BOEING

Frontiers

www.boeing.com/frontiers

OCTOBER 2013 / Volume XII, Issue VI

WELCOME TO THE FAMILY!

Meet the 787-9, which is much more than a simple derivative

BOEING

"It's not always about technology—it's about looking at things a slightly different way to come up with an innovative and creative solution."

Dan Smith
Director
Innovation Center and
Technology Development
Boeing Commercial Airplanes

787-9 INNOVATION EVOLUTION

Stories of
innovation
at Boeing

www.boeing.com/stories

22
DREAM BIG

The newest member of the Dreamliner family, the 787-9 is much more than a simple derivative. Boeing leveraged the visionary design of the 787-8 and innovative technology to bring a new level of efficiency to the market, while enhancing the production system they share. The result: Employees say the first 787-9 went together with remarkable ease.

COVER: THE TAIL SECTION OF THE FIRST 787-9, FEATURING A VIBRANT NEW LIVERY. THE AIRPLANE IS SHOWN ON THE FLIGHT LINE AT THE EVERETT, WASH., SITE. BOB FERGUSON/BOEING

PHOTO: THE 787-9 IS READIED FOR ITS FIRST FLIGHT. BOB FERGUSON/BOEING

AD WATCH

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

Inside cover:

"787-9 Innovation Evolution" is one in a series of innovation stories told by Boeing employees such as Dan Smith. Learn more at www.boeing.com/stories.

Page 6:

This new recruitment ad draws on wordplay and 737 MAX imagery to reinforce how an employee pursuing a career path can "Take it to the MAX" with Boeing. This ad will primarily run in career fair program guides at recruiting, diversity and college events.

Pages 14–15:

Featuring the AH-64 Apache, "Enduring Support" focuses on Boeing's services and support expertise and is one of several ads in a Boeing Defense, Space & Security advertising campaign highlighting the capabilities Boeing brings to its customers. The ads are running in print and online business, political and trade publications.

Back cover:

Boeing is involved in the creation and transfer of technology with Brazil, building on a partnership that began 80 years ago with the arrival of the Boeing F4B-4 aircraft. Today, Boeing has several agreements and projects for advocacy and research with Brazil, including one with aircraft manufacturer Embraer.

FSC LOGO

Publisher: Tom Downey
Editorial director: Anne Toulouse

EDITORIAL TEAM

Executive editor:
Paul Proctor: 312-544-2938

Editor:
James Wallace: 312-544-2161

Managing editor:
Vineta Plume: 312-544-2954

Graphic designers:
Al Callanta: 310-364-6743
Brandon Luong: 312-544-2118
Cass Weaver: 480-216-4539

Photo director:
Bob Ferguson: 312-544-2132

Commercial Airplanes editor:
Cecelia Goodnow: 206-766-2931

Defense, Space & Security editor:
Diane Stratman: 562-797-1443

Engineering, Operations & Technology editor:
Junu Kim: 312-544-2939

Human Resources and Administration editor:
Len Vraniak: 312-544-2351

Shared Services Group editor:
Beriah Osorio: 425-577-4157

Staff writer:
Eric Fetters-Walp: 425-266-5871

ONLINE PRODUCTION

Web manager:
Wendy Manning: 312-544-2936

Web designer:
Michael Craddock: 312-544-2931

Web developer:
Lynn Hesby: 312-544-2934

Information technology consultant:
Tina Skelley: 312-544-2323

HOW TO CONTACT US:

E-mail:
boeingfrontiers@boeing.com

Mailing address:
Boeing Frontiers
MC: 5003-0983
100 N. Riverside Plaza
Chicago, IL 60606

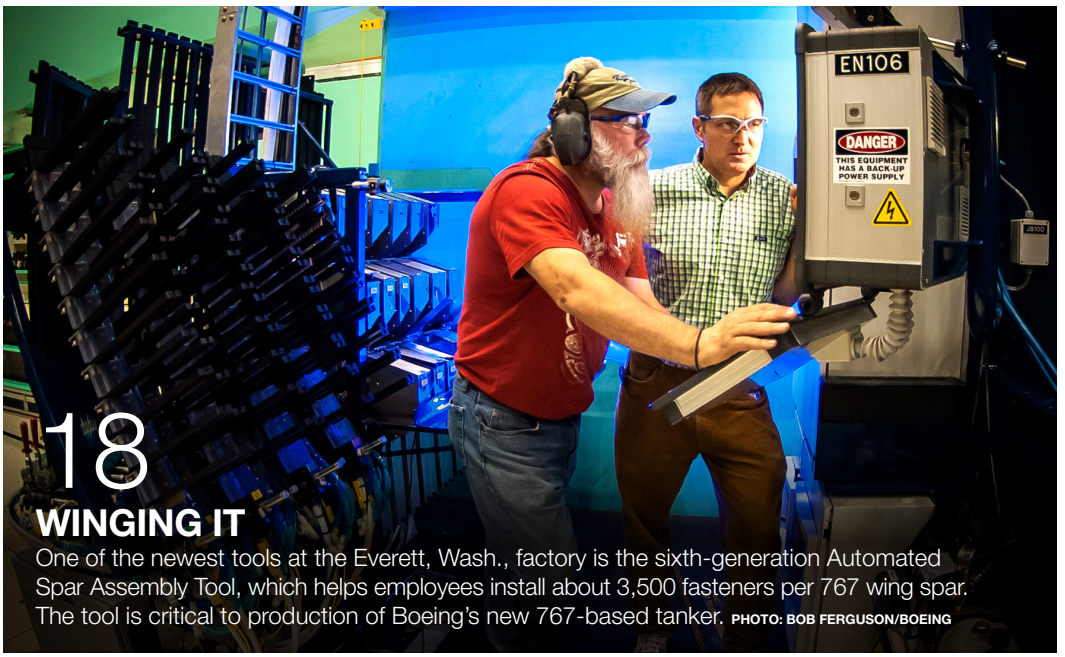
Phone:
312-544-2954

Fax:
312-544-2078

Web address:
www.boeing.com/frontiers

Send all retiree address changes to
Boeing Frontiers, MC 6Y-66
P.O. Box 3707
Seattle, WA 98124-2207

Postmaster: Send address corrections to
Boeing Frontiers, MC 6Y-66
P.O. Box 3707, Seattle, WA 98124-2207
(Present addressees, include label)

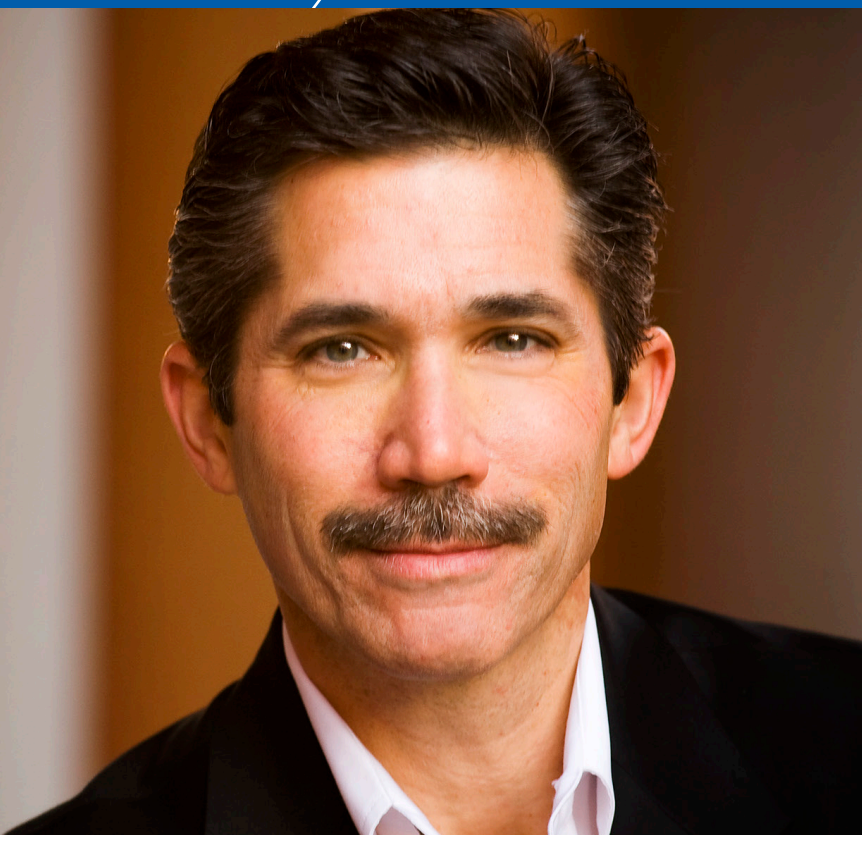


Inside


TAKE IT
TO THE
MAX
Together, we set higher standards in aerospace every day. Join Boeing and take our industry – and your career – to the next level.
BOEING
737-9
737 MAX
737
737 MAX 9
boeing.com/careers
Boeing is an equal opportunity employer supporting diversity in the workplace.
BOEING

The value of great ideas

Boeing's competitiveness stems from its intellectual property



Pete Hoffman
Vice president, Intellectual Property Management

We are living in a time of ever-increasing global attention to intellectual property and the benefit it brings to the world economy. One need only glance at a newspaper to understand the substantial value being assigned to ideas, invention and innovation today.

Case in point, the America Invents Act, the core of which took effect this year, contains the most significant changes in the U.S. patent system in many decades. In March, the White House released a federal strategy on mitigating the theft of U.S. trade secrets. And in July, the U.S. Commerce Department adjusted its calculation of the United States' gross domestic product to include intellectual property production and investment. This move caused the GDP to be adjusted by a whopping 3 percent—almost $400 billion. That's like adding the total output of the entire state of Washington and Charleston, S.C., combined.

The cumulative know-how of our employees and Boeing's intellectual property, comprising our patents, trade secrets, copyrights and trademarks, is collectively the company's most valuable asset, and it drives our competitive advantage.

That is why every year, we celebrate those among us who have brought accountable and proven value to the company through the Special Invention and Technical Replication Awards. These innovators and their work ensure our products contain the highest state of the art and that Boeing remains the aerospace leader. The awards demonstrate the tangible benefits from the billions of dollars the company invests each year in research and development. (Read about some of these great ideas, and the employees behind them, on Page 44.)

There is absolutely no doubting the results our inventors bring to Boeing's success. And we're not just talking about the rocket scientists. The inventor's mindset is an approach all employees can and should follow, regardless of professional discipline.

First, inventors focus on solving problems and making improvements to whatever work they might be doing—both within their own organizations and through their work externally. They then make the deliberate decision to capture and protect this hard-earned knowledge by filing invention disclosures and serving as active guardians of proprietary information. Boeing uses this valuable intellectual property to enable profitable business results, which, in turn, allows us to invest in further technology innovation—and sustains growth and jobs.

Through this time-tested strategy, Boeing has developed one of the best patent portfolios among technology companies. This year, the Patent Board rated Boeing the No. 1 innovator in the aerospace and defense sector for the seventh year in a row.

The rating is not just a nod to the size of our patent portfolio; the most important measurement used in this rating is technology strength. And the strength of our technology is the reason why Boeing people are able to solve our customers' toughest problems day after day, year after year.

