defense, Space & Security.

Based on the KC-10 boom, the updated, fly-by-wire KC-46A boom will be complemented by centerline and wing-mounted hose and drogue systems. Boom mechanic Jim Cha said the second boom already reflects improvements and lessons learned in building the first test boom.

What won't change are visits by the program's interested customer.

Air Force officials have frequently stopped by the boom shop as work has progressed. In fact, the Air Force Materiel Command established the 418th Flight Test Squadron, Detachment 1, at Boeing Field earlier this year to oversee KC-46A tanker developmental tests.

By summer 2014, the detachment could include about 40 people, with representatives from the Air Force Operational Test and Evaluation Center, the Federal Aviation Administration and the Defense Contract Management Agency. Pilots, boom operators, flight-test engineers and others also will work with Boeing Test & Evaluation as aircraft testing begins.

Scott Campbell, vice president and general manager of the 767 program, noted that the program established the date and time for the first tanker's entry into final assembly two years ago. The actual entry into that stage came within 20 minutes of that time.

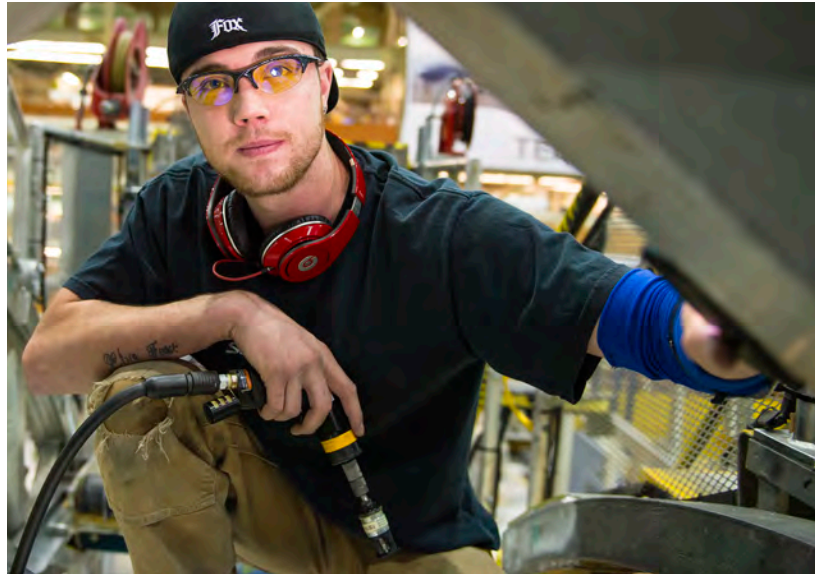
"The biggest thing we can do to keep this aircraft sold is to stay on schedule and under budget—and we're doing that," Campbell said. "There are a lot of military men and women serving out there who can't wait to get this tanker into their fleet. They're counting on us."

The initial 18 KC-46A tankers are scheduled to be delivered to the Air Force by August 2017. The first test aircraft is expected to roll out of the Everett factory in early 2014, followed by first flight later in the year. First flight of a fully outfitted tanker is scheduled for 2015.

All of those milestones are represented by the first aircraft



PHOTOS: (Clockwise from top left) Boom mechanic Scotty Vattana works on part of the second boom being assembled in Seattle for the tanker; Michael Hurst, left, a Body Join and Installation team lead, and door rigger Tom Yardy work on a tanker door in the Everett, Wash., factory; mechanic and team lead Kyle Babcock drilled rivet holes into the fuselage to start the final body join process on the first KC-46A test aircraft for the U.S. Air Force; Michael Contreras works on the aft body section of the first KC-46A test aircraft being assembled in Everett. **BOB FERGUSON/BOEING**





Tanker milestones

FEBRUARY 2011

Boeing receives an engineering and manufacturing development contract for the KC-46A tanker

JUNE 2013

Assembly begins on the first test aircraft

AUGUST 2013

Assembly of the second test aircraft starts

NOVEMBER 2013

First test aircraft enters final body join in Everett, Wash.

taking shape on the production line, located in a fenced-off, secure part of the factory in Everett.

“It’s pretty amazing to see,” said Steven Olson, a mechanic in Tool Engineering. “It’s a great airplane, and I think we’ll sell these for years and years.”

Among the mix of newer and experienced Commercial Airplanes mechanics on the 767 team in Everett, John “J.J.” Jenkins is one of the latter, having worked on the program for 25 years. The team lead for Aft Structures, Jenkins said he and his co-workers are focused on meeting the expectations for the tanker after all the hard work that went into winning the contract. He is looking forward to seeing the first tanker aircraft fly.

