



# Frontiers

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## Flying into the future

777X builds on a legacy of  
innovation and performance

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## ADVERTISEMENTS

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

### 03



This ad spotlights *Trailblazers: The Women of The Boeing Company*, a new book celebrating the women of Boeing and featuring some of the company's most dynamic female leaders. The book is available at the Boeing Store.

### 16-17



"Enduring Force," which features the V-22 Osprey, is one of several ads in a Boeing Defense, Space & Security campaign highlighting the capabilities Boeing brings to its customers. The ads appear in business, political and trade publications.

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Part of an advertising campaign focused on the Middle East, this ad supports Boeing's collaboration with Masdar Institute of Science and Technology and will run in major print publications in the United Arab Emirates. Translated the text reads: "Together we innovate. Boeing collaborates with Masdar Institute of Science and Technology, Etihad Airways and Honeywell UOP to reduce the aviation industry's carbon footprint through the development of sustainable biofuel in the region. Leading through partnership."

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## IAM PROMOTIONS

No promotions listed for periods ending Jan. 31 and Feb. 7, 14 and 21.

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FSC LOGO

Trailblazers are born  
of courage and  
dedication.

**TRAILBLAZERS**  
THE WOMEN OF THE BOEING COMPANY

Quantities limited.  
**\$35** FIRST EDITION.



"The women of Boeing are as diverse and inspiring as the history of the company itself. Attracted by the challenges of aviation and the magic of flight, the trailblazers—female pioneers, aviators, engineers, and executives—contributed dedication, skill, and passion to the company's growth and success for nearly a century."

— Betsy Case, author, *Trailblazers: The Women of The Boeing Company*

Visit [BoeingStore.com](http://BoeingStore.com) for  
information about the book  
and events.

[www.boeingstore.com](http://www.boeingstore.com)

**THE BOEING STORE**  
Authentic merchandise and collectibles

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The 777 is the world's leading long-haul, twin-aisle commercial jetliner. Building on that success, Boeing engineers are developing a replacement airplane, the 777X, that promises to further raise the bar for efficiency, performance and innovation. The 777X wing, for example, made of composites, will be bigger than any airplane wing Boeing has ever made—even the 747's. The Boeing team bringing the 777X to life represents a broad mix of experience and expertise from throughout the company and includes engineers who helped design the first 777.

**COVER ILLUSTRATION: THE 777X AIMS TO BE THE WORLD'S LARGEST AND MOST EFFICIENT TWIN-ENGINE JETLINER WHEN IT IS SCHEDULED TO ENTER SERVICE IN 2020. BOEING**

**PHOTO: MIKE NANGLE, LEFT, AND JIM CONNER ADJUST A MODEL OF THE 777X AT THE BOEING TRANSONIC WIND TUNNEL IN SEATTLE. BOB FERGUSON/BOEING**





## 12 SPOTLIGHT ON INNOVATION

Boeing's new TV advertising campaign, "Build Something Better," features employees talking about what they do and their passion for innovation, excellence and community service. PHOTO: BOB FERGUSON/BOEING



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Fifty years ago, teak planking from the USS *Colorado* battleship was salvaged to adorn a Boeing facility's walls. Now, with employees' help, the wood will have a new home supporting military service members and their families. PHOTO: ASSOCIATED PRESS



## 28 TRACK TEAM

In a darkened room in Everett, Wash., surrounded by large display screens, a team of Boeing experts continuously monitors the growing number of 787 Dreamliners operating around the world, collecting valuable operational data and ready to help customers around the clock. PHOTO: BOB FERGUSON/BOEING

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# Partnering for Success: It's everyone's job

Making Boeing and its supply chain more competitive—our customers expect no less

In a Q&A with *Frontiers*, Dennis Muilenburg, Boeing vice chairman, president and chief operating officer, discusses Partnering for Success, a companywide effort with supply-chain partners to create a sustainable competitive advantage in the cost, quality and reliability of Boeing products and services.

## What's the goal of Partnering for Success?

We want to create the strongest, most capable and efficient supply chain in the industry. This aggressive, long-term effort aims to significantly reduce supply-chain costs while generating unmatched value for our customers and substantial mutual economic benefit for our company, Boeing suppliers and all our stakeholders. Our unique "One Boeing" approach, global scale and capabilities position us to realize this vision and sustain our industry leadership.

## What market dynamics are driving the effort?

Our customers today, and even more so tomorrow, expect more for less from our products and services, over their entire life cycle—more capability, quality and reliability, all at less cost and lower risk.

Despite the great gains we've made in those areas over the past few years, the global marketplace is clearly telegraphing that Boeing and its partners must step up to be even

more cost competitive. On top of that, the aerospace business requires tremendous investment—much shouldered by Boeing—and the reality is that the relationship between risk and reward needs more balance. More than 60 percent of the cost of Boeing products comes through our supply chain, and, like our customers, we also expect increased affordability and focus from our partners.

## How are suppliers responding?

About one-third of our suppliers are eager participants and have already defined plans with us to achieve targets. In many cases, that has also led to increased business volume for these partners.

Another third are seriously studying how to make it work for them. And there's a third that hopes this goes away. That's not an option, because this is such a competitive necessity.

We're trying to engender a real, long-term partnership between Boeing and our suppliers to achieve mutual success. We know that goal is achievable.

## What about reports where suppliers claim we're trying to squeeze their profits so Boeing can earn more?

This is not a simple demand to cut pricing. Creating a long-term competitive advantage in the cost, quality and reliability of Boeing products is an enduring commitment that, first and



foremost, benefits our customers. It helps us earn their trust and their repeat business, and the importance of their missions demands our absolute best.

We're not asking suppliers to do anything that we're not willing to do, or haven't already done ourselves. We've been intensely focused on delivering greater value to customers through Lean+, Development Program Excellence, safety (through "Go for Zero") and other initiatives. We've offered to share our best practices with our supply-chain partners to improve their productivity, too.

#### **So it's not just about near-term cost savings?**

Correct. This benefits both Boeing and our supplier-partners. The more efficient we all are, the more we can invest our productivity gains to self-fund the

product and process innovation that will differentiate us—and help Boeing and our suppliers win new orders.