That achievement can be a matter of pride for all of us at Boeing. ■

PHOTO: BOB FERGUSON/BOEING

On cloud ‘9’

With thousands of excited Boeing employees watching and taking pictures, the 787-9 takes off on its first flight Sept. 17 from Paine Field in Everett, Wash., accompanied by two T-33 “chase” jets. The newest member of the Dreamliner family is 20 feet (6 meters) longer than the 787-8 and will carry about 40 more passengers. Air New Zealand is scheduled to take first delivery of the 787-9 in mid-2014. (For more about the innovative 787-9, see story on Page 22.) PHOTO: BOB FERGUSON/BOEING

“If a picture is worth a thousand words, a flying model is worth a million words.”

– *Perry Ziegenbein, chief engineer for Boeing’s Phantom Swift, a working scale model for a vertical takeoff and landing aircraft that was prototyped by a Phantom Works team in Philadelphia. The model was designed, built and flown in less than a month, allowing it to be included in Boeing’s proposal in an X-plane program by the U.S. Defense Advanced Research Projects Agency, or DARPA.* Boeing News Now, *Sept. 11*

“Every country that has ever bought a Chinook or has operated them has come back and asked for more.”

– *Mark Ballew, director of business development, speaking to reporters about the long success of Boeing’s Chinook military helicopter, the latest version of which, the CH-147F, was recently delivered to Canada.* Delaware County Daily Times, *Sept. 10*

“We’ve got five more hours of gas left in there. We’d still be flying if they hadn’t told us to bring it back.”

– *Capt. Mike Bryan on the 787-9’s first flight, Sept. 17. Bryan reported it was a “no-squawk” flight, which is pilot-speak for no problems to report, big or small.* Everett Herald, *Sept. 17*


"No matter what projects we work on, we try to come up with different ideas."
– Dan Johnson

Rise and 'shine'

When mechanics on the factory floor need help, this Moonshine Shop employee is ready to lend a hand—with creative thinking

By Dawsalee Griffin and photo by Marian Lockhart

Boeing Moonshine Shops are areas where employees can design and build a prototype of an idea or concept that can streamline or make factory work easier and more efficient. Dan Johnson is a member of the 737 Moonshine Shop in Renton, Wash. In this Frontiers *series that profiles employees talking about their jobs, Johnson describes the satisfaction of prototyping tools and solutions that help his co-workers succeed.*

We're helping the people on the floor, whether it's finding a solution to a problem or actually building a prototype tool for them. It's good to know they have somewhere to come to have their ideas developed and that we can get something back out to them in a timely manner.

It's essential to be creative when you work in the Moonshine Shop. The 737 Moonshine Shop was a good fit for me because I do this at home. I have a pretty extensive metal fabrication shop.

You also need to be open to learning and be able to work well with people. That's an important part of our job because we talk with people and ask a lot of questions to find out what they need and how we can help them.

I was a mechanic before I joined the Moonshine Shop, and so are most of the others on our team. It's an advantage when we talk with mechanics about improvements. They know we understand what they're talking about because of our experience. Anytime I walk through the factory, somebody will grab me and ask if we can help with an installation problem, training aids or safety, or ask for help in figuring out how to reduce defects or make the job easier to perform.

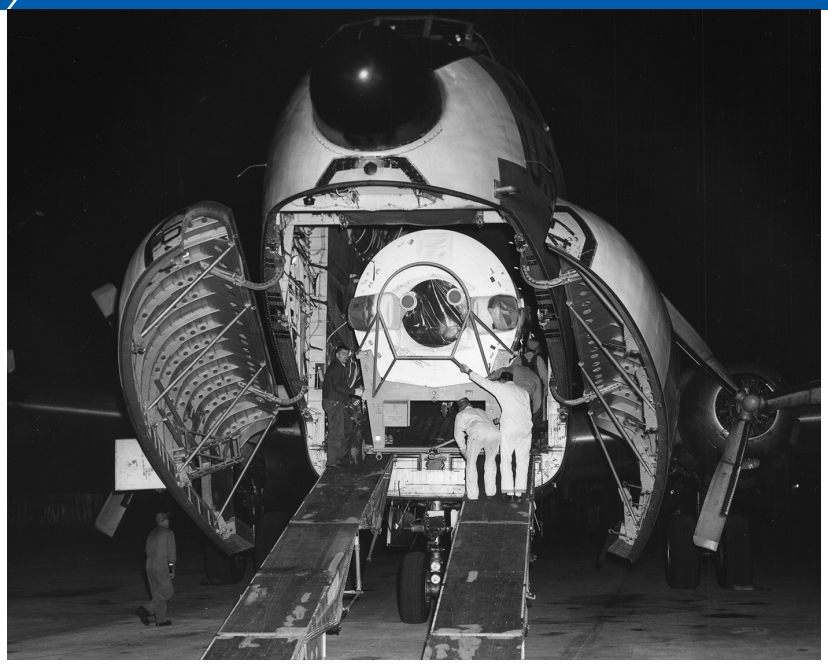
No matter what projects we work on, we try to come up with different ideas. We've been through a lot of training to learn to think outside the box. When we attend improvement workshops, we challenge others to come up with ideas as well. We know there's got to be another way, or three or four or 10 different ways. We want the best way. And we want to help them find that way.

Sometimes it's something simple. A few years ago, I was helping a Moonshine team with a project and went to South Carolina to see the teammates' process in action. My partner from the 737 Moonshine Shop and I watched mechanics carry a panel the length of the airplane. We decided the first thing we needed to do was build a cart so they could roll that panel down to the end of the airplane to install it. The smiles when they put that panel on the cart and rolled it to where they installed it is something I'll never forget—just simple and quick solutions that can improve someone's job.

Basically, if there are things that the people on the floor need, whether it's help with a design or redesign of a tool or if they just have an idea that will help them do their job better, we can help.

For us, it's worth all the work when we see the mechanics, with smiles on their faces, using what we've built for them. ■

dawsalee.griffin@boeing.com



DAYS OF THUNDER

Douglas Aircraft's Thor missile served as nuclear deterrent before ICBMs

By Henry T. Brownlee Jr.

In Norse mythology, Thor was the god of thunder, wielding a mighty hammer that flashed lighting across the sky.

It was a fitting name for the first operational ballistic missile deployed by the U.S. Air Force.

The Thor missile, developed in the 1950s by Boeing heritage company Douglas Aircraft, never had to wield its own hammer—a nuclear warhead—but it served as an early nuclear deterrent before the development of longer-range intercontinental ballistic missiles (ICBMs) such as Minuteman.

Thor also left an important legacy. It was modified to become the highly successful Delta launch vehicle, an eventual family of Boeing rockets that continue to hurtle military and commercial satellites into orbit to this day—satellites that make possible everything from global communications to forecasting the weather.

The single-stage, liquid-fueled Thor was designed as an intermediate-range

ballistic missile to meet Air Force requirements for a missile capable of accurately delivering a payload 1,500 miles (2,400 kilometers) from its launch site. A missile with that range could hit Moscow from the United Kingdom. The Korean War had ended, but the Cold War was escalating and the United States wanted not only the ability to respond to nuclear threats but, more important, a deterrent to nuclear war.

Thor left an important legacy. It was modified to become the highly successful Delta launch vehicle.

In late November 1955, three companies were given one week to bid on the project—Douglas, Lockheed and North American Aviation. On Dec. 23, 1955, the Air Force selected Douglas as prime contractor for the missile's airframe and integration, while North American Aviation's Rocketdyne division was awarded the contact for the engine, which would produce 135,000 pounds (600 kilonewtons) of thrust. North American also is a Boeing heritage company.

Donald W. Douglas Jr., president of Douglas Aircraft Co., noted at the time: "In point of experience and volume of production, the Douglas Santa Monica Division holds a position of unquestioned leadership as a manufacturer of missiles. ... Our output of missiles since we entered the business in 1941 numbers more than 19,000 and by weight exceeds that of all other American missile manufacturers combined."

Thor measured 8 feet (2.4 meters) in diameter and was 65 feet (20 meters) long, and could be transported by a Douglas C-124 Globemaster for rapid deployment if needed.

After several failures, Thor made its first successful flight in September 1957. It reached a speed of about 10,000 mph (4.5 kilometers per second) and attained an altitude of 1,100 miles (1,800 kilometers) before the inert warhead splashed into the south Atlantic Ocean. Further testing continued and in August 1958, after 18 research-and-development launches, Thor was cleared for operational use.

Under the code name Operation Go Away, the first Thor operational missiles were deployed in the United Kingdom in September 1958, and by April 1960 four Royal Air Force squadrons had 60 missiles. They were all deployed at above-ground launch sites, stored horizontally on transporter-erector trailers.

More than 200 Thor missiles were built. But once the first generation of ICBMs based in the United States became operational, Thor was no longer needed and the missiles were quickly retired. Thor was deactivated in 1966.

"The capability of sending such a missile hurtling above the earth's atmosphere at supersonic speeds has tremendous implications," Douglas said of Thor. But his words also could have been used to describe the more powerful ICBMs that took Thor's place.

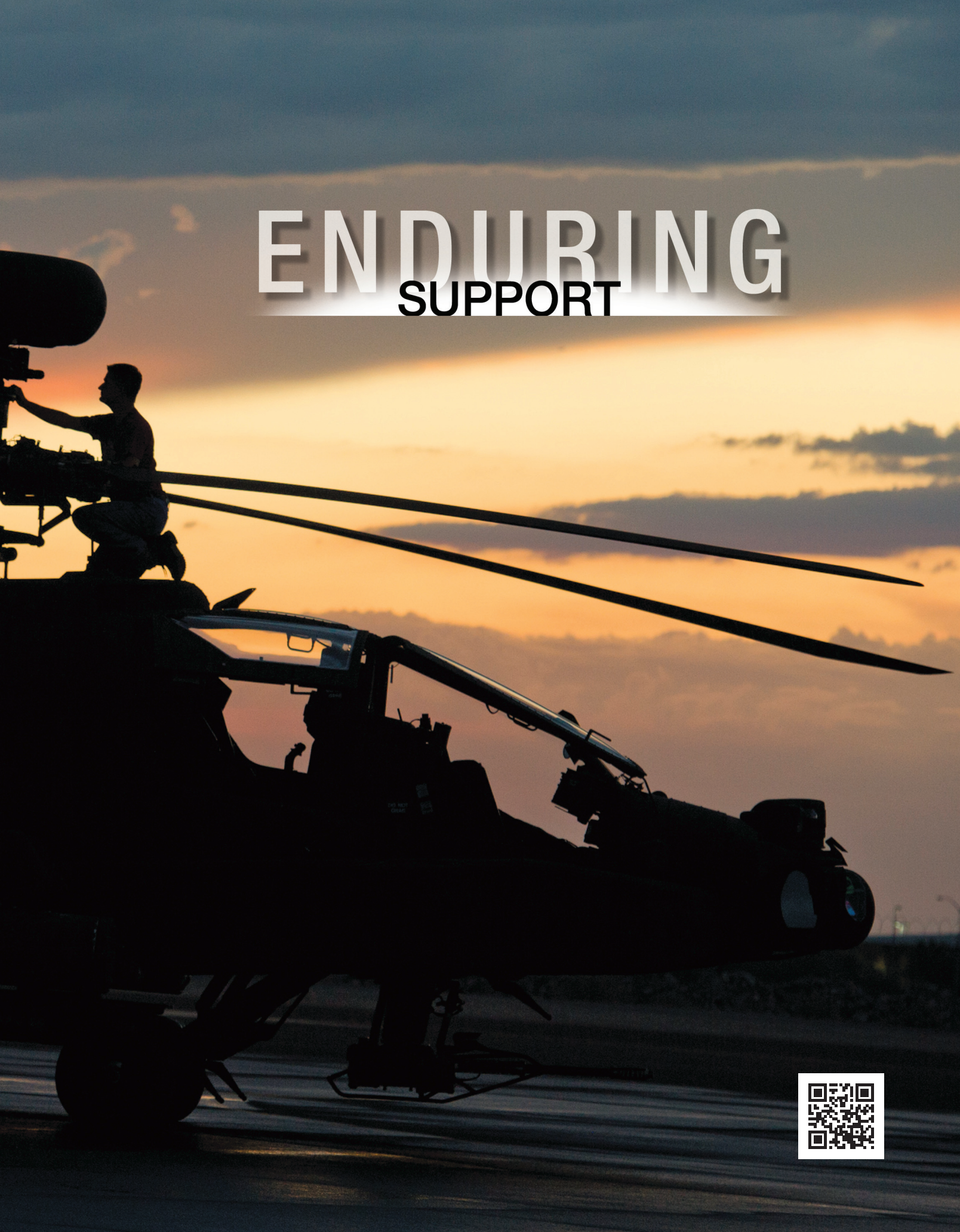
"Any nation so armed can strike devastating blows at any adversary with only a moment's notice," Douglas noted. "Perhaps this is truly the ultimate weapon which no one will dare to use. Yet we must be prepared to use it if we have to and to take countermeasures against similar weapons that might be used against us." ■