“We’re going to have a big, huge celebration,” Jenkins said with a smile, “even if I have to throw the party myself.” ■

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PHOTOS: (From far left) Wing Join mechanic Francisco Capistrano; Eric Berglund, left, and Maisie Todd, both Heavy Structures mechanics, work inside the fuselage of the first KC-46A test aircraft. **BOB FERGUSON/BOEING** Employees signed a banner to commemorate the start of production last month of the first KC-46A tanker. **GAIL HANUSA/BOEING**

PHOTO ILLUSTRATION: (Below) The KC-46A test aircraft will have a maximum airspeed of .86 Mach and a service ceiling of 43,100 feet (13,100 meters). **BOEING**



MID-2014

Flight testing of the first test aircraft

EARLY 2015

Projected first flight of the KC-46A configured tanker

AUGUST 2017

Contractual date for Boeing to have 18 combat-ready tankers for the U.S. Air Force

2027

Boeing completes delivery of 179 KC-46A tankers to the U.S. Air Force

This is an occasional feature about Boeing employees and the work they do that helps the company be more successful. Emily Howard is the first woman to lead Boeing's Technical Fellowship.

The human factor

Boeing technical expert helps fuse the principles of engineering and psychology

By Candace Barron and photos by Bob Ferguson

By the time Emily Howard was 12 years old, she knew she wanted to become a psychologist. A self-described “nerdy, curious child,” she planned her academic career toward that pursuit.

“I was always fascinated by why people would behave the way they did,” she explained. “I also knew I wanted to help people.”

It wasn't until halfway through college, though, that Howard came to accept that she wasn't only a whiz in behavioral science but was pretty good at math and computers, too. Through a passion for competitive sailing—also found in college—Howard became interested in the need for people and technology to work together as a system.

From there, she discovered the quickly growing field of engineering psychology, often referred to as “human factors.” A perceptive professor, aware of a lack of women in aerospace careers, convinced Howard that the diversity she would bring to this field could be a challenge, but would ultimately prove to be an advantage for her career.

Howard had found her calling, was recruited by Boeing heritage company Rockwell International, and eventually worked up the engineering ranks into the Boeing Technical Fellowship, which she now leads as the company's first chairwoman.

Aerospace human factors is a critical part of Boeing's technology mix. Among other advantages, the field fuses the principles of engineering and psychology to make sure that pilots effectively interact with flight systems. Specialists such as Howard are involved in the analysis and design of platforms, as well as the study of factors affecting aviator performance. Howard's innovative contributions have been to translate this discipline to apply to a broad range of Boeing products and services.

“We design and build highly complex and technically advanced machines, but we ultimately build these machines for people, to help them do a wide variety of missions,” said Allen Adler, vice president of Boeing's Enterprise Technology Strategy and corporate sponsor of the Technical Fellowship program.

Based in Huntington Beach, Calif., as part of Boeing Phantom Works, Howard now serves as the user experience architect for the Digital Aviation business within Boeing Commercial Aviation Services.

In the past, she has worked on numerous Boeing products, including fighters, bombers, tankers, training systems, handheld radios, and various command and control stations.

As a Senior Technical Fellow, Howard is one of Boeing's top technical leaders and has spent a significant amount of time encouraging and supporting other technologists, particularly women, to advance along Boeing's technical career path, as she did.

“One thing I wish I knew earlier when I first started in my career is that people don't always think the way you do. And that's a good thing,” Howard said. “That's one of the advantages of human factors. It helps bring people with different thought patterns and approaches onto teams that might have in the past held more of a homogenous view.”

Most of that diverse thinking comes from an individual's life experiences. But some of it can be as simple as biology. The psychologist in Howard appreciates the neuroscience that within the past 20 years has shown gender differences in response to stress, for example, based on fundamental brain chemistry.

“Men and women tend to react to stressful situations differently. They think differently. They will often approach solutions to problems differently,” Howard explained. “And so achieving better gender diversity among our technologists will lead to competitive advantage.”

Despite this latest neuroscience, however, Howard stresses that group traits should not automatically be associated with

PHOTO: Senior Technical Fellow Emily Howard (foreground) reviews data with Linhcat Nguyen, a computer software engineer for Phantom Works in Boeing Defense, Space & Security. A renowned expert in human factors, Howard encourages and supports other technologists to advance along Boeing's technical career path.