In the long term, everyone benefits from reducing waste and inefficiency. And the link between productivity and future growth has never been clearer.

#### **Is it working?**

We're off to a good start, but we need to do more to meet the goals we've set. Partnering for Success has contributed to winning competitions; it has generated leaner operations and several billion dollars in cost reductions and long-term committed savings.

Many suppliers are increasing their production-system efficiencies with aggressive Lean+ approaches. Some have asked us for help, while others have suggested ways that we can do things differently to help make them more efficient. Things we're working on with suppliers include value engineering, which involves adjusting requirements or redesigning parts so they can be produced more efficiently and with greater first-time quality; real repurposing of designs, hardware and software, across product lines and across our commercial and defense sectors where appropriate; and aggregated purchasing of common parts and materials.

#### **What about those who don't see value in Partnering for Success? Is there really a "no-fly list" of suppliers who won't get further business from us?**

This is all about choices. Our suppliers can choose whether or not to work with us in providing our customers greater value at increasingly lower costs.

Whenever possible, we're providing more opportunities to those who choose to partner with us. These suppliers are seeing, and will continue to see, more

chances to share in our tremendous growth potential—a good chunk of which is already booked in our record \$441 billion backlog. And yes, we do consider other options—including bringing work in-house, building our own vertical capabilities, or re-competing work packages—when dealing with suppliers who choose not to participate. We believe that's the right thing to do for our customers and the competitiveness of our entire supply chain.

#### **Is this something that Supplier Management is responsible for or can I help, too?**

Delivering on our broader affordability and first-time quality goals depends on contributions from every employee. As for Partnering for Success, the responsibility extends well beyond Supplier Management. We're working hard to create the mindset that Partnering for Success is everyone's job. So if your job touches suppliers in any way, you can help.

In every part of Boeing, you can pursue first-time quality in every work product; you can eliminate traveled work that drives instability in our operations and those of our suppliers. Whatever your business or function, you might be able to help develop—and, even more likely, support—new procurement strategies with Supplier Management and our Shared Services Group.

You can take actions that drive excellence and the utmost integrity in all that we do. Just engage with a One Boeing headset to bring value to customers. We really need everyone to redouble their efforts, because our competitiveness is directly linked to productivity, which fuels our innovation and drives our ability to win in the global marketplace. Our customers expect this of us, our Boeing values demand it, and our future depends on it. ■

“We want to create the strongest, most capable and efficient supply chain in the industry.”

—Dennis Muilenburg

Boeing vice chairman, president and chief operating officer

## SNAPSHOT

### Custom delivery

Boeing delivered the first C-17 Globemaster III for the Kuwait Air Force last month from Long Beach, Calif., where the huge military aircraft is assembled. The airlifter, pictured here on its first test flight, features a custom paint design that distinguishes the Kuwait C-17 from the 259 others that have been delivered to customers including the U.S. Air Force. “When this C-17 arrives to deliver humanitarian aid or disaster relief anywhere in the world, people in need will know that the aid came from Kuwait,” explained Col. Abdullah Al Foudari, deputy commander of the Kuwait Air Force, during his remarks at the delivery ceremony. PHOTO: PARRY HAVELAAR/BOEING







## QUOTABLES

“BBJ customers are not buying off the rack—they are looking at a custom suit from Savile Row.”

—Steve Taylor, president of Boeing Business Jets, invoking the famous London street of top-end tailors in describing VIP, government and charter customers who order Boeing jetliners, including the 787, and outfit them with customized interiors, avionics and exterior paint schemes. Thirteen BBJ 787s have been ordered. *Boeing News Now*, Feb. 5

“We cannot settle for No. 2. It’s just not in our makeup.”

—Ray Conner, Boeing vice chairman and president and CEO of Commercial Airplanes, speaking to employees on the importance of regaining market share from competitor Airbus, which has a bigger commercial jetliner order backlog. *Boeing News Now*, Feb. 19

“It is analogous to standing at the top of the Empire State Building and tracking an ant.”

—Andrew Kopito, director of civil space programs for Boeing Space and Intelligence Systems, describing the capabilities of the company’s newest Tracking and Data Relay Satellite for NASA that is orbiting 22,000 miles (35,400 kilometers) above the equator and tracks and communicates with low-altitude satellites. *CBS News*, Jan. 23



## Art Lenox

HAS WORKED FOR BOEING:  
25 years

ORGANIZATION:  
Environment,  
Health and Safety

SUPPORTING SANTA SUSANA  
REMEDICATION:  
21 years

# FROM SPACE RACE TO OPEN SPACE

For this employee, the next frontier is helping restore a former rocket-engine test site

By Megan Hilfer and photo by Paul Pinner

Environmental project manager Art Lenox leads the team conducting soil and groundwater investigations as part of Boeing's remediation program at Santa Susana, Calif., a 2,850-acre (1,150-hectare) site, a portion of which was previously used for government rocket-engine testing and energy research. In this *Frontiers* series that profiles employees talking about their jobs, Lenox describes how Boeing teamwork and public involvement are helping shape the site's future as open space.

I grew up listening to the sound of rocket-engine tests at the Santa Susana Field Laboratory at a time when the United States was enthralled with space exploration. This testing supported virtually every major U.S. space program, from the first manned Mercury flights through the Apollo moon landings and space shuttle fleet. While it has been nearly a decade since the last rocket engine was tested here, the natural beauty of Santa Susana lives on.

I spend much of my free time hiking, camping, kayaking and fishing with my family, which is why it suits me well to work amid Santa Susana's sandstone bluffs and oak tree groves. Santa Susana is home to deer, bobcats, coyotes and cougars, and it sits within one of the last links of a vital wildlife corridor that connects inland and coastal mountain ranges. As a lifelong San Fernando Valley resident, I've always felt like Santa Susana has been part of my backyard. This proximity, combined with my love of the outdoors, is why I find it so gratifying to play an integral role in the site's cleanup and preservation as open space.