henry.t.brownlee-jr@boeing.com

Visit Boeing's Thor Missile history page to see a video of the first fully successful Thor launch and other firsts: www.boeing.com/boeing/history/mdc/thor.page

PHOTOS (Clockwise from top far left): A Thor intermediate-range ballistic missile is loaded into a C-124 for transportation to Tulsa, Okla., for modification; an early Thor-Delta launch; Thors were used to launch vehicles into space for research on re-entry; Thor missiles in Tulsa await reconfiguration to Thor-Deltas. BOEING ARCHIVES


Logistics & Training
Life-Cycle Support Services
Supply Chain Management
Systems Integration
Maintenance & Modifications
www.boeing.com/support
TODAYTOMORROWBEYOND
BOEING


ENDURING
SUPPORT

"For us it was all about the power of one. It just takes one person to make a good idea reality."

– Ginny Woodhouse, manager, Supplier Management

It starts with awareness

How a small Boeing team that cares about the environment makes a big difference

By Patrick Summers and photos by Gail Hanusa

Charleen Khane and a handful of colleagues in Everett, Wash., are proving that even small actions to improve the environment can have a big impact.

The team has generated ideas that are saving the company millions of gallons of water and miles of paper towels, while increasing environmental awareness—another example of how Boeing employees are working to continually improve the company's environmental performance.

"In our first meeting we talked about what was important to us and what we were passionate about. That helped focus our efforts on areas where even a small group could have an impact," explained Khane, a scheduling analyst on the 777 program.

The team, which includes about 15 people, decided to tackle several projects with high potential for reducing waste and saving money, including retrofitting bathroom faucets with low-flow aerators, which use 75 percent less water, and evaluating the size of paper towels used in bathroom dispensers.

The team also designed and distributed 20 different signs that encourage conservation by pointing out, for example, Everett employees could save a substantial amount of energy by simply turning off idle computer monitors, according to company estimates.

"It starts with awareness," said Rachele Horner, a project manager on the 777 program and team member. "People need to know the impact of throwing a can into the garbage instead of the recycle bin."

The site installed low-flow aerators in office restroom sinks in 2012 and is retrofitting factory sinks known as Bradley basins for a projected water savings of more than 14 million gallons (5.3 million liters) a year, according to Vince Villa, site utility conservation engineer.

"Employees using the restrooms account for two-thirds of Everett site water use, so every little bit helps," Villa said.

Everett employees also used almost 74 million feet—14,000 miles, or 22,500 kilometers—of paper towels in 2011 when drying their hands after washing.

"We worked with our supplier to start adding signs to the dispensers that remind users to conserve because 'These

come from trees,'" Khane said.

Representatives of Boeing Site Services reviewed industry standards with the supplier and adjusted site dispensers to provide uniform paper towel sizes of 8 inches (20 centimeters) long in office buildings and 12 inches (30 centimeters) long in the factory. Site Services will continue to monitor and evaluate paper towel use and related employee feedback.

Thanks to projects such as these, the team has won Boeing's annual conservation award the past two years. Company leaders also noted that employee-led projects helped Boeing meet its environmental targets to reduce carbon dioxide emissions, hazardous waste, and energy and water use the past five years, and are critical in reaching the current goal of zero-carbon growth.

Supplier Management manager and team member Ginny Woodhouse believes every employee can make a difference. "For us it was all about the power of one," she said. "It just takes one person to make a good idea reality." ■

patrick.a.summers@boeing.com

PHOTOS: (Left) The Everett, Wash., site installed low-flow aerators in office restroom sinks last year. (Above) Rachele Horner, left, and Charleen Khane help lead a project that is reducing waste and conserving resources by reducing the size of paper towels used and discarded in restrooms at the Everett site.

Precision drill team

New 767 tool is fast and accurate—and critical to meeting Boeing tanker deadlines

By Kymberly VanDlac and photos by Bob Ferguson

Dwarfed by hundreds of tons of hulking machinery, Glenn Huckabay sat at the controls of the 767 program's sixth-generation Automated Spar Assembly Tool and proceeded to make short work of a very long wing spar.

Using the advanced software of the ASAT6, as the new tool is called, Huckabay guided an automated carriage along an 82-foot (25-meter) spar, drilling and installing wing fasteners at rates that were once unimaginable.

"This machine is a dream come true," said Huckabay, who spent 14 years working the early-model tooling the ASAT6 has replaced. "Not only is this machine 50 percent faster, it cleans as it goes, picking up 90 percent of its own debris."

One of the Everett, Wash., site's newest and most sophisticated pieces of tooling, the ASAT6 is critical to meeting production deadlines on the KC-46A aerial refueling tanker, which is based on the 767 commercial airframe. The first tanker is on track to deliver to the U.S. Air Force in 2016, with a total of 18 tankers to be delivered by year-end 2017, according to tanker program executives.

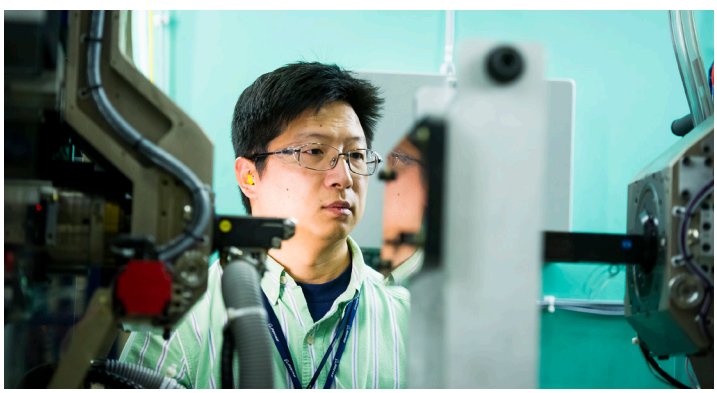
"It gives us the ability to meet the high expectations of the U.S. Air Force," ASAT operator Keith Jacobsen said of the latest-generation tooling. "Maintaining quality is essential. It electronically tests every hole for accuracy while at the same time rejecting any misshapen or misaligned fasteners."

In the early 1980s, Boeing installed the first generation of the tool, the ASAT1, to streamline production of its new line of 767 commercial jets. Digital technology was just starting to blossom. At a time when Pac-Man ruled the video arcade and desktop PCs were still a novelty in American households, ASAT1 was a technological marvel.

But 30 years and 1,000-plus airplanes later, it was sorely outdated.

"It was superior for the day, but now it is old technology," maintenance technician Arthur Peterson said of the ASAT1. "The parts and software from 30 years ago are no longer readily available. When the machine breaks down, in some cases it takes days to fix, putting production behind schedule."

By 2011, the need to replace ASAT1 had become pressing. With the tanker contract in place and several back-to-back freighter orders secured, Boeing Commercial Airplanes



PHOTOS: (Clockwise from top) Equipment engineers Richard Wilkes, left, and Mark Pflum discuss the precision of the new Automated Spar Assembly Tool, or ASAT6; Keith Jacobsen (top), ASAT tool operator, and Yu Chin Jou (above), equipment engineer, perform system quality checks. ASAT tool operator Roderick Nelson shows a drilling precision test.

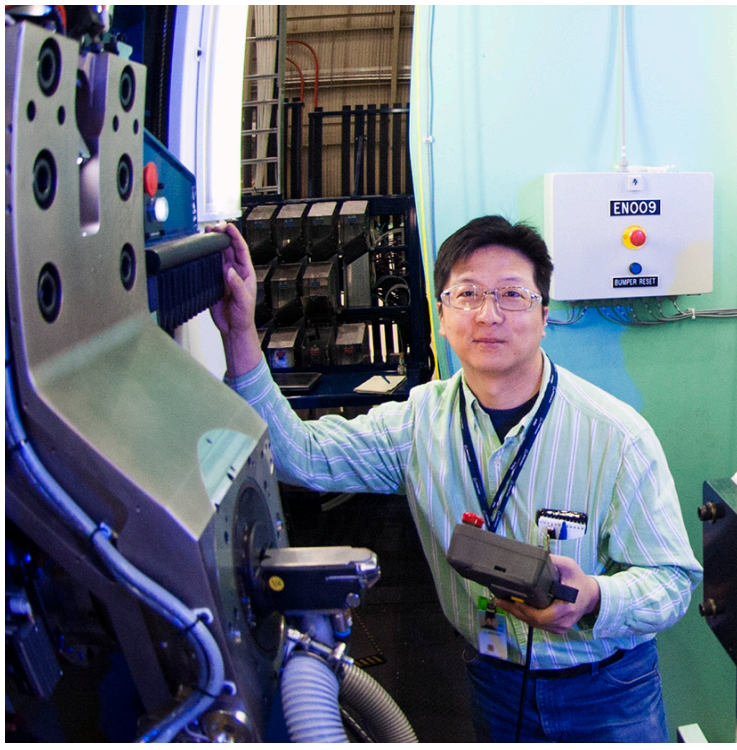
‘MARVELOUS PIECE OF TECHNOLOGY’