“One of the advantages of human factors is that it helps bring people with different thought patterns and approaches onto teams that might have in the past held more of a homogenous view.”

– Emily Howard, Senior Technical Fellow



“I was always fascinated by why people would behave the way they did. I also knew I wanted to help people.”

— Emily Howard



individual character. For example, in her 25-year career, she has fought against and overcome a fair bit of preconceived thinking in the workplace in order to challenge the prevailing stereotypes.

As a single mother of two daughters, Howard is proud to have achieved her level by mastering a sense of work-life balance that can elude both men and women in Boeing's competitive and high-stress technical environment.

She has done so, Howard theorizes, because she applies simple human factors knowledge in everything she does.

“People talk about their home life versus their work life. But to be successful, what you really have to do is integrate your professional and personal activities into your one life,” Howard explains. “I have only one block of time to cover all of my responsibilities. If we're honest with ourselves, we can admit that priorities shift. Sometimes family comes first. But a lot of times, I have to focus on work and ask others to help meet my kids' needs.”

That comes back to Howard's deep sense of purpose in

her career choice. What Howard achieves professionally she also sees as personal success—especially if she can model her success to help others achieve their own goals.

“A woman as successful as Emily in technical leadership is extremely powerful for other women to see,” said Mary Decicco, a manager with Boeing subsidiary Jeppesen, who has worked with Howard in Digital Aviation. “It is vital for women to have an example of what it takes to be successful in technical fields, because it is still not all that common.” ■

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PHOTO: Emily Howard says she became interested in the need for people and technology to work together collectively, inspired in part by her passion for competitive sailing—reflected in this 2005 photo.

“There is no relationship in the world like the one we share with Japan.”

– *Ihssane Mounir, vice president of Sales for Northeast Asia, Boeing Commercial Airplanes*



COMMON GOALS, SHARED VALUES

PHOTO: A traditional red pagoda with Japan's Mount Fuji in the background. SHUTTERSTOCK

Boeing's close relationship with Japan began 60 years ago—and continues to grow

By Eric Fetters-Walp

The Large Cargo Freighter, also known as the Dreamlifter, lands in Nagoya, Japan, nearly every day to load wings, fuselage barrels and other large parts of the 787 Dreamliner for transport to the United States and final assembly of the 787.

Meanwhile, an ANA (All Nippon Airways) 787 prepares to land in Tokyo after its flight from Singapore while a Japan Airlines 787 takes off from Tokyo's other main airport, headed for San Diego.

And at Chitose Air Base in northern Japan, F-15J jet fighters operated by the Japan Air Self-Defense Force sit ready to help protect the nation in which they were assembled.

Boeing is everywhere in Japan, evidence of a relationship between the company and the country that reached 60 years in 2013. This year also saw the 40th anniversary since Boeing

JAPAN AT A GLANCE

Location	Eastern Asia, island chain between the north Pacific Ocean and the Sea of Japan, east of the Korean Peninsula
Area	More than 145,914 square miles (377,916 square kilometers), similar in size to California
Population, 2013	127.2 million people; ranked 10th in the world
Capital	Tokyo
Other major cities	Osaka, Kobe, Nagoya, Sapporo, Fukuoka and Kitakyushu
Gross domestic product, 2012	\$5.96 trillion; ranked third worldwide
GDP growth rate, 2012	2 percent
Largest export partners, 2012	China, United States, South Korea and Thailand

Sources: U.S. government, World Bank



and Japan started collaborating on major production work on the company's twin-aisle airplanes.

"When I think of the nature and quality of our customers and partners around the world, Japan ranks among the very best in terms of the duration of the relationship, the quality of the relationship and the clear mutual benefit that we have experienced over the many years," said Shep Hill, president of Boeing International and senior vice president of Business Development and Strategy.

The mutual relationship can be summed up in numbers. In 2012, Boeing spent more than \$4 billion on goods and services from Japan, accounting for 22,000 high-tech aerospace jobs—more than 40 percent of such jobs in the country. In addition to the major components designed and produced by the three large aerospace "Heavies" in Japan, supplier companies there make everything from composite materials to lavatories to video entertainment centers for Boeing jets.

That type of "Made with Japan" contribution to the nation's manufacturing base has been repaid by Japan's trust in Boeing products.