I brought my kids to witness the last rocket-engine test at Santa Susana about eight years ago. I remember

us sitting in amazement as we felt the ground shake, heard the roar of the engine and saw the flash as it ignited. It is unfortunate that the price of this innovation was contamination, but we have some of the best and the brightest minds in the country dedicated to tackling that issue head-on—from Boeing employees and contractors to nature groups and experts who act as advisers. It brings me great pride to know that I have a hand in shaping this place that my grandkids will visit when they want to experience nature.

Under the oversight of federal and state agencies, we have made significant progress in cleaning up Santa Susana in a way that will be far more protective than what is required for open space. I led the team that recently completed an extensive soil removal project to improve stormwater quality. Over four years of fieldwork, we removed 25,000 cubic yards (19,100 cubic meters) of affected soil while taking precautions to minimize our impact on streambeds and wildlife habitat. It is this extra level of care we take while fulfilling our cleanup and restoration commitments that represents Boeing's environmental stewardship in action.

Our accomplishments so far have relied a lot on technology and teamwork, but the true key to Boeing's progress is our interaction with the community. As the Santa Susana team implements cleanup activities and demolishes structures, we are sharing our open-space vision and building trust with the public by addressing concerns and answering questions. As the landscape at Santa Susana changes, it is rewarding to celebrate this progress through other people's eyes when they attend a tour, nature walk or other event at the site.

The legacy of Santa Susana goes beyond cleanup. The site is transitioning from a historic industrial facility to open space, with native grasses and plants reclaiming the land in the footprint of former buildings. I am energized by the growing number of people who visit and see what I have known all along: Santa Susana is a place of wonder, beauty and vast ecological value. And it will be for generations to come. ■

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*To learn more about Boeing's restoration work at Santa Susana, visit [boeing.com/santasusana](http://boeing.com/santasusana)*

# PASSION FOR INNOVATION

Employees tell Boeing story in new TV ads  
that 'build' momentum toward 2016 centennial

*Photos by Bob Ferguson*





**N**onstop innovation; the relentless passion of Boeing people to set new and higher standards. It's what Boeing stands for—and Boeing wants to ensure the world identifies the company, its products, technology and services the same way.

Last month, Boeing began airing a new, integrated TV and digital advertising campaign, "Build Something Better." It spotlights the people of Boeing who apply their talents to build the leading-edge products, technologies and services the company delivers every day, around the globe.

Boeing employees are featured throughout the five TV ads, shown on the job in Boeing factories and offices as well as out in the community, volunteering.

Meredith Monroe, a Business Skills Rotation participant working in Finance in Philadelphia, was cast as a coach in the ad highlighting Boeing employees' tradition of community service. Not too much of a stretch for the former hoops player for Penn State. In her real life as a Boeing volunteer, she teaches elementary and middle school children about business through Junior Achievement. She also helps build homes for Habitat for Humanity, and she works with Cradles to Crayons, sorting donated clothes and accessories for children in need.

"When I came to Boeing it was like joining another team that helps the community," said Monroe, whose volunteering began on the Penn State

women's basketball team, which performs a lot of community service. She found she loved working with the team to help others.

"This new ad campaign was inspired by the vision of the founders of our legacy companies—Bill Boeing, Donald Douglas, Dutch Kindelberger and James McDonnell—who had an enduring passion for innovation, discovery and achievement for their customers and the world," said Tom Downey, senior vice president, Communications. "Its theme draws on the very words of Boeing, who after flying an early biplane in 1914 said to his future business partner, 'I think we could build a better one.'"

"The spirit and sense of purpose in these words, and similar comments from our other heritage founders, has inspired nearly a century of achievement by Boeing people," Downey said.

Fritz Johnston, vice president, Global Brand Management & Advertising, said Boeing wants the ads to be a rallying call for employees.

"Build something better is simply what we do—it's in our DNA," Johnston said. "It was imperative that we build these ads around our people and their passion for performance, technical excellence and integrity. It is they who are defining the future."

The campaign builds momentum toward Boeing's 2016 centennial while aligning with the enterprising spirit of Boeing's past, present and beyond, Johnston said. It is a natural follow-on

to the multiyear success of Boeing's previous TV ad campaign, "That's Why We're Here," which is being retired.

Key to the Build Something Better campaign are five TV ads, which launched on national network, on cable and in local key markets. The 30-second spots feature:

**Out there**—Boeing's advanced defense and security-related products and systems

**Nonstop**—Boeing's world-leading commercial airplanes and related products

**Passion**—employees' passion to innovate and build something better, every day

**Some come here**—why people come to work at Boeing, the diverse, open and inclusive culture that brings forth the ideas and innovation that create industry-leading products and services

**Doesn't fly**—the scope and scale of how employees volunteer their time and skills to help make their communities be the best they can be

The Build Something Better theme is being applied across other media

**PHOTOS:** Meredith Monroe (far left) and Bronson Edwards (above, second from left) perform typical community volunteer roles in scenes for Boeing's new "Build Something Better" television and digital advertising campaign.

and digital and traditional channels including Boeing recruitment, international air shows, videos and merchandise, Johnston said. It supports launch of the company's latest "Innovation" videos. And it can be incorporated in Global Corporate Citizenship and STEM (Science, Technology, Engineering and Math) events and employee communications. An online style guide is available at [brandcenter.web.boeing.com](http://brandcenter.web.boeing.com) to help employees properly and consistently use the theme across all communications.

The new TV ads are running on the *Meet the Press* show on NBC, as well as the CNN, MSNBC, CNBC, Bloomberg, Discovery, Military, History and Science channels in the United States. Digital outlets expected to carry the advertising include Facebook, Google and YouTube. ■

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*To view the five new "Build Something Better" TV ads, go to [boeing.com/advertising](http://boeing.com/advertising). For an overall look at the campaign, go to [buildsomethingbetter.com](http://buildsomethingbetter.com). To check out related merchandise in the Boeing Store, go to [boeingstore.com](http://boeingstore.com).*



**PHOTOS:** (This page, from top) Marquetta Thomas reprises previous volunteer experience as she prepares lumber for framing a house; Shresta Deitering is shown on set helping a student. (Opposite page) Boeing employees get their feet wet performing wetland restoration, a frequent Boeing volunteer project.