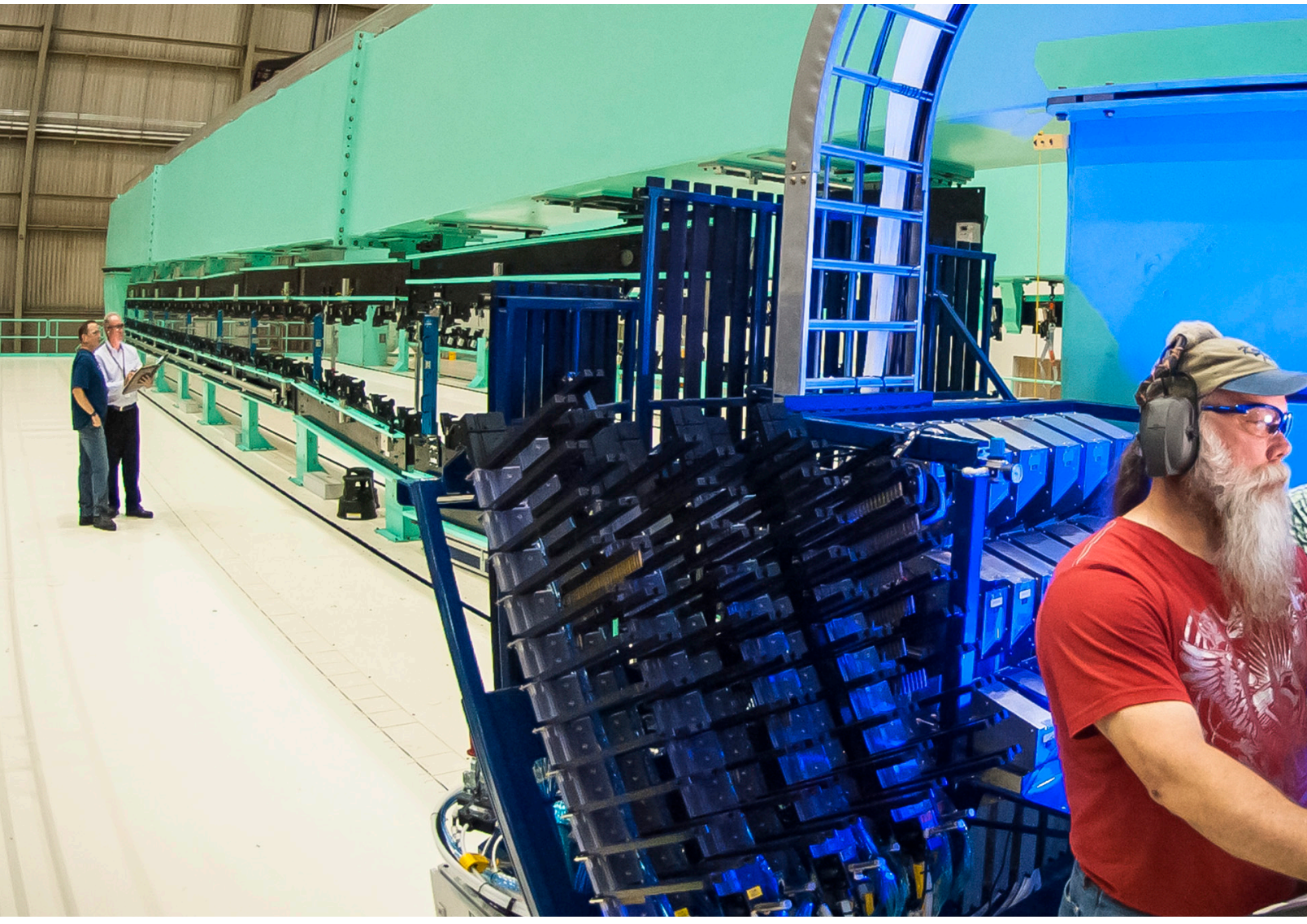
The new Automated Spar Assembly Tool, or ASAT6, drills and installs seven fasteners per minute into the 82-foot (25-meter) wing spar of the 767. That’s 50 percent faster than ASAT1, the tool it replaced.

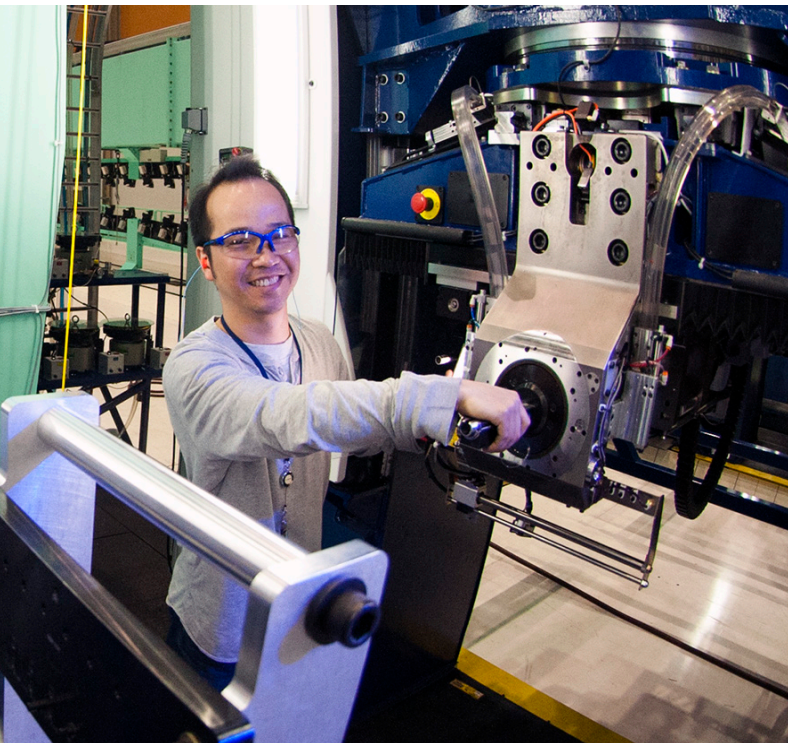
Advanced software technology allows the tool to quickly measure and install about 3,500 fasteners per spar, and the tool can accommodate more than 150 different fastener combinations. It has the capacity to drill and quality-check holes as small as 3/16 inches and as large as 3/8 inches wide (about 0.5 to 1 centimeter, respectively). The variety of options means flexibility to accommodate differences between the commercial 767 wing spar and KC-46A tanker wing spar.

Built by Electroimpact of Mukilteo, Wash., ASAT6 includes ergonomically designed workstations, a visual color-coding system and easy one-step setup. And ASAT6 collects more than 90 percent of its own drill shavings.

It has two separate spar lines, each weighing 140 tons (125 metric tons) and extending 120 feet in length and 12 feet across (37 and 3.7 meters, respectively). Each line sits atop 38 inches (1 meter) of steel and is surrounded by 30 tons (27 metric tons) of decking.







collaborated with Defense, Space & Security to design and qualify a state-of-the-art tool capable of building wing spars for both the KC-46A and the baseline 767 commercial airplane.

The spar is the main structural component of the wing. Each wing contains two spars—one front and one rear. The spars support critical in-flight loads and the weight of the wings.

"The wing spar is a component on the airplane Boeing manufactures from scratch," Jacobsen said. "Building the spar is the first step to wing construction, and it is the first step in the structural assembly of an aircraft."

The sixth-generation of the wing-spar tool was installed in the Everett factory in February and, following several months of qualification testing, entered production in June. The 777 program had installed an earlier-model ASAT5 in 2011, and the sharing of information between programs helped testing on the ASAT6 proceed smoothly, said Wade Price, who participated in both installations.

Unlike its preceding five models, which require four separate lines—one dedicated to each spar—ASAT6 has two lines, each capable of producing both front and rear spars. Advances in tool design, drill technology and computer programming ensure ASAT6 is well-equipped to handle the variations between commercial and military wing spars, according to 767 Equipment Engineering.

Equipment engineer Yu Chin Jou said color coding makes the tooling intuitive and easy to use. "On the old machine, setup time required a lengthy five-step process; now setup involves one quick, easy step."

On June 26, the new machine began drilling and fastening the first wing spar for the tanker. It was a major occasion for program employees, who received commemorative tanker pins and signed a banner marking the achievement.

"The team has a great sense of pride in loading the wing spar on time and on schedule," said Scott Campbell, vice president and general manager of the 767 commercial program. "We are proud to launch a new era in aerial refueling."

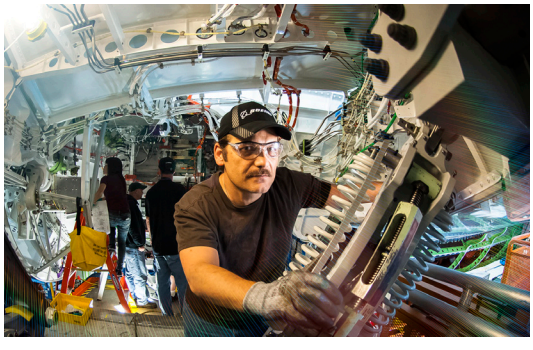
It was just the first of many spars that the new tool will produce for the KC-46A and the 767 for years to come.

"I've seen a lot of machines come and go," said Peterson, the maintenance technician. "This is a marvelous piece of technology." ■

kymberly.y.vandlac@boeing.com

PHOTOS: (From top) Equipment engineers Yu Chin Jou, left, and Huy-Van Huynh quickly set up the Automated Spar Assembly Tool, or ASAT6; at the controls are Keith Jacobsen (foreground), ASAT tool operator, and Mark Pflum, equipment engineer.

THE DREAM C



PHOTOS: (Top) The 787-9 after its rollout from the Everett, Wash., factory in late August. PAUL GORDON/BOEING (Above, clockwise from top left) Final assembly of the first 787-9; a distinctive new tail livery; Kevin Nguyen, left, and Donald Mulvey; Hong Bou; mechanic Bruce Kaufman of the 787-9 main landing gear team; Ngoc Nguyen. BOB FERGUSON/BOEING

CONTINUES...

With innovative new technology and other improvements, the 787-9 is much more than just a longer Dreamliner

By James Wallace

Like proud parents watching their child stand up without help for the first time, this was the day Bruce Kaufman and his team had been waiting for, when the newest member of Boeing's commercial jetliner family was able to support itself, the airplane's landing gear holding it up on the factory floor instead of powerful jacks.

It was mid-June in the Everett, Wash., factory and Kaufman and other members of the 787 main landing gear team were putting the 787-9 gear through a battery of functional tests before the OK was given to remove the jacks.

"Pretty awesome," Kaufman said, as he stood off to the side and looked at the first-ever 787-9 Dreamliner in final assembly, and at the four large tires of the main landing gear on that side of the plane. "It will be neat to see it out on the runway and think, Wow! I had a part in that."

Weeks later, that first Dreamliner with "9" on its tail left the factory floor late one night and was towed a short distance to be painted, one of the last remaining big tasks before the 787 team officially rolled out the airplane in late August.

The 787-9 made its first flight Sept. 17. (See photo on Page 8.)

All of Boeing, and not just the 787-9 team, has reason to be excited about the new plane. It's much more than the next member of the Dreamliner family, a longer version of the 787-8 that will carry more passengers and have more range. Years ago, when some of the brightest aerodynamicists and engineers with Boeing Commercial Airplanes were planning the 787 family, they knew then the 787-9 held great promise. It would take lessons learned from the 787-8 and, with some new technology and innovation added to the mix, raise the efficiency bar even higher. And so would the 787-10 to follow.

The 787-10 is a few years away from the start of final assembly. But the 787-9 is here, ready to show what it's got.

And that's a lot, according to Mark Jenks, vice president of 787 development, with responsibility for both the 787-9 and 787-10.

"When you look at the build of the airplane, the supply chain, the performance of the airplane and all the improvements we have made, this really brings home the

airplane that we all envisioned 10 years ago," Jenks said. He was speaking of the 787-9, but his words reflected the vision that Boeing engineers had for an airplane that would become the 787.