"It's an important market for us, because 80 percent of the commercial fleet flying today in Japan is Boeing airplanes," said George Maffeo, president of Boeing Japan. "Also, we have the largest fleet

PHOTOS: (Left, from top) George Maffeo, president of Boeing Japan. CHRISTOPHER JUE PHOTOGRAPHY A Boeing F-15J jet fighter manufactured in Japan. JAPAN AIR SELF-DEFENSE FORCE (Right) A Boeing Next-Generation 737-800 in Japan Airlines livery. JIM ANDERSON/BOEING



of F-15s and Chinooks outside of the United States right here in Japan.”

The largest single market for Boeing twin-aisle airplanes, Japan also is home to the first two customers of the 787—ANA and Japan Airlines (JAL). The two airlines, with extensive Boeing-oriented fleets and numerous international routes, have ordered a total of 110 Dreamliners alone, according to Commercial Airplanes. Additionally, Japan-based NCA, in tandem with Cargolux, was the launch customer for the 747-8 Freighter.

Solaseed Air and Skymark Airlines, smaller airlines that fly domestically, both operate Next-Generation 737s.

“Our partnership with Japan is built on a foundation of personal relationships developed over many, many years,” said

Ihssane Mounir, vice president of Sales for Northeast Asia, Commercial Airplanes. “There is no relationship in the world like the one we share with Japan. Our common goals and shared values are deeply ingrained in the very fabric of our business.”

Boeing’s *Current Market Outlook* predicts that Northeast Asia—including Japan—will need 1,360 new airplanes worth \$280 billion between now and 2032. Fifty-five percent of those airplanes are forecast to be twin-aisle models. As Airbus’ recent sale of its new A350 widebody jetliner to Japan Airlines proves, however, Boeing will need to compete hard to retain its dominance in the market, Mounir said.

“Japanese customers expect the

best from Boeing, and as a result, they’ve set the standard very high,” Mounir said. “We recognize that the global market is as competitive as it has ever been and we will continue to work hard to meet the growing expectations of our customers in Japan. We still have many opportunities in Japan and I am confident that we will maintain our market leading position in Japan.”

Boeing Defense, Space & Security also sees potential future sales in Japan. The nation already has the largest fleet of both F-15s and Chinooks outside of the U.S. and operates the AH-64D Apache Longbow rotorcraft. The Japan Air Self-Defense Force also was the launch customer for the KC-767 tanker,

(Continued on Page 45)

THE 'HEAVIES'

In 1973, Boeing began working with Japan Aircraft Development Corp. on opportunities to build commercial airplanes. Five years later, that relationship evolved into a partnership, with Japanese companies helping in the design and development of the 767.

As a result of that collaborative effort, 16 percent of the 767 is made in Japan to this day. The partnership grew as Japan continued to play an important role in the development, design and build of Boeing's other twin-aisle jetliners over the past 40 years. Today, Japan is the single-largest international contributor in Boeing's supply chain, producing 21 percent of the 777 and 35 percent of the 787 Dreamliner.

Japan Aircraft Development Corp. jointly represents Fuji Heavy Industries, Kawasaki Heavy Industries and Mitsubishi Heavy Industries, collectively known as the "three Heavies"

for manufacture of large structural components for Boeing.

"The Heavies are very important to our supply base, our partnership and to the company-to-country relationship that we have," said Shep Hill, president of Boeing International and senior vice president of Business Development and Strategy. They work with Boeing both collectively through Japan Aircraft Development and individually.

Fuji, best known worldwide as the parent company of Subaru, builds the center wing box section for the 777 and 787 in the suburbs of Nagoya. It also supplies parts for the 737 and 767 models.

Nagoya, in central Japan, has served as the center of airplane manufacturing by Kawasaki and Mitsubishi since the 1920s. Mitsubishi Heavy Industries makes the 787's composite main wing and fuselage panels for the 777, in addition to other



PHOTOS: (Clockwise from above) Inside the Kawasaki Heavy Industries facility; Kawasaki makes the mid-forward 787 composite fuselage section (shown); a Kawasaki employee drills fastener holes into the door edge frame of the fuselage section.

CHRISTOPHER JUE PHOTOGRAPHY





parts for Boeing's twin-aisle airplanes. Kawasaki produces the 787 mid-forward fuselage, the 787 main landing gear wheel well and the 787 fixed trailing edges for the wings, as well as structural parts for other models.

Mitsubishi was the first Boeing supplier partner to build the wings of a Boeing commercial jetliner.

"What is very evident in Japan is the partnership and the depth of relationships," Hill said. "The Heavies clearly represent that in terms of a willingness to invest and partner with Boeing. Anybody who's been to Nagoya and witnessed what the Heavies have invested in facilities and tools sees that it really is a partnership, not simply a supply relationship."