# Doing what comes naturally

Boeing Commercial Airplanes employees Jason Jamerson, a designer for 747-8 wing structures in Everett, Wash., and Alison Robinson, an airplane contracts administrator in Renton, found themselves in waders in the Ballona Freshwater Marsh at Playa del Rey, near the Los Angeles Airport.

Bronson Edwards, a design engineer in 767 Structures for Commercial Airplanes in Seattle, was cast as a robotics coach.

And Marquetta Thomas, a Global Services & Support program manager for Defense, Space & Security in St. Louis, was featured building a house.

They were among more than 30 Boeing employees who were flown to Los Angeles in July 2012 to shoot one of Boeing's new series of TV commercials, "Build Something Better," which began airing in February. The five ads focus on Boeing's products, systems and services, as well as its diverse and innovative culture—and its employee tradition of community service.

In 2011, about 800 Boeing volunteers, from sites across the United States, answered a call in *Boeing News Now* and submitted audition tapes for a chance to perform in the new ads, which were filmed in Seattle and Los Angeles.

The Los Angeles shoot featuring the more than 30 selected employees

focused on Boeing's culture of volunteerism and building better communities. Employees acted in vignettes showcasing Boeing volunteers helping veterans and the elderly, building a house, caring for the environment, and mentoring young people. The vignettes were edited down to a 30-second commercial that is running on regular and cable networks in the United States, and on local U.S. stations.

In their real volunteer lives, both Jamerson and Robinson have helped preserve natural areas—Jamerson, celebrating Earth Day by pushing a wheelbarrow and removing invasive species at another estuary, the Union Slough restoration site north of Everett; Robinson, battling invading blackberries and ivy at Seattle's densely forested Carkeek Park.

Edwards' role as a robotics coach reflected work he has done with high school and middle school students. He also volunteers with Seattle's 4C Coalition, a mentoring program for at-risk youth, and with the Mathematics, Engineering, Science Achievement Program helping educationally disadvantaged students.

Kevin Meredith, an Advanced Technology program manager at Huntington Beach, Calif., said his audition was easy. "It's really easy to go in and talk to someone about

what you're passionate about."

Meredith was filmed framing a house, which was fitting. He has volunteered his management and carpentry skills to repair old houses and make them safer for the elderly and accessible for homeowners in wheelchairs.

But he said his main volunteer focus is getting young people excited about science, technology, engineering and math, or STEM, through the Tiger Woods Learning Center.

Marquetta Thomas, the St. Louis program manager, was also shown building a house, just as she has done back home where her many community service activities include volunteering for Rebuilding Together. The nonprofit organization repairs the homes of low-income families and people with disabilities to make them safer and more comfortable.

For George Yang, a systems and data analyst with Information Technology in Seattle and a regular volunteer on Earth Day and Global Month of Service projects, working to support the community is fun—and an important part of being a Boeing employee.

"When we're wearing our volunteer shirts," he said, "it lets everybody know we not only make good products but also contribute to the community." ■

*kathrine.k.beck@boeing.com*



# ENDURING FORCE



Strike



Mobility



Surveillance & Engagement



Unmanned & Missile Systems



Global Support





# wing

A man with long blonde hair and glasses, wearing a dark t-shirt and blue jeans, is sitting on a red stool. He is looking up and adjusting a circular component on the underside of a long, thin aircraft wing that is suspended horizontally. The setting is a large, industrial wind tunnel with blue lighting. On the left wall, there is a shelf with various tools and a bright light fixture. A red vertical strip is visible behind the man.

PHOTO: At the Boeing Transonic Wind Tunnel in Seattle, Mike Nangle, left, and Jim Conner of Boeing Test & Evaluation prepare a model of the 777X for testing.  
BOB FERGUSON/BOEING

# leader



With a large composite wing, the 777X will make the next big leap in performance and efficiency

*By Eric Fetta-Walp*

As he stood next to a model of the new 777X twinjet, Terry Beezhold, vice president and chief project engineer for the program, ran his hand over the wing and studied it for a moment.

“No one can do what we do,” he remarked to a fellow engineer. “This is truly an amazing wing.”

It’s hard to overstate how big the wing, complete with folding wingtips, will be when it’s built in real size.

The 777X will have the largest wing ever built by Boeing. To gain even more efficiency and range over the current 777, the new wing, made of strong but lightweight composite, will span 233 feet 5 inches (71.1 meters). That’s



more than 30 feet (9 meters) wider than the span of the 777. It is greater than the wingspan of the 747-8. The new wing also will have 45 percent more area than the composite wing on the 787 Dreamliner.

The 777X, which recently completed the first phase of high-speed wind-tunnel testing, is incorporating material and design lessons from the 787, as well as from the 777—the first Boeing jetliner to include a composite vertical fin and horizontal stabilizer.


“It’s fun for me to be working on a composite wing on this airplane, which builds on that technology we first worked with on the original 777,” said Jess Trostle, engineering leader on the 777X wing design team.

Trostle and other engineers

designing the new airplane recalled that the 777, which entered airline service in 1995, was initially considered “too large a leap in technology” by some because of its innovations. Among other things, it was the first commercial airplane designed entirely on computers; the first two-engine jetliner designed to fly on long-haul international routes, thanks to the largest jet engines ever developed; and Boeing’s first fly-by-wire commercial aircraft.

The 777X also will introduce features new to commercial airplanes, but those will be combined with proven materials and design elements, said Bob Feldmann, Commercial Airplanes vice president and general manager for the 777X.

“The 777X is a huge leap in capability



“The 777X is a huge leap in capability for the next generation.”

—Bob Feldmann, Commercial Airplanes vice president and general manager for the 777X

for the next generation,” Feldmann said. “We got there by harnessing technological improvements from the 787 and 737 MAX and other programs. We then leveraged the fuselage and systems of the 777-300ER (Extended Range) to get a huge improvement in performance without taking a huge risk with the technology.”