Jenks knows about that early vision. He has been with the 787 program from the beginning, when a working-together group of airline customers, back in 2001 and 2002, were deciding between a futuristic-looking Boeing jet known as the Sonic Cruiser that would carry passengers just shy of the speed of sound and a more conventional-looking jetliner that would be super-efficient—a new commercial airplane for a new century. They opted for efficiency over speed, and the 7E7 (later renamed 787) was born.

In his Everett office, Jenks has a model of the Sonic Cruiser, along with models of the 787-8, 787-9 and 787-10. He was technology integration director for the Sonic Cruiser program before moving over as team leader for wings, empennage and landing gear on the 787. Much of the advanced technology that would have gone into the Sonic Cruiser, he said, instead went into the 787, the first large commercial jetliner with a mostly composite skin instead of metal.

The 787-8 entered passenger service with launch customer ANA (All Nippon Airways) in late 2011.

Air New Zealand is scheduled to take first delivery of the 787-9 in mid-2014. The next member of the family, the 787-10, is set to deliver in 2018.

At first glance, the 787-9 looks pretty much like the 787-8, with the same fuselage cross-section and advanced interior. But the 787-9 is 20 feet (6 meters) longer. Depending on how an airline configures the cabin, that extra length will typically mean about 40 more passengers. The 787-9 has a range of about 8,500 nautical miles (9,800 miles, or 15,700 kilometers), or some 300 nautical miles (350 miles, or 555 kilometers) more than the 787-8.

In addition to its longer fuselage and greater range, the 787-9 includes a number of advancements.

Take the tail. The leading edge of both the vertical and horizontal stabilizers on the 787-9 utilize "hybrid laminar flow control," a breakthrough technology that smooths out airflow and reduces drag on the plane's tail. That, in turn, reduces fuel use and emissions with every flight—meaning both the airlines and the environment will benefit.

Industry engineers worked to perfect hybrid laminar flow control technology for decades, but the weight of the systems was more than the potential fuel savings. Finally, Boeing engineers figured it out, and the 787-9 will be the first production commercial jet to feature the innovative technology, according to John Koppelman, structural design lead engineer on the 787-9 empennage. He was selected as Boeing's Engineer of the Year in 2012 for his role as team lead on hybrid laminar flow control.

Boeing has not only incorporated new technology and improvements to the 787-9, but it has also used lessons learned from the 787-8 to improve the 787 production system and supply chain—helping introduce the 787-9 while ramping up production of the 787-8. The result: The 787-9 went together with an ease that even surprised Jenks and other program leaders.

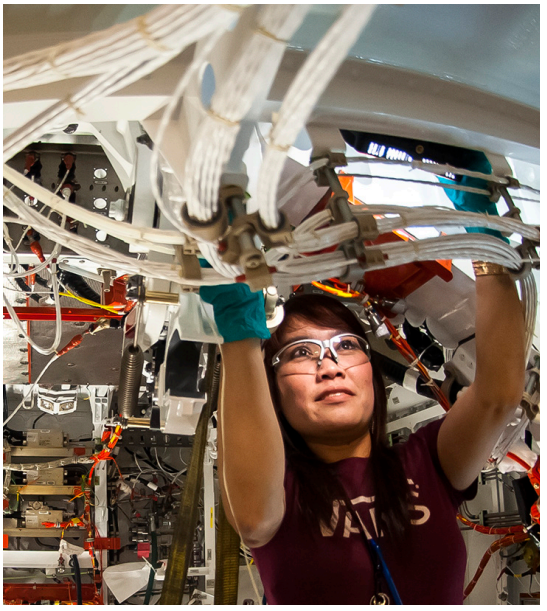
And the first plane, to be joined by the rest of the flight-test fleet by the end of this year, actually weighs several hundred pounds less than engineers had projected when the 787-9 design configuration became firm in 2010. That's almost unheard of on airplane development programs, even for a derivative model.

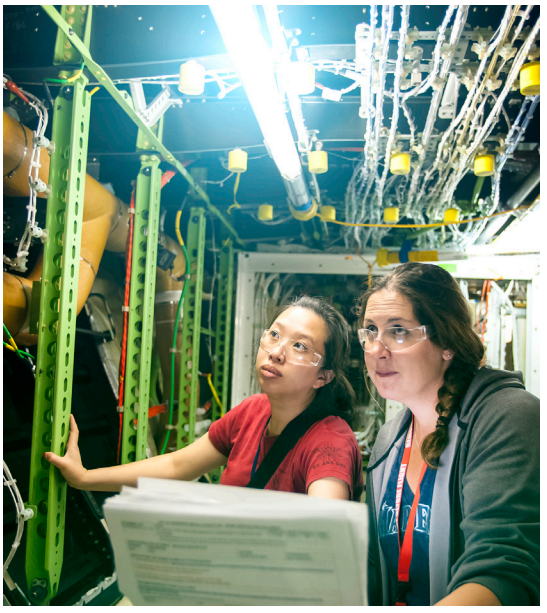
Employees who assembled the first 787-9 echo what Jenks and others say about how well production has gone.

Early on, Boeing took some of its most experienced 787-8 employee teams, gave them some additional training, and moved them over to the 787-9. Those employees brought not only their skills and know-how but also lessons learned from initial production challenges with the 787-8.

"It's awesome how well the build has gone," said Amanda Evangelista, a manufacturing representative for the 787-9 who was doing the same work on the 787-8. She

(Continued on Page 29)



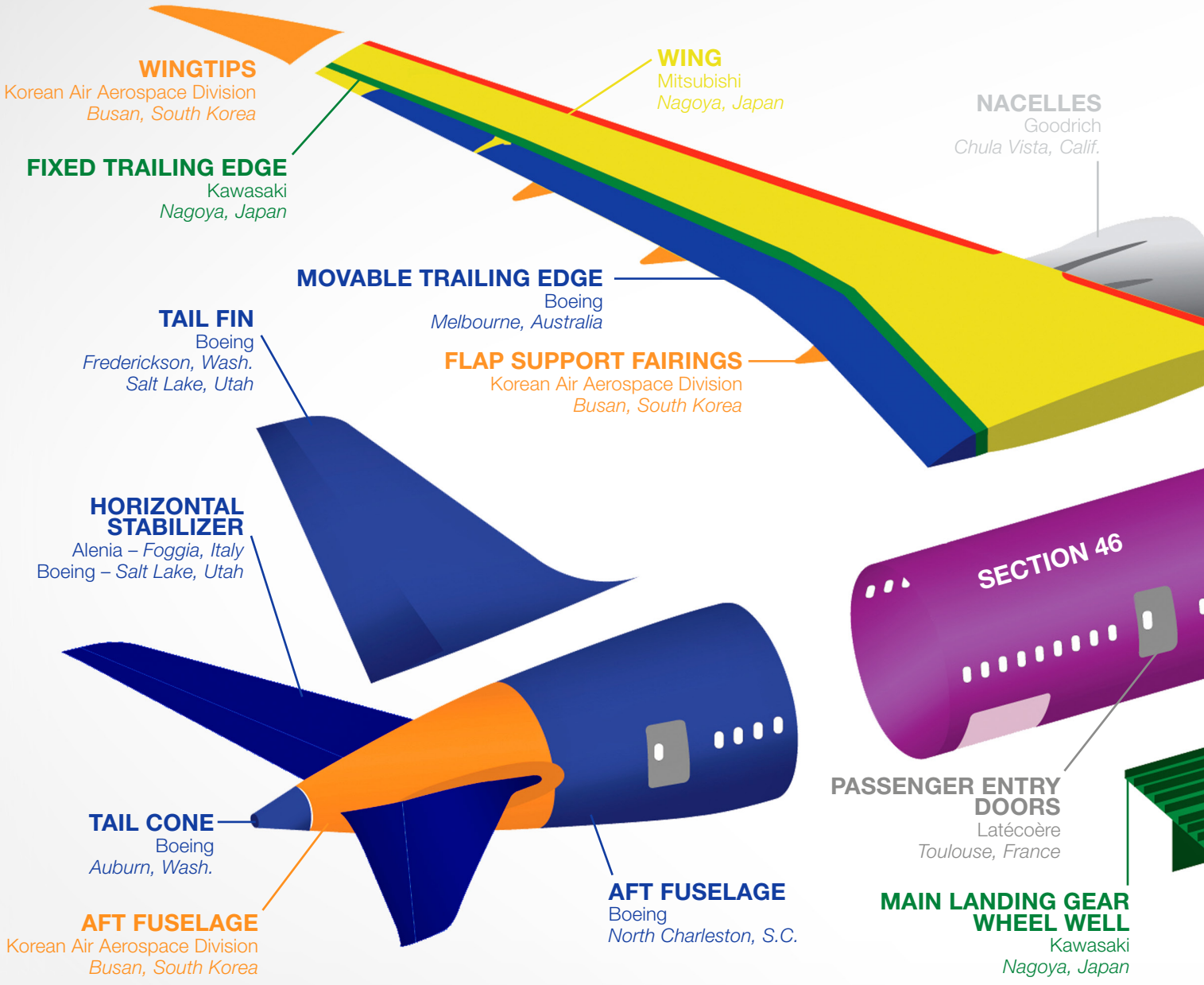


GRAPHIC AND PHOTOS: (Clockwise from top left) An artist's concept of a Boeing 787-9 in the Air New Zealand livery. BOEING Mark Jenks, vice president of 787 development; Harrison Lockhart III; Tom Hagerty, left, and Stephen Soran; Ponareay Heng, left, and Amanda Evangelista; Uyen Mach. BOB FERGUSON/BOEING

"There is a tremendous amount of technology in the airplane, a lot of changes. It's not at all a simple derivative."

– Mark Jenks, vice president of 787 development

WORKING ON A DREAM: ***THE 787***



BOEING FABRICATION AND **THE 787-9***

Composite Manufacturing Center, Frederickson, Wash.: Vertical fin

Advanced Developmental Composites, Tukwila, Wash.: Advanced door surrounds; horizontal stabilizer; composite floor beams; hybrid laminar flow control

Integrated AeroStructures, Auburn, Wash.: Lower spar web; tubes and seals

Auburn Tooling Services, Auburn: Tool design and fabrication

Tube, Duct and Reservoir Center, Auburn: Shipside support; hybrid laminar flow control chemical processing

Advanced Metals Structures, Auburn: Tail cone; hybrid laminar flow control

Interiors Responsibility Center, Everett, Wash.: Floor coverings; partitions; closets; stow bins; crew rests

Electrical Systems Responsibility Center, Everett: Emergency lighting system; wire bundles

Boeing Portland, Ore.: Engine mounts; side-of-body chords

Boeing Helena, Mont.: Side-of-body chords

Boeing Salt Lake, Utah: Vertical fin; horizontal stabilizer assembly; flight-deck structures

Boeing Canada Winnipeg: Main landing gear door; wing-to-body fairings; vertical-fin fairings; aft-engine pylon fairings

Boeing Aerostructures Australia: Movable trailing edge; aileron; flaperon; inboard flap; outboard flap