Over the years, Mitsubishi has manufactured 200 F-15J jet fighters and Kawasaki has produced about 100 Chinook rotorcraft for the Japan Self-Defense Forces, both under license agreements with Boeing. The company is working with Mitsubishi on a potential upgrade to the F-15 fighters with modernized features.

And as a sign of how Boeing and the three Heavies are investing in their future, the companies are among the founders of the Tokyo-based Consortium for Manufacturing Innovation. The goal of the consortium, which was founded in April 2013, is to research manufacturing technologies that will benefit Boeing and eventually companies in other industries.

Boeing and Japanese partners also are teaming in smaller but fast-growing sectors. Boeing subsidiary Insitu Pacific recently partnered with Mitsubishi to provide a ScanEagle unmanned aircraft system for the Japanese Ground Self-Defense Force for disaster recovery and other missions. In the realm of cybersecurity, Boeing and Sojitz Corp. established a partnership in 2012 to offer advanced cybersecurity solutions in Japan to help protect critical government, civil and commercial information technology infrastructure.

Boeing Japan President George Maffeo said these companies have a "quality first" approach that fits perfectly with Boeing's culture. "That's one of the reasons the partnership is so great," he said. ■

TIES THAT BIND

The long-standing ties between Boeing and Japan extend well beyond manufacturing partnerships and airplane deals, as Boeing Japan employees volunteer and support charitable efforts across the country.

Since 2011, when the Tohoku earthquake and tsunami devastated parts of northeast Japan, Boeing employees have particularly focused volunteer and corporate citizenship resources on that region.

Boeing employees worldwide responded to the disaster by donating \$1.3 million. The company supplemented that with a \$1 million donation, split between Disabled Peoples International and Mercy Corps. The company also has funded training for more than 50 people to become facilitators for orphans who lost their parents in the earthquake and tsunami.

Boeing volunteers also have taken part in several reforestation projects in areas wiped out by the tsunami. This summer, during Boeing's Global Month of Service, employees planted 1,600 seedlings to help restore a greenbelt in Watari, northeast of Fukushima.

"It really was a humbling experience, frankly, because when we were there planting these seedlings, some of the local farmers came over with baskets of fruit to thank us for what we were doing," said Boeing Japan President George Maffeo.

In 2012, Boeing's Higher Education Program was extended to Japan. Under the program, the universities of Tohoku, Nagoya and Tokyo are eligible to receive funding from Boeing to encourage students to pursue academic excellence. Additionally, Maffeo said that Boeing Japan representatives host students from those universities for an annual summer-long "externship"—a series of lectures and workshops at the Tokyo office. It culminates in an aerospace-related assignment and a competitive yet friendly presentation session before a panel of Boeing judges.

"If we can encourage the students to consider the field for their future careers, then we're doing a good job," he said.

Other corporate citizenship activities by Boeing Japan include environmental and science learning activities for children and sponsorship of camp experiences for seriously ill children and their families. ■

PHOTOS: (Below) Boeing Japan volunteers plant seedlings in July to reforest a tsunami-damaged area in Watari in the northeastern prefecture of Miyagi. CHRISTOPHER JUE PHOTOGRAPHY (Right) A Boeing 787 Dreamliner in ANA (All Nippon Airways) livery. ANA and Japan Airlines were launch customers for the 787. BOB FERGUSON/BOEING





of which it has four. The force also flies 767-based Airborne Warning and Control System, or AWACS, aircraft, and Boeing is providing support and upgrades to those models.

“We believe there are opportunities in Japan for the Chinook, for maritime patrol aircraft, for more rotorcraft and for satellites,” Hill said. “They have a wide variety of BDS products, and the potential is there for that to grow.”

Since the establishment of the Boeing International Corp. office in Tokyo in 1953, Boeing and its heritage companies have become lasting partners with Japanese industry and government. Hill said Boeing has strived to show Japan it values the same things that are important to businesses and people there: honor, performance, living up to commitments and loyalty.

Takeshi Yamamoto said he tries to demonstrate those attributes every day in his “dream job” as a Boeing Field Services representative. Yamamoto, who previously worked in the airline industry and has spent time at Boeing’s Everett, Wash., factory, said he has seen first-

hand how the company and its Japanese suppliers work together.