Officially launched in November of last year, the 777X promises improved fuel consumption and better operating costs for customers.

The 350-seat 777-8X will have a range of more than 9,300 nautical miles (10,700 miles, or 17,200 kilometers). The 777-9X will seat more than 400 people.

Both models also will have commonality with the existing 777 wherever it makes sense, including

*(Continued on Page 24)*

PHOTO: A model of the 777X is tested in a wind tunnel to help validate the airplane’s design advances. BOB FERGUSON/BOEING

# SPANNING THE GLOBE

The 777X builds on innovations that made the current 777 the world's leading widebody aircraft. The all-new composite wing of the 777X will have a span greater than that of Boeing's 747-8; folding wingtips will allow the 777X to use existing airport gates when on the ground. The 777X also will have new and more-efficient engines and a redesigned flight deck. A newly designed interior will feature larger windows.

## BY THE NUMBERS:

350: Passenger seat count for 777-8X\*

400: Passenger seat count for 777-9X\*

9,300 nautical miles (10,700 miles, or 17,200 kilometers): Range of the 777-8X

8,200 nautical miles (9,400 miles, or 15,200 kilometers): Range of the 777-9X

GE9X: New engines supplied by GE Aviation

2020: First delivery of the 777-9X

*\*Typical three-class configuration*





## EARNING THEIR WINGS

The Wright brothers' first powered flight, in December 1903, covered 120 feet (37 meters). The wingspan of the 777X will be almost twice that length and will be the biggest wing of any airplane Boeing has ever built, even the 747-8. This chart compares the wingspan of the 777X with other Boeing and Airbus jetliners.

787	197 feet (60 meters)
777-300	199 feet 1 inch (60.7 meters)
Airbus A350	212 feet 4 inches (64.7 meters)
747-8	224 feet 7 inches (68.5 meters)
<b>777X</b>	<b>233 feet 5 inches (71.1 meters)</b>
Airbus A380	262 feet (79.9 meters)

ILLUSTRATION: An artist's concept of a 777-9X taking off. **BOEING**

a metal fuselage.

“We have, in the 777-300ER, a very reliable fuselage that performs well,” said Beezhold, explaining that designers balanced cost considerations with performance and customer input for the new model’s basic specifications.

The 777-9X, which will come first, is expected to be delivered to airlines starting in 2020.

“Providing certainty around the delivery and reliability of this airplane are major priorities for this team,” Feldmann said. “We will spend extra effort and extra focus on that.”

Among the components that need to be “ultra-reliable” is the one that also will make the 777X unique among commercial airplanes: a folding wingtip. The wingtips will fold up while the airplane is on the ground to allow it to use existing airport gates. With the tips folded, the wingspan of the 777X on the ground will be 212 feet 9 inches (64.8 meters).

“We want that fold mechanism to be as simple and reliable as a landing gear door so it’s never an issue for our customers,” Feldmann said.

A folding wing was researched and even built for the original 777, but was never included in the final design. The design of the folding tip for the 777X is much more “robust and simple” than that earlier one considered for the 777, Beezhold added.

Other innovations on the 777X will include the GE9X engine, which will use composite matrix ceramics and fourth-generation composite fan blades for higher compression ratios and efficiency.

In addition, hybrid laminar flow control will be used on the 777X’s vertical fin, Beezhold said. This breakthrough technology smooths out airflow and reduces drag. That, in turn, reduces fuel consumption and emissions with every flight. The concept had been considered for decades. But Boeing engineers finally found a way to develop a simple and reliable way to deliver the performance







PHOTO: Jess Trostle, from left, engineering leader on the 777X wing design team; Warren Steyaert, a Technical Fellow on the wing design team; and Terry Beezhold, vice president and chief project engineer for the 777X, examine a model of the airplane in the program's offices in Everett, Wash. BOB FERGUSON/BOEING

at a reduced weight and it is now operational on the 787-9—the first time hybrid laminar flow control has been used on a commercial jetliner.

Inside the 777X the flight deck will be similar to that of the 787, including its large displays and seats. For passengers, the cabin will feature larger windows located closer to eye level.

So far, airlines have given a strong vote of confidence in the new airplane. The 777X was launched at the 2013 Dubai Airshow, with 259 orders and commitments. Customers include Lufthansa with 34 airplanes, Etihad Airways with 25, Qatar Airways with 50, and Emirates with 150 airplanes. With those orders and commitments,

worth more than \$95 billion at list prices, the 777X currently stands as the largest product launch in commercial jetliner history by value. Additionally, Cathay Pacific Airways ordered 21 777-9X airplanes at the end of last year.

“Our sales team has been engaging with customers around the world, and the response to the 777X has been nothing short of overwhelming,” said John Wojick, vice president of Sales, Commercial Airplanes. “These are all industry leaders who recognize the extraordinary value the 777X will bring to the market and reiterates the confidence they have in Boeing’s new product technology.”

Feldmann, who previously worked in Boeing Defense, Space & Security,

## SIMPLICITY

Wingtips will fold up once the jet lands so it can use existing airport gates.

## POWER

Energy-efficient engines will use fourth-generation composite fan blades.

said his team has drawn employees from across the company to have a good range of experience. But a number of engineers working on the 777X, like Trostle, also helped to bring the 777 to the world more than 20 years ago.

Bruce Shull, an Associate Technical Fellow working on 777X fuselage design, has helped develop every version of the 777 flying today.

“They have proved to be extremely valuable assets for our customers and the people they fly,” Shull said of the original 777. “I enjoy sharing all the innovative design features that the 777 program pioneered with our new engineers, while helping them add even more to the 777X.”

That mixture of using both long-proven and new knowledge and technologies, Beezhold said, will result in a more efficient and advanced airplane that upholds the enviable reliability of its predecessor and meets customers’ needs.

“We want to be able to build on the things that went well, learn from the things that didn’t go as well and then use those lessons on this airplane,” Beezhold said. “It’s exciting to build on the legacy of the 777 and take it into the future.” ■

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ILLUSTRATION: The 777X is scheduled to enter service in 2020. BOEING

## TECHNOLOGY

Hybrid laminar flow control on vertical stabilizer smooths out airflow and reduces drag.