**Not all the work done by Boeing Fabrication for the 787-9 is listed here.*

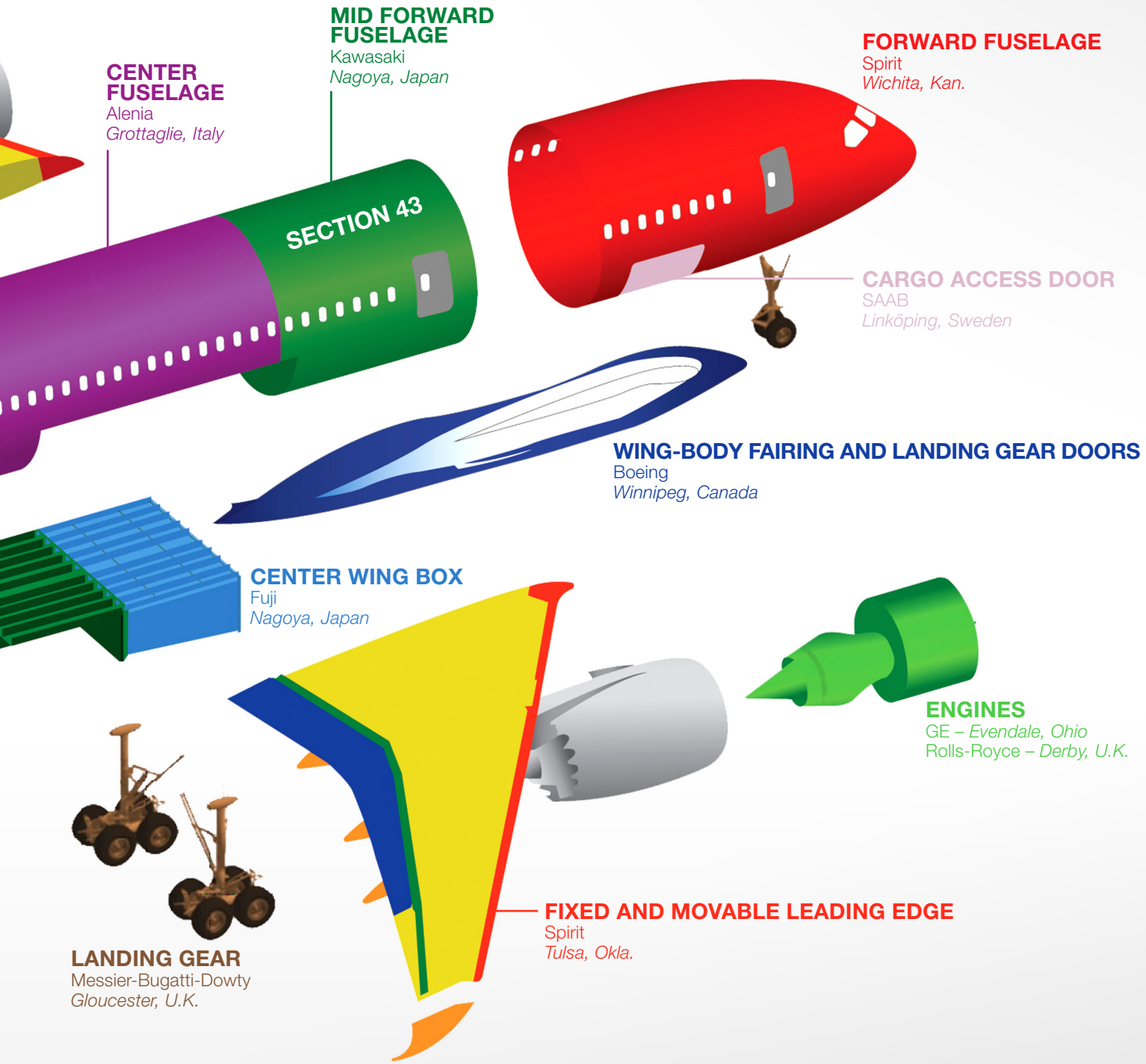
BY THE NUMBERS: KEY DIFFERENCES BETWEEN 787-9 AND 787-8

20
feet (6 meters) longer than the 787-8. Sections 43 and 46 are each 10 feet (3 meters) longer than on the 787-8

40
more passengers than on the 787-8, depending on cabin configuration

8,500
nautical miles (9,780 miles, or 15,700 kilometers) range

300
nautical miles (350 miles, or 550 kilometers) more range than the 787-8



The 787-9 relies on the support of the global supply chain established for the 787-8, with previously announced changes in the partners who supply the horizontal stabilizer. The above graphic is for illustration purposes only and is not to scale.

> “It’s a pretty cool feeling,” coming to work one day and seeing the wings on the fuselage.
>
> – Phil Vergara, a 787 mechanic who was part of the team that joined the 787-9 wings to the fuselage

helps mechanics with their paperwork and other requirements during assembly.

"Mechanics have learned from experience, and the transition time has been much faster than we expected," she said. "It's been really smooth. I was kind of surprised because with something new, you never know."

Phil Vergara, a lead for the team that joins the 787-9 wings and body during final assembly, said about 50 percent of his crew transitioned over from the 787-8.

"We took a lot of experienced mechanics from the dash-8 and formed a new team for the dash-9," he said, adding that final assembly for the 787-9 has been "amazing."

"We used a lot of processes and technologies from the dash-8 and, most important, lessons learned," he said.

When Vergara was interviewed for this story in mid-June, the first 787-9 was in final assembly position 2, with the wings and body already joined. Just as seeing the landing gear on the 787-9 for the first time was a highlight for Bruce Kaufman and his team, it was a big day for Vergara and his teammates when the first 787-9 had wings.

"It's a tremendous sense of accomplishment, when you come in here every day," Vergara said. "Then one day you come to work and you see the fuselage sitting there and the wings off to the side, and you know by the end of the day when you go home the wings will be attached, and you were a part of that. It's a pretty cool feeling."

Daniel Mizumori, a shipside support manager for the 787-9, summed up what has been a successful and seamless transition to the 787-9 this way: "We have an experienced team that grew with the dash-8."

Jenks and other program leaders stress that the 787-8 is a great airplane, and with production ramping up, the company could not afford to have any disruptions caused by the 787-9. It had to be right the first time.

"Clearly we were going to do better, no question," Jenks said. "But the team set the bar high from the start. We emphasized continually that we needed an extremely smooth introduction of the 787-9 into final assembly. It had to be very clean. The entire team rallied around that idea."

A huge amount of preparation and planning went into getting ready for the 787-9, he said. Boeing spent a couple of years "digging down" into the details of what is done in final assembly, Jenks said.

"We have an unprecedented level of understanding of all our factories, dozens of sites around the world that are making parts for the airplane," he said. "That's what it takes."

That relentless focus on execution continues to pay off. The first major assembly, from Boeing Fabrication, was delivered to final assembly in Everett some three weeks early, and the start of final assembly came on schedule at the end of May.

What makes the job the entire 787-9 team has done even more impressive, Jenks said, is that this isn't a typical derivative airplane.

"There is a tremendous amount of technology in the airplane, a lot of changes," Jenks said. "It's not at all a simple derivative."

For competitive reasons, Boeing won't publicly discuss in detail many of the changes in the 787-9. But the benefits include better performance and lower production costs in some cases.

"We have made significant improvements," said Ed Petkus, director and deputy chief project engineer of the 787-9 and 787-10.

For example, he noted that the horizontal stabilizer on the 787-9 is a two-piece composite structure rather than three pieces on the 787-8. This simplifies manufacturing and assembly—efficiency gains that translate into lower costs and faster production.

Also, the flight-deck window frame on the 787-9 is a one-piece aluminum structure. On the 787-8, it was built up from a number of titanium pieces. The improvement, which is being rolled into 787-8 production, saves weight and costs.

And engine-makers Rolls-Royce and

PHOTOS: (Clockwise from top) The first 787-9 in final assembly in the Everett, Wash., factory; the tail section of the 787-9 features cutting-edge technology to reduce fuel burn; Daniel Mizumori, shipside support manager for the 787-9; mechanic Marcel Lagua works on the 787-9 main landing gear during final assembly; Monica Elizondo; mechanic Phil Vergara of the 787-9 wing body join team. BOB FERGUSON/BOEING

> "It will be neat to see it out on the runway and think, Wow! I had a part in that."
>
> – Bruce Kaufman, a 787 mechanic who helped install 787-9 main landing gear

General Electric are improving their engine offerings, Petkus said. These advanced engines will be brought over to the 787-8 as well.

Like Jenks, Petkus has been on the 787 program from the start, when he and about 40 others were "locked" in a room for a 90-day study of what became known as the Dreamliner.

"The airplane we have built, which we will deliver next year, is what we envisioned back then," Petkus said of the 787-9. "We set out to learn all those lessons and do it right. And the entire team is doing just that." ■

james.a.wallace4@boeing.com

Click here to view a photo gallery of the 787-9's first flight, from before takeoff at Paine Field in Everett, Wash., through landing at Boeing Field in Seattle.

PHOTOS: (Clockwise from top left) The 787-9 is readied for its first flight; the airplane departs from Paine Field in Everett, Wash., on its first flight; the 787-9 is reflected in rainwater after landing at Boeing Field near Seattle after first flight. **BOB FERGUSON/BOEING** The 787-9 rolls out of the factory in late August. **COLLEEN PFEILSCHIEFTER/BOEING**

A PERFECT '10'

Super efficiency will be star attraction of the 787-10 Dreamliner

As director and deputy chief project engineer of the 787-9 and 787-10, Ed Petkus has had many opportunities to meet with airline customers to talk about what will be the third and longest member of the Dreamliner family—the 787-10.

One of the key charts Boeing uses in those meetings to compare jetliner fuel efficiency shows "block fuel per seat," or the amount of fuel burned per seat from when the engines are started after push-back from an airport gate until they are shut off upon arrival at the destination.

The 787-10 will burn about 25 percent less block fuel per seat than the Airbus A330-300 flying the same mission, according to Petkus.

"All you have to do is show that chart to an airline CEO and they want to know how soon they can get the airplane," Petkus said of the 787-10.

That would be 2018, which is when the first customer deliveries are scheduled.

While the 787-9 includes a number of innovations and changes from the 787-8, commonality is the name of the game with the 787-10, which essentially is a straightforward stretch of the 787-9.

"By keeping the design of the 787-10 as common as we can with the 787-9, we will leverage all we've learned with the 787-9 and drive even more efficiencies into the production system," explained Mark Jenks, vice president of 787 development.

The 787-10 will be 38 feet (11.6 meters) longer than the 787-8 and 18 feet (5.5 meters) longer than the 787-9. That extra length means the 787-10 will seat from about 300 to 330 passengers, depending on how an airline configures the cabin. In a typical three-class configuration, the 787-10 will seat about 81 more passengers than the 787-8, according to Boeing.

United Airlines, which has committed to ordering 20 of the planes, has said its 787-10s will carry about 100 more passengers than its 787-8s, which are configured with 219 seats.

To hold changes to a minimum, Boeing did not increase the maximum

takeoff weight on the 787-10 from that of the 787-9. The 787-10 will fly about 7,000 nautical miles (8,100 miles, or 13,000 kilometers), or about 1,500 nautical miles (1,700 miles, or 2,778 kilometers) less than the 787-9.

"Our customers asked us to optimize the 787-10 for efficiency and versatility," explained Petkus. "By not chasing extra range, the 787-10 will have the best operating economics in the industry."

Boeing has studied all the routes airlines are flying today with twin-aisle planes, and the 787-10 will do more than 90 percent of those, Petkus said.

Boeing officially launched the 787-10 at the Paris Air Show in June, with 102 order commitments from British Airways, Singapore Airlines, United, Air Lease Corp. and GECAS. Industry analysts said such an unusually large initial launch order for an airplane signaled the market is keen for the jetliner.