“I discovered that the strong relationship between Boeing and partners is, in fact, a win-win proposition. For example, while Japanese manufacturers learn how to build large systems, Boeing is also learning from Japan’s high standard of quality control,” Yamamoto said. “Boeing understands how Japanese partners are valuable.”

Mako Gillan, Supplier Management program manager at JAMCO Corp., which supplies galleys and lavatories for Boeing jets, said she has enjoyed the strong sense of collaboration with JAMCO and, before that, Japan Airlines, which she supported as part of the Field Services team during the 787’s entry into service for the airline.

“Boeing is recognized as a good company,” Gillan said. “There are fewer people in Japan now who are like I was eight years ago—that’s to say, those who have never heard of the company. The 787 changed all that; there’s so much more awareness, thanks to that airplane and the amount of Japanese content on it.”

Boeing’s long-held reputation in Japan did not emerge unscathed from initial problems with the 787, Maffeo noted. But taking the long view, which Boeing and its partners in Japan have done over the decades, the company and the country seem destined to continue working closely in the future.

“We know that developing new airplanes takes a long time,” Maffeo said, “and the patience and dedication of our partners and customers here to see the horizon, and develop airplanes together that our customers want, is a key success factor for us in Japan.” ■

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COMMAND performance



For Mission Control teams, the excitement starts *after* a satellite is launched

By Bill Seil

A rocket launch is a powerful experience—flames shooting from the engines as the vehicle roars away from the pad in an explosion of light and sound and streaks into the sky on its way to the darkness of space.

For the Boeing Mission Control team, the excitement doesn't end there. Far from it.

From their posts in the Mission Control Center at Boeing Space & Intelligence Systems in El Segundo, Calif., they are just beginning the task of guiding and deploying the satellite to its final orbit.

"The launch phase is the most severe environment that a satellite is likely to encounter," said Eric Roth, who serves as Attitude Control Subsystem lead in Mission Control for a government satellite program. "You typically lose spacecraft telemetry, so there's always that question of what you're going to see at that moment when you first reacquire the signal after the satellite has separated from the rocket."

For Vera Horoschak, a Telemetry and Command Digital Subsystem lead in Mission Control, that moment produces a combination of feelings.

"Mixed emotions of relief and exuberant elation can fill the room immediately after the acquisition of signal," she said. "The mission team members will all smile—with some exhaustion—then regroup to continue supporting the next tasks."

Combined, Roth and Horoschak have participated in nearly 20 satellite missions. In each case, they have been part of a team of professionals led by the Boeing mission director to bring the mission to a successful conclusion, when the orbiting satellite is operating as planned and the customer officially takes delivery from Boeing.

It's a process that can take months to complete.



Chris Cutroneo has been involved in satellite missions for more than 30 years, including a range of assignments as a mission director. He currently is manager of Space & Intelligence Systems' Mission Systems Engineering and Operations, the Mission Control Center organization.

The mission director has a multifaceted role, he said.

"One very big element is to be able to engage effectively with our customers. "The second part of it," he continued, "is that the mission directors need to be able to guide their team, which is fairly large, from launch to hand-over to the customer. People skills are as important as technical expertise."

The Mission Control team can range in size from 40 to 60 people, representing the various skills needed throughout the mission. The mission director's second-in-command are the flight directors, who work in shifts around the clock until the satellite is handed over. The spacecraft engineer is responsible for sending commands to the spacecraft at the direction of the flight director. Other team roles address key elements and subsystems, including astrodynamics, vehicle dynamics, attitude control, liquid propulsion, power, thermal, telemetry and command, and facilities. Together, they execute the sequence of steps to activate the satellite and deploy components like the solar arrays.

To train, Mission Control teams

participate in computer-based mission rehearsals. A dynamic satellite simulator is programmed to mimic the satellite's systems and how the vehicle will respond to different commands.

"We have a phrase, 'test like you fly; fly like you test,'" Cutroneo said. "If you make a critical mistake during a mission, there are no second chances."

One member of Cutroneo's team, Doug Leber, is mission director for Inmarsat-5, one of the international commercial satellite programs that are critical to the continued success of Boeing's satellite business and a key growth market. Boeing's Inmarsat-5 team is building four 702HP (high power) spacecraft to join U.K.-based Inmarsat's fleet of 10 geostationary satellites that provide a wide range of voice and data services to a global customer base.

Inmarsat-5 is Boeing's first commercial contract where all the satellite operations, after separation from the rocket, will be directed from the customer's mission control center, which, in this case, is in London. Inmarsat personnel, in close consultation with the Boeing team, are serving as mission control lead.