## EFFICIENCY

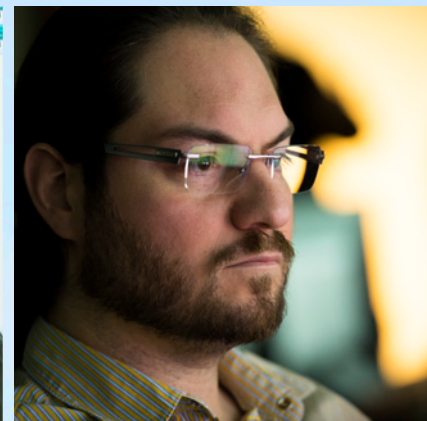
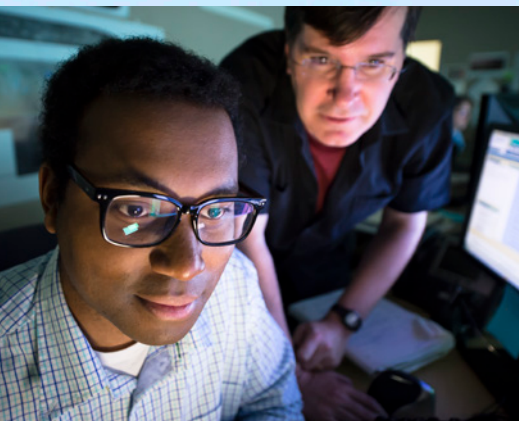
The super-efficient composite wing will be the biggest airplane wing Boeing has ever made.



# Following the DREAM

Boeing ops center monitors every 787 around the world—and around the clock

By Eric Feters-Walp



The darkened room with large digital screens hanging on the walls and technicians staring at smaller computer screens is abuzz with activity, slightly reminiscent of a mission control center.

Which it is, but the mission here isn't a space launch or satellite deployment. This room, in Everett, Wash., is where a team of experts keep their eyes on the worldwide and ever-growing number of 787 Dreamliners operated by airlines.

Around the clock, every day, the center's team stands ready to respond to airline customers when any issue, down to a maintenance reminder, arises with one of their 787s. Some of the center's employees focus on talking with airline and field service representatives when they call with questions, while others read and analyze real-time data being sent by the 787s in service. A mission director and "first responders"—those charged with resolving urgent questions or issues—round out the team.

"It is a dynamic and exciting place to work. We need to be nimble and quickly refocus when priorities change," said Bill Connell, one of the 787 Operations Control Center's controllers. "There is always something to do in the center, but when a customer contacts us for a hot issue, efficient collaboration of the team enables us to respond quickly."

The 787 Operations Control Center, supervised by Commercial Airplanes' Commercial Aviation Services, is the only such facility at Boeing dedicated to monitoring a specific model.

"The Operations Control Center is really setting a standard for us," said Mike Fleming, vice president of Services and Support for the 787 program. "The center creates tremendous value for Boeing in terms of the information

we get. It also creates tremendous value for our airline customers in terms of the support we provide them."

Roxann Hirst, senior manager of the 787 Operations Control Center, said the center was launched in 2011 to answer questions quickly and provide support as airlines put the advanced jetliner into service. Now, in addition to supporting additional airlines putting the Dreamliner into service, it is providing vital information that can help improve the airplane's reliability.

"It is gratifying to play a part in the entry-into-service process, to watch the airplanes and the operators succeed and make the 787 everything we know it can be," said Andy Beadle, a Supplier Management expert in the operations center.

Key to the center's mission is the 787's Airplane Health Management system, which uses advanced sensors and communication technology to send live data from the airplane to airline monitoring centers and the 787 control center. The system can alert airline officials and the operations center's staff to potential maintenance issues before they become serious enough to delay a flight.

"It is changing how we support our airline customers," Beadle said. "When we see issues, we start working support plans while the aircraft is in flight rather than waiting until after landing and troubleshooting have occurred."

Hirst, who calls the Airplane Health Management system "the voice of the airplane," added that in addition to providing timely alerts for immediate issues, the volume of data sent by the system also is helpful in the long term.

"There's a lot more information that we get from this airplane than any previous model," Hirst said. "We can look

at the data over time and use fleetwide experience to assist our customers."

That is especially useful as more airlines take delivery of their first 787s and aren't as familiar with the airplane as those who have been flying it for the past couple of years, Hirst said. Also, as the operations center gathers more information about the airplane over time, that is shared with the design engineering teams and, through them, to Boeing's suppliers.

"This airplane isn't as reliable as we'd like it to be at this point," Hirst said, referring to the 787's reliability rate of about 98 percent as of early this year. That means the 787s in commercial service had a departure delayed for more than 15 minutes due to technical reasons about 2 percent of the time.

With the data it receives and tracks, the operations center can help pinpoint components that might need to be improved as Boeing learns more about the airplane's long-term performance.

Employees from a number of organizations within Commercial Airplanes are included in the operations center to ensure a variety of expertise is on hand. For example, the center's Supplier Management representatives can

PHOTOS: (Far left, top) A Boeing 787 Dreamliner. **FLIGHTAWARE** (Insets, from far left) Ravin Pierre, left, monitors airplanes in the 787 Operations Control Center while Cam Carnegie, a mission director at the center, looks on; Roxann Hirst, from left, senior manager of the 787 Operations Control Center, along with Dale Miles, an operations center controller, and airplane monitor Wistremundo Dones, consult one of the center's information screens; Dones; Hirst; Carnegie, clockwise from left, Will Fant, a systems generalist, Tom McCleave, a service engineer, and Pierre. **BOB FERGUSON/BOEING**





“It is a dynamic and exciting place to work. We need to be nimble and quickly refocus when priorities change.”

— Bill Connell, 787 Operations Control Center controller

directly contact suppliers to harness their technical guidance or arrange for the movement of specific parts to repair an airplane as soon as possible.

“We have a variety of experts in the room that know an amazing amount about the intricate ways the 787 operates and can be supported, but that’s not entirely why the room is so successful,” Beadle said. “We are successful because of the support we receive from the entire Boeing team.”