> "The 787-10 will be one of the most powerful widebody aircraft for decades ahead."
> – Steven Udvar-Házy, chairman and CEO of Air Lease

The 787-10 also received a ringing endorsement at this year's Paris Air Show from Steven Udvar-Házy, one of the industry's most knowledgeable and respected leaders and the chairman and chief executive officer of Air Lease Corp., which has 30 of the 787-10 on order for delivery.

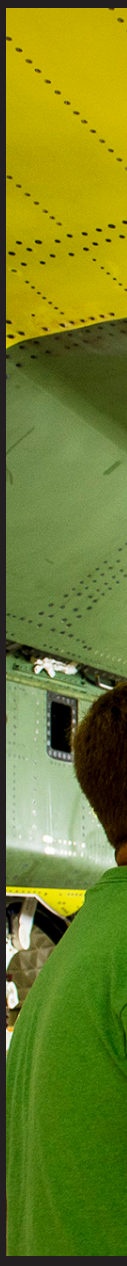
"The 787-10 will be one of the most powerful widebody aircraft for decades ahead," Udvar-Házy told reporters at the air show.

Petkus points out that when the 787 program was launched, fuel was about a quarter of an airline's operating costs. It's now more than half.

That's a pretty compelling case for the super-efficient 787-10—and the other two members of the Dreamliner family. ■

– James Wallace

GRAPHIC: An artist's concept of the 787-10, which will be 38 feet (11.6 meters) longer than the 787-8. BOEING



"The LEDs have a much better lighting pattern."

– Brad Telford, Energy and Conservation specialist

Light touch

New LED lighting is saving money and energy—and employees love it

By Bill Seil

After energy-efficient lighting was installed in Boeing's Integrated Aircraft Systems Laboratory in Seattle, the Shared Services specialist in charge of the project heard some surprising comments from employees as they adapted to the brighter glow.

The LED (light-emitting diode) lights were installed in the high bay of the facility, after the building's Green Team—a group of employee volunteers interested in their workplace environment—requested a more energy-efficient approach to lighting the building, said Brad Telford, Energy and Conservation specialist.

"After the LEDs were switched on, I asked an employee, 'How do you like your new lights?'" Telford recalled. "He told me, 'It's great! I don't need a flashlight to see my drawings anymore.'"

Another employee, who was using a table saw to build temporary wood structures, said he "absolutely loved" the new-technology lighting because it allowed him to better judge the motion of the saw blade.

Telford explained that the LED lights operate with improved light quality over the lights they replaced.

New LED lighting is part of the company's overall effort to use the latest

technology to improve its infrastructure, according to Keith Warner, Shared Services' senior manager of Environmental and Utilities Services. The switch is also helping Boeing to continue reducing its energy use. From 2007 to 2012, Boeing saw its energy consumption decrease by 3 percent and is now focused on carbon neutral growth for its operations over the next five years, Warner said.

In general, LEDs last two to four times longer and are 50 to 60 percent more energy-efficient than a standard halogen bulb, Warner said.

And even though LED lights may cost more to install, they last much longer, which means fewer replacement change-outs are needed. And when the lights are on a tall factory ceiling, that's a big benefit for maintenance personnel.

Before LEDs, "all the light was coming straight down from the ceiling," Warner said. "It didn't scatter well and there were some very dark corners. The LEDs have a much better lighting pattern."

As another benefit, the LED lighting gives the appearance of being closer to daylight than other forms of artificial lighting.

"It is more consistently bright," Telford said of LED lighting. "It's a bluer color that we see as white. And they spread the light out more evenly across the floor."

LED lighting also was recently installed in two production bays of the C-17 Globemaster III assembly line in Long Beach,

PHOTOS: (Opposite page, clockwise from left) Maintenance electrician Darrell Hill (center), assisted by co-worker Robert Lisk, installs a new LED (light-emitting diode) light bulb in Seattle's Integrated Aircraft Systems Laboratory, or IASL; Brent Symens, a test mechanic at the IASL hydraulics lab, said the LED lights are an improvement; an LED light shines brightly from the ceiling of the IASL in Seattle. **MARIAN LOCKHART/BOEING** (This page) LED floor lights illuminate the underside of an F-15 wing in St. Louis for Cody Morgan, left, and his manager, Bobby Deadmond. **RON BOOKOUT/BOEING**

Calif. The improvements have been popular with employees, according to John Rainwaters, a manufacturing analyst with the C-17 program, which now is developing plans to install LED lighting in three remaining production bays.

"You could see the difference from quite a distance when you walked into the building," Rainwaters said.

In St. Louis, in response to a request from employees, management replaced fluorescent lights in wing stands with LED lighting. The stands are positioned to get better lighting beneath the wings and on other areas of the airplane. Employees are enthusiastic about the improvement, said Bobby Deadmond, manager of F-15 final assembly. And the lights are expected to last approximately 10 years—not six months, which is the case with the fluorescents, he explained. They also use 50 percent less electricity.

"With a life of 10 years, that's 20 times a maintenance guy doesn't have to come over, take the lens off and change the bulbs out," Deadmond said. "Plus, when you switch them on, they come on immediately. And you get a lot more light, with fewer shadows. It's just a totally different lighting experience."

In a pilot project, Boeing recently replaced lights in a small Huntsville, Ala., employee parking lot with new LED lights. While the old lighting appeared a greenish yellow, the new lights are much crisper, blue-white in color and more effective in lighting the area, Warner said. The results encouraged Huntsville Site Services to proceed with a project to replace all remaining parking lot and roadway lighting with LEDs.

> "With a life of 10 years, that's 20 times a maintenance guy doesn't have to come over, take the lens off and change the bulbs out."
>
> – Bobby Deadmond, manager of F-15 final assembly

So far, Boeing has focused on installing LED lighting in large areas, such as factories and parking lots. While there has been some use of LED in office buildings, Warner said there is no rush to replace existing, already highly efficient fluorescent lights.

"The technology behind the large LED fixtures for industrial areas is more mature," he said, "so that's where we're focusing our attention right now."

Warner noted, however, that the company recently installed LED lighting during the renovation of an office building near Boeing Field in Seattle. That pilot project has been working out well. LED has replaced fluorescent lighting in some other areas, too.

In some cases, LED lighting projects are financed with the support of local electric utilities through their energy conservation programs. For example, the LED lighting installation at Boeing's Integrated Aircraft Systems Laboratory was done in partnership with Seattle City Light, Telford said.

The employee Green Team that asked for more-efficient lighting in that project, which was completed last year, also requested that lighting in the high-bay area be divided into zones. So instead of having one switch to light all high-bay areas, various laboratory areas would have control over their own lighting. That way it would not be necessary to light the entire facility to serve isolated testing that operated overnight.

"Shifting over to LED was an exciting experience," Telford said. "It is cutting-edge technology and there's always a little risk in doing something new. But it has proved to be very successful." ■

william.j.seil@boeing.com

PHOTO: John Rainwaters, a manufacturing analyst with the C-17 program in Long Beach, Calif., says the new LED lights cast a noticeable difference. **PAUL PINNER/BOEING**

Macon it happen

Employees at this Boeing site in Georgia play vital role producing military aircraft parts

By Vineta Plume

In the two years that Jared Dillon has been working for Boeing in Macon, Ga., one day still stands out. It's the day he joined the H-47 Chinook team.

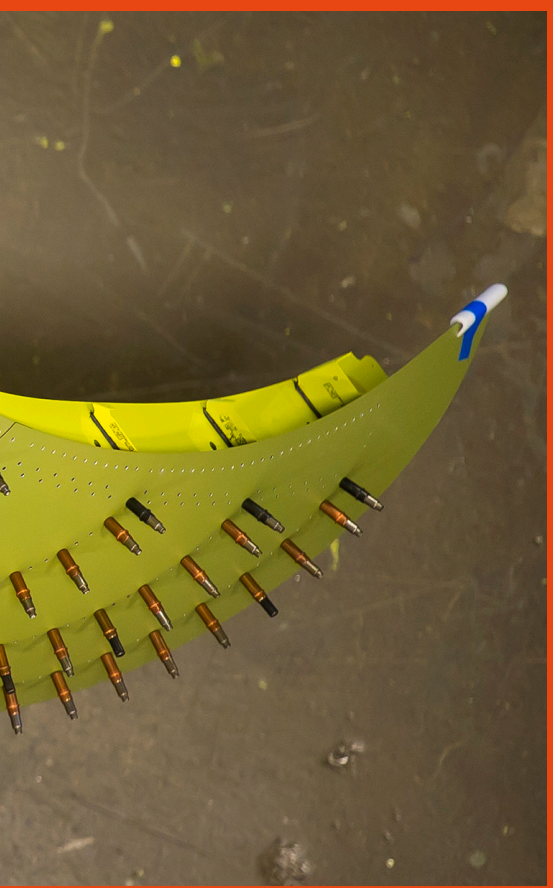
"It felt like I found my home," he said.

Dillon builds engine cowlings—doors that cover an engine, similar to the hood of a car—for the Chinook military helicopter. He works mostly by hand, laying out patterns, cutting, sanding, fitting, trimming. Like many of the mechanics at this site, Dillon came up through Quick Start, an intensive two- to three-month training program that teaches Boeing standards. Working first in another area on the site's shop floor, he was selected to join the Chinook team, where being mechanically inclined and good with his hands helped him catch on quickly to the

PHOTO: Boeing Macon's Derick Moore, a sheet metal mechanic.
BOB FERGUSON/BOEING

“Beyond These Doors Is a Winning Team.”

– Message stenciled above the entryway of Boeing Macon’s main facility



level of detail and hand craftsmanship required for the job.

"We got this special bond," he said of his teammates and the ease with which they joke around with one another. "This is my family. I could just tell I found my family."

Located some 80 miles (130 kilometers) south of Atlanta, positioned square in the center of the state, Macon truly is the "heart of Georgia," where tea is served sweet, the humidity can stick like sugar, and a perfect day might be one spent fishing for crappie, the favored catch, or getting together with family and friends.

Away from the major thoroughfares, hotel chains and shopping malls, tucked along a two-lane road that bisects intermittent stretches of pine-filled woods and grassy fields, lies Boeing Macon. Its two buildings are just a few miles apart, the short drive slowed only by a lone railroad track crossing. Stenciled letters along the glass windows framing the main building's entryway state what its many awards throughout the years confirm: "Beyond These Doors Is a Winning Team."

Whether on the shop floor or in a supporting role, the employees of "Team Macon" play a vital role in pumping out parts large and small for Boeing products that support military and humanitarian missions around the world.

Visitors typically won't find completed aircraft here, other than those seen in the pictures and posters that pepper the walls of common areas or that are flown in by the military on special occasions. That's because Boeing Macon is a place for sub-assembly work, where parts for the Boeing-built C-17 Globemaster III airlifter and H-47 Chinook, as well as for the A-10 Thunderbolt, leave the facility at a steady pulse on 18-wheel trucks bound for sites such as Long Beach, Calif., Ridley Township, Pa., St. Claire, Ill., and Hill Air Force Base, Utah.

Completed products for the Chinook leave the site every four days.

Some 500 employees work at Boeing Macon, with roughly 300 of them at Building 1, where larger parts for the three aircraft are assembled. Twenty-five years ago, this was the only building in a site first started by Boeing heritage company McDonnell Douglas.