Leber said the Boeing team in London is doing the same thing as the Mission Control team in El Segundo, but Inmarsat personnel will send commands to the satellite.

"We're partners in making sure that the satellite is successful," he said.

Mark Dickinson, vice president of

Satellite Operations for Inmarsat, said teams from Boeing and his company have worked closely over the past couple of years, culminating in a series of rehearsals in which the teams jointly practiced every aspect of the mission.

"The Boeing team has been superb," Dickinson said. "They are highly experienced and professional and, as the launch date draws closer, the excitement is really building."

Leber joined Hughes Space and Communications, a Boeing heritage company, two decades ago after working in satellite operations for the U.S. Air Force.

Successfully placing a satellite into orbit and seeing it become fully operational, Leber said, is "a little like christening a ship"—the final step in a long process.

Another member of Cutroneo's team, Carrie Hartman, is currently serving as mission director for a different international commercial satellite program as well as deputy mission director for a U.S. government military satellite program.

One of the most important tasks

PHOTOS: (Left) A Delta IV rocket carrying a Boeing-built GPS IIF-3 satellite blasts off from Cape Canaveral in Florida last year.

UNITED LAUNCH ALLIANCE (Above) To complete delivery of a satellite, Mission Director Carrie Hartman, left, counts on support from team members such as Henry "Mac" McClintock Jr., Computer Operations, in the Boeing Mission Control Center in El Segundo, Calif. BOB FERGUSON/BOEING



“When there’s
a spacecraft
in orbit, it’s
everyone’s
highest priority.”

– Carrie Hartman,
mission director





for the Mission Control team, she said, is ensuring they are prepared for unexpected occurrences—particularly those that could jeopardize the satellite. For example, a spacecraft could spin or tumble in an unacceptable manner. When that happens, she said, the team’s first responsibility is to ensure the satellite is safe; then experts are brought together to find a solution to the problem.

“Our mission teams are amazing,” Hartman said. “When there’s a spacecraft in orbit, it’s everyone’s highest priority. If I call someone at home at 11 o’clock at night and tell them I need their help, they’re on it immediately.”

Many who work in Mission Control were inspired as children by space missions that were taking place at the time.

“I was a space geek when I was a kid,” said Leber, whose father was a U.S. Air Force pilot. The space shuttle program

was underway when Leber was in college.

Hartman’s path to becoming a mission director also began when she was very young, watching episodes of *Star Trek* with her mother. In elementary school she loved classes in science and math. When she got to high school, her physics teacher encouraged her to go to Illinois Space Academy, a space camp-type program at the campus of the University of Illinois. When she went on to enroll at Illinois as an undergraduate, she decided to major in aerospace engineering.

She joined Hughes in 1999 after receiving a master’s degree in aerospace engineering.

“I just love being in the Mission Control Center,” she said. “I love the fact that we’re flying a real satellite and that we’re providing a quality product to our customer that they’re going to use for 15-plus years to provide services to their

customers. We have a quality team here at Boeing, and it’s just exciting to see people at work, solving problems and all working toward a common goal.” ■

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PHOTOS: (From far left) Carrie Hartman is one of the mission directors at Boeing Space & Intelligence Systems whose job is to complete the launch, deployment, on-orbit checkout and delivery of a satellite; Eric Pahl, left, and Jennifer Rysanek are part of the Mission Control team supporting a commercial satellite mission, with Pahl serving as flight director and Rysanek overseeing astrodynamics. BOB FERGUSON/BOEING In Inmarsat’s London offices, Mark Dickinson, left, vice president of Satellite Operations at Inmarsat, and Boeing’s Doug Leber share mission director responsibilities for the Inmarsat-5 satellite mission. ASSOCIATED PRESS



DIVING IN TO HELP

For Boeing employees, volunteering their skills can make a big difference

By *Tim Granholm*
and photos by *Marian Lockhart*

As a manager of Boeing's 747 Lean+ Promotion Office in Everett, Wash., Blake Skouras leads a team focused on reducing manufacturing time and overall costs for one of aviation's most iconic airplanes. So when Skouras heard about an opportunity to volunteer his professional skills to benefit the Seattle Aquarium, he dived right in.

Since July, Skouras and fellow Boeing Lean+ teammate Toni Miller have been part of a team working to help transform the Seattle Aquarium's school and group registration process. Using the Lean+ problem-solving model, Skouras set out to help the aquarium reduce the amount of time it takes for groups to register for a visit, lessen the administrative burden on staff and improve the overall customer experience.