Hirst said the operations center works closely with Boeing’s field service representatives supporting

787 customers around the world. They can quickly fix or check on any issues flagged by the operations center.

Additionally, those working in the 787 Operations Control Center regularly visit airlines operating the Dreamliner to talk with them, answer questions and become familiar with the airlines’ representatives.

“When we are visiting with the airlines, a big part of what we do is build that bridge between the airlines and the operations center,” Hirst said. “I love the chance to work directly with the operators and the airlines and help them understand ways to operate



the airplane more effectively.”

“One of the most rewarding things is to know that you have helped a customer in a way that either prevents or minimizes a delay or returns it to service as quickly as possible,” Connell added. “Being part of a solutions-oriented team and helping customers every day is one of the most gratifying experiences I can think of.”

At the end of January, the 787 Operations Control Center was supporting 114 Dreamliners in commercial service, up from less than a dozen at the end of 2011. More than 220 787s are expected to be in service by the end of this year.

While the team in the operations center has shifted to meet changing needs, it hasn’t grown dramatically in that time. That’s because the operation of 787s is becoming more routine as more of them are delivered, Hirst said.

“The airplanes are definitely getting better,” she said. “We’re getting more experience, and operators are getting more familiar with dealing with the airplane.”

While the control center is helping airlines avoid delays and save money by monitoring and responding quickly to maintenance issues, airline passengers benefit as well due to fewer delayed flights

and safer operation of the airplanes.

“Ultimately, our focus—and the airlines’ focus—is on the passenger,” Fleming said. Everything is designed to provide them a safe, reliable and comfortable journey to their destination.” ■

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PHOTO: A real-time display showing 787s in service worldwide highlights the urgency of addressing customer support issues as Jules Carstea, left, a service engineer, and Christopher Park, a maintenance engineer, discuss a customer information request.

**BOB FERGUSON/BOEING**

HISTORICAL PERSPECTIVE

# RETURN TO SERVICE





# URNED

## With the help of Boeing employees, teakwood decking from WWII battleship becomes the floor of a USO center

By Bill Seil

**D**uring World War II, U.S. Navy personnel scrambled across the teakwood decks of the battleship USS *Colorado*, valiantly facing heavy fire and kamikaze attacks.

After the *Colorado* was scrapped in 1959, much of the decking was salvaged by Boeing, which used it to adorn the walls of one of the employee cafeterias at its Developmental Center in Seattle.

Today, more than 50 years later, that cafeteria is being remodeled, and the teak has been removed. But thanks to the efforts of Boeing employees, it will soon be brought back into service—as the floor of a new USO facility at Seattle-Tacoma International Airport.

“A number of people within Boeing have really gone out of their way to make sure that the teak was treated with respect and donated to people who would use it in an appropriate way,” said Jeff Doan, a Site Services planner who coordinated the initial work to preserve the teak planking.

Along with Brad Hill, who is managing the remodeling project for Site Services, part of Boeing’s Shared Services Group, they worked with Global Corporate Citizenship and Mike Lombardi, corporate historian,

to find a new home for the teak. Bid specifications were developed; Boeing Surplus Sales personnel were responsible for transferring most of the teak to the USO.

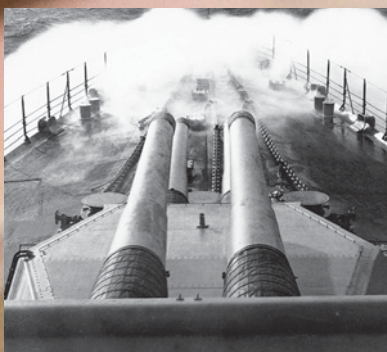
Site Services took great care to protect the teak as it was removed from the walls of the cafeteria, Doan noted.

Most of the roughly 2,000 square feet (190 square meters) of teak will go to USO Northwest for its new airport facility.

Much of the impetus behind preserving the teak came from Pam Valdez, support and training director for the KC-46 Tanker program, Boeing Defense, Space & Security, in Mukilteo, Wash. In 2004, while she was working at the Developmental Center, she discovered the history of the cafeteria teak. She worked with Ryan Jutte, now an F-22 training systems integrator with BDS at the Developmental Center.

To honor the history of the *Colorado*, Jutte designed a plaque to place on the cafeteria walls, and a small group of *Colorado* veterans, along with their families, were invited for a celebration and an opportunity to see the decking they had served on 60 years earlier. Each was given a small piece of the teak as a keepsake.

“It just struck me that the historical



PHOTOS: (Left) Teak planking from the USS *Colorado* that adorned a Boeing cafeteria’s walls is stacked for new use as a USO facility floor. MARIAN LOCKHART/BOEING (Insets, from top) The USS *Colorado* in New York Harbor, 1932. U.S. NAVY A view from the deck circa 1920. U.S. NAVAL HISTORICAL FOUNDATION

“We spent many an hour scrubbing the deck... Those decks were clean enough to eat off of.”

—Ken Jones, a heavy machine gun operator on the *USS Colorado* during World War II



significance of those teak walls was just being lost to the people who were passing through the cafeteria,” Valdez said. “If you look at the planks closely enough, you can see fire markings from battle. People died on those decks.”

In fact, a number of sailors on the battleship were killed during a kamikaze attack in the Philippines, and during numerous battles over the course of the war.

“To those of us who served on the *Colorado*, that decking has a hallowed meaning, because it was baptized with the blood of our shipmates,” said Ken Jones, now 86, who was a heavy machine gun operator on the *Colorado* from 1944 to 1945.

Jones recalled maintaining the teakwood decks and, at times, sleeping on them.

“Those decks were not painted; there was just bare wood showing,” Jones said. “We spent many an hour scrubbing the deck, hosing it down, removing the water with squeegees, then swabbing it down. Those decks were clean enough to eat off of.”

Since the *Colorado* was not air-conditioned, Jones sometimes took a blanket and slept outdoors on the teakwood deck.

“The problem there was by the time I got to sleep, we’d run into a rain squall,” Jones recalls. “I’d then have to grab my blanket and run below deck and wait out the rain.”

The *Colorado*’s crew, including Jones, witnessed the Japanese surrender on board the USS *Missouri* in Tokyo Bay in August 1945.

Valdez, a U.S. Navy veteran and a USO Northwest board member, said she was delighted when Lombardi asked whether the USO might want to make use of the teak.

The new USO center at Sea-Tac Airport will replace an older facility that’s about half the size, which has been providing hospitality to service personnel and their families since 1966. When it opens, the 7,500-square-foot (700-square-meter), \$1.7 million facility will better accommodate

the approximately 10,000 local and traveling military personnel who visit it each month.

In July 2013, the project received a \$335,000 donation from the Boeing Employees Community Fund, which played a big role in helping to get it underway.

Don Leingang, executive director of the USO Northwest, also a Navy veteran, said there is enough decking to cover most of the floor of the new facility. It will be given a coating to help protect it from damage, and signage will be used to tell the story of the *Colorado* and the significance of the decking.

“The teak decking is an amazing piece of history,” Leingang said. “But even more important is the mere fact that Boeing employees immediately thought of the USO as the appropriate location for its new home.”

The USS *Colorado*, launched in March 1921, had an interesting history even before World War II.

In July 1937, famed aviator Amelia Earhart and her co-pilot, Fred Noonan, disappeared while flying in a Lockheed Electra from New Guinea to Howland Island. The USS *Colorado*, which was on a training mission, joined the search. While the *Colorado* continued to search for nearly a week, Earhart and Noonan were never found. What happened to them is one of the great mysteries in aviation history.

Seattle’s Museum of Flight recently acquired one of the few remaining Model 10-E Electras, which duplicates the appearance of Earhart’s plane and is on display in the Museum’s Great Gallery, along with other Earhart memorabilia—soon to include a small share of teakwood from the deck of the battleship that helped search for her and was later salvaged, not once but twice, by Boeing. ■

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PHOTOS: (Far left) U.S. Navy veteran Ken Jones, shown with a replica he’s building of the USS *Colorado*, the ship on which he served in World War II. ASSOCIATED PRESS (Insets, from top) Don Burnside of BNB Construction stacks teak planking removed from a Boeing cafeteria wall; the teak was donated to USO Northwest, shown, for a new facility; Jeff Doan, left, Boeing Site Services planner, shares a sample of the planking with Museum of Flight Curator and Director of Collections Dan Hagedorn for inclusion in the museum’s Amelia Earhart exhibit. MARIAN LOCKHART/BOEING

## CUSTOMER PROFILE

# Crossroads of success

Air Astana is one of the fastest-growing airlines in Central Asia

By Elena Alexandrova



With 16 million people, Kazakhstan is a small market, but its location at the heart of Central Asia makes it a natural crossroads for business across the region.

And that has enabled Air Astana, the Kazakhstan flag carrier, to become one of the most successful and fastest-growing airlines in Central Asia, while also winning industry recognition for its passenger experience.

Air Astana has grown rapidly since 2002 when it made its first flight from Almaty to Astana with a Boeing 737. Today, the carrier operates a fleet of 30 Western aircraft, including two Boeing 767s and five 757s, on a network of more than 60 international and domestic routes from its main hubs in Almaty and Astana.

Boeing's 787 Dreamliner is part of the airline's growth plans.

Air Astana has been profitable since launch, with ownership split 51-49 percent, respectively, between the National Welfare Fund "Samruk-Kazyna" and the United Kingdom's BAE Systems.

The carrier provides regional service into its Almaty and Astana hubs from neighboring countries, including China, Kyrgyzstan, Russia,

Uzbekistan, Azerbaijan, Georgia and India. Connections provide services to long-haul destinations in Asia, Europe and the Middle East.

Air Astana was named Best Airline in Central Asia and India at the 2013 World Airline Awards ceremony during the Paris Air Show, based on results from one of the largest passenger-satisfaction surveys in the world. It won for Best Staff Service in Central Asia and India as well. Air Astana also received a four-star rating (out of five) from Skytrax, which operates an airline quality rating system. And 2013 marked the second consecutive year this carrier—the first based in Russia, the Commonwealth of Independent States (CIS) and Eastern Europe—won these prestigious awards.

Air Astana's fleet is scheduled to grow to 43 airplanes by 2020, with three new Boeing 767s and three 787s in the mix. Development of Air Astana's long-haul service, particularly in Asia, will receive critical support from two new Boeing 767-300ER (Extended Range) airplanes that entered the fleet in 2013 and by a third 767-300ER planned for future delivery.

The 767, equipped with fuel-saving winglets, is capable of operating on all of Air Astana's present and most of its future route network without restriction or the need for technical stops, according to Air Astana President Peter Foster.

"We are looking at another year of success in 2014," said Foster, a former Cathay Pacific, Philippine Airlines and Royal Brunei executive. "The main focus will be on further expansion in the CIS and Central Asia region, and the new Boeing 767-300ERs will also enable capacity growth across our long-haul network."

Looking further ahead, Foster said the delivery of the three 787-8s in coming years promises to be transformational, giving Air Astana an airplane with a global reach, strong customer experience, high fuel efficiency and a reduced environmental footprint. ■

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PHOTO: A Boeing 767-300ER (Extended Range) in Air Astana livery. The airline plans to bolster its long-haul service with Boeing 767s and 787s. **AIR ASTANA**



## IN FOCUS

# HIGH FIVE

One of five 747-8 Freighters operated by Moscow-based AirBridgeCargo, Russia's largest cargo airline, flies over the mountains of Washington state prior to its recent delivery. Boeing photographer Ed Turner captured this photo from Wolfe Aviation's Learjet, which is specially modified for air-to-air photography. Turner mounted his camera in a pod under the wing of the Learjet and controlled it from inside the cabin. While flying in a carefully coordinated chase formation, he estimated the 747 was about 200 feet (60 meters) away when he took this picture.

PHOTO: ED TURNER/BOEING





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AirBridgeCargo



BOEING 747-8F

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