"There are many forms of giving back to the community," Skouras said, "but the way I like to give back is by transforming something and making it better than it was before."

Skouras' work is one example of Boeing employees giving back to the community through skills-based volunteering, said Lianne Stein, vice president of Global Corporate Citizenship.

"There is a tremendous amount of skill in this company, and when combined with our charitable contributions, the impact we can have in the community is driven even higher," Stein said, adding that through volunteer work employees receive valuable experience, collaborate with others and gain a strong sense of satisfaction.

The Seattle Aquarium group, applying a Lean+ tool known as Value Stream Mapping, used dozens of sticky notes—and lots of patience—to map out the registration process from start to finish. The exercise allowed the team to see all the actions required to successfully register a group visit.

They identified 36 improvement opportunities that, if implemented, have the potential to reduce the time it takes for visitors to register and for aquarium staff to process the request.

As a result of the mapping exercise, aquarium officials realized they could speed up the confirmation process by switching from a phone call confirmation to an automatic email confirmation, according to Catie Fyfe, who manages school and family programs at the Seattle Aquarium.

"We've put in place a number of the to-do's and are already seeing a reduction in time," Fyfe said. "We anticipate seeing time savings of anywhere between 25 and 80 percent. This means we are able to bring more students and families in the door, allowing us to meet our mission of educating more people about the importance of our oceans. Because we have a better understanding of how registration flow works, we can mirror what works best and apply that across our different programs."

Whether Boeing employees have technical know-how, organizational expertise or just a personal talent, when it comes to skills-based volunteering, everyone has something to offer, Stein said.

Since September, for example, Dan Rubin, Boeing Electronic & Sensor Solutions IT Business Partner, has spent one afternoon a week volunteering his technical skills and experience to help a nonprofit organization in Fairfax, Va., improve its Information Technology infrastructure.

From eliminating dormant email accounts, which bog down computer systems, to setting up mobile modems that allow employees to connect remotely, Rubin has helped the nonprofit, known as FACETS, maximize its limited IT assets.

"We really didn't know how much



improvement would be possible until Dan came in,” said FACETS volunteer manager Alyson Zimbler. “With Dan’s help, we now have a five-year plan and budget for how to keep improving. We are much more independent now and can do much more without relying on our outside contractor.”

For Rubin, helping the nonprofit organization also gave him have a better appreciation of the dual benefits of skills-based volunteering: his own leadership development and the deeper community impact.

“I appreciate the value of traditional volunteering, but I’ve never felt that it’s quite as rewarding or sustainable as something like this,” he said. “I feel like I’m enabling them to help themselves. I want them to feel as if they’re empowered to continually improve.”

“If they don’t need my help for another year or two,” he added, “that’s how I’ll know I made an impact.” ■

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PHOTOS: (Top) A close-up of starfish and other aquatic life at the Seattle Aquarium. (Above) Toni Miller, from left, Boeing 747 Lean+ practitioner, Blake Skouras, Boeing 747 Lean+ promotion office manager, Renatta Williams, Seattle Aquarium program scheduler, and Dan Newburn, Seattle Aquarium education operations coordinator. (Right) A young visitor peers into a tide-pool exhibit.





GETTING INTO THE SPIRIT

Maintenance crews from the 509th Aircraft Maintenance Squadron and 131st Bomb Wing inspect a B-2 Spirit bomber at Whiteman Air Force Base, Mo., in 2012. Boeing had a significant role in developing the B-2 stealth bomber and, as part of an industry team led by Northrop, built the outboard portion of the B-2 wing, aft center fuselage, landing gear, fuel system and weapons delivery system. At its peak in 1991, the B-2 was the largest military program at Boeing, employing about 10,000 people. Boeing recently announced it is teaming with Lockheed Martin to compete for a new long-range U.S. Air Force bomber, with Boeing acting as the prime contractor and Lockheed Martin as the primary teammate. Boeing and its heritage companies have a legacy of producing great bombers, including the B-17, B-29, B-47, B-52 and B-1.

PHOTO: U.S. AIR FORCE







FOR INDIA, A WORLD OF MISSION CAPABILITY.

The world's most capable airlifter, the C-17 Globemaster III, will substantially enhance India's ability to support military and humanitarian operations. Boeing is proud of its long-standing commitment to India and salutes the Indian Air Force and the Ministry of Defence on the delivery of this world-class capability.

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