Ed Raines was among the first few classes of production mechanics hired back then to build flaps for the C-17, parts of the aircraft wing that extend to provide extra lift for takeoff and landings. At the time, he was in the U.S. Air Force and engaged to his high school sweetheart, who was, he said, determined to find him a job—she even put in his application. The rest happened quickly: He left the Air Force in April, married in May, began a training course in October and by December was on the shop floor, ready to start work.

The space was just an empty facility then.

"We had to paint the floor until the tools came in," Raines recalled. Now a production manager on the Chinook program, Raines, along with about a dozen colleagues who still work at Boeing Macon, helped shape the site into what it is today. In the familiar, fond manner of friends who have grown up together, who have watched one another marry, have children and watched those children graduate, colleagues still joke about the early days and how many times they must have mopped that wide open floor—all in anticipation for the first tools to arrive.

Added Renee Copeland, hired into Business Planning and Management in October 1998 and now in Finance: "There was nobody here to hold our hand … We just had an incredible team of people, everybody trying to make it work. We didn't want to let anybody down. We didn't want to let the customer down."

The experience taught Raines and his teammates some valuable lessons about resilience and working together.

"Flaps used to be labeled the toughest area in the facility," said Raines, referring to the many quality issues they had to overcome. "It was a lot of titanium, a lot of

PHOTOS: (Top, from left) Jessica Powell, C-17 sheet metal mechanic; A-10 sheet metal mechanics Algrin Bell, left, and Hope Sirman; Ed Raines, Chinook production manager; Satish Erramelli, Chinook quality inspector. (Center) Sheet metal mechanic Jeff York prepares the skin of a Chinook tail cone assembly for final installation. (Bottom) A view of Boeing Macon's main facility, where major parts are assembled for the H-47 Chinook, the C-17 Globemaster III and the A-10 Thunderbolt. **BOB FERGUSON/BOEING**

process drilling and angles. It took a lot of time, but the team in flaps stayed through it all, and now it's one of the best-running areas in the facility."

Today, Macon produces a large number of C-17 assemblies including wing components and doors. And the teaming concept embedded in the site's footprint still is evident throughout the shop floor. Last year, for example, the C-17 Fixed Leading Edge Subassemblies team was awarded a regional John Van Gels Award, which recognizes significant contributions to Defense, Space & Security as a result of close collaboration between teams and their management. (Boeing last month announced it will continue production on the C-17 through 2015. Although the company will close its final assembly facility in Long Beach, Calif., it will continue to support and modernize the global fleet.)

Recently, the Macon A-10 team overcame major production challenges in building replacement wing sets for the Global Services & Support A-10 Thunderbolt program. The combat aircraft, known as the "Warthog," provides close air support to ground troops in battle. The new center wing sets will allow the A-10 fleet to operate through 2035, according to the U.S. Air Force.

Allan Treen came to Macon from Canada 24 years ago when the site supported the MD-80 commercial jetliner program. Now an engineer on the A-10, he described it as a far tougher assembly than what Team Macon had ever experienced, due to the challenges of upgrading a military airframe built decades ago by a company no longer in business. (The A-10 was developed in the early 1970s by Fairchild-Republic.)

"We had to rely on some of our best mechanics here, and we had to rely on a lot of outside help," Treen said, referring to the "One Boeing" effort of Team Macon—along with Defense, Space & Security partners across the company and even Commercial Airplanes—to turn things around.

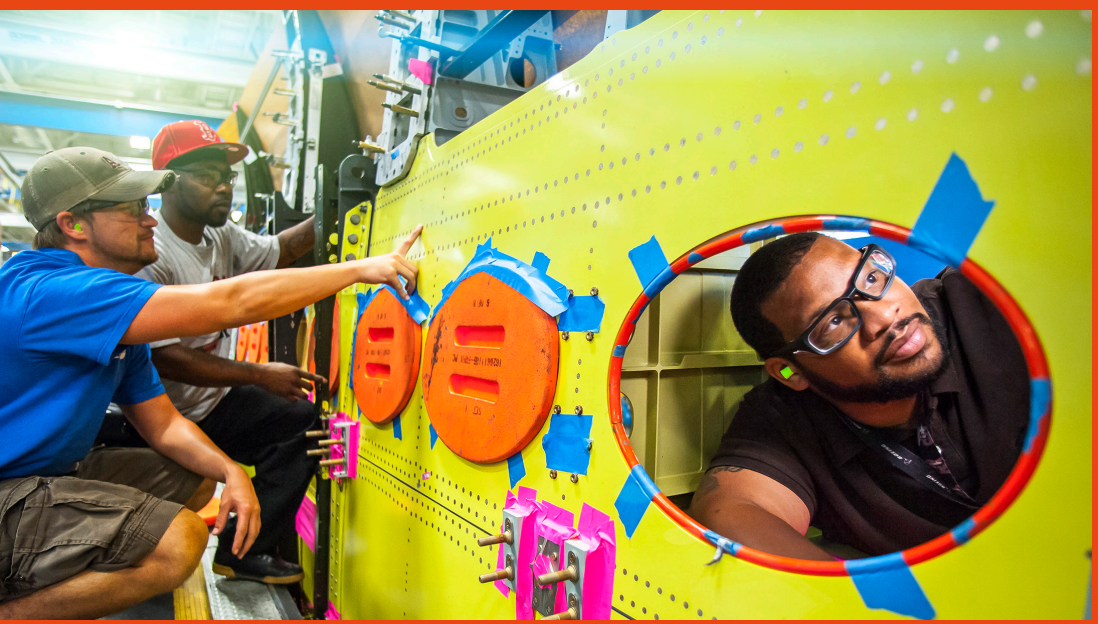
Earlier this year, the Macon A-10 team reported it not only met 2012 contract deliveries but was exceeding 2013 targets by four deliveries. This performance has not gone unnoticed. The U.S. Air Force recently awarded Global Services & Support a $212 million A-10 contract to upgrade an additional 56 wings. The work will be done in Macon.

Richard "Holden" Vickers joined Boeing Macon's A-10 program two years ago. He builds the aircraft's torque box, like a skeleton, and loads the wing skins, which are then drilled by machine. What he likes most about the Macon site is the friendly atmosphere.

"Everybody looks out for everybody, everybody knows everybody," he said.

In his short time here, Vickers has learned that success comes from trusting one's teammates and not being afraid

PHOTOS: (Left) Shelby Smith, Chinook sheet metal mechanic. (Opposite page, clockwise from top left) A-10 sheet metal mechanics Jeffrey Fowler, from left, and Rod Rutherford, with A-10 quality inspector Aaron Rutherford; Brian Eis, C-17 production team leader; Hank Copeland, left, C-17 sheet metal mechanic, with Boeing Military Aircraft's Bryan Scott, director of quality for the St. Louis and Macon sites; C-17 sheet metal mechanics Ty Bennett, left, and Kristine Huff pause from assembling boxes that will store life rafts on the C-17; Tashia Butts, C-17 sheet metal mechanic; Debra Crites, A-10 sheet metal mechanic. **BOB FERGUSON/BOEING**



“It felt like I found my home. We got this special bond.... I could just tell I found my family.”

– Jared Dillon, Chinook sheet metal mechanic

“Quality means you do it right the first time. And you try to do it as close to perfect as you can. … You do it so people can count on you.”

– Richard “Holden” Vickers, A-10 sheet metal mechanic

to ask questions. His goal is to move into planning or Quality, which for him is personal.

“Quality means you do it right the first time. And you try to do it as close to perfect as you can. You do it so that you don’t have to later on, when it gets to a harder area. You do it so people can count on you.”

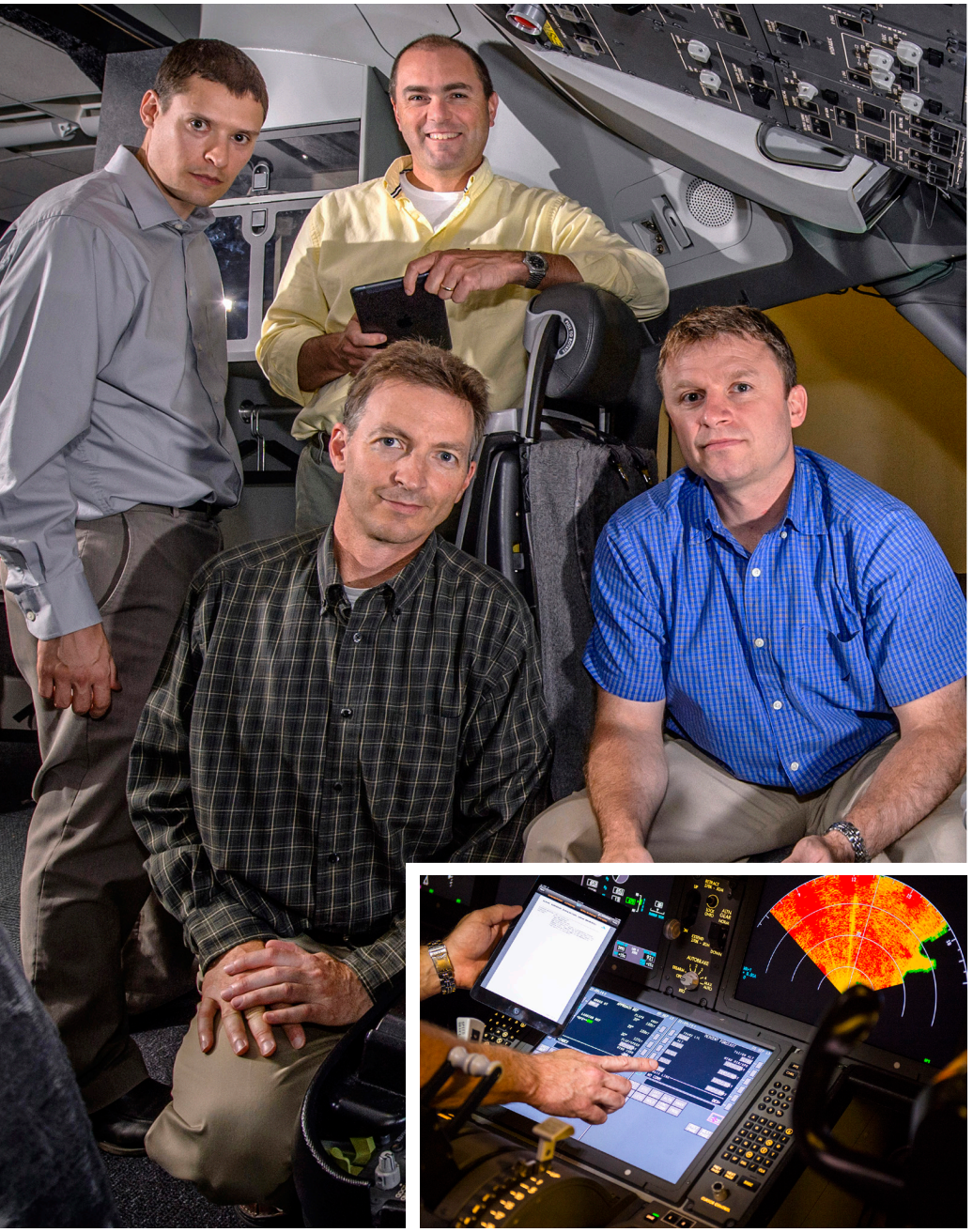
Another thing Vickers is counting on is the site’s continued success.

“Macon has a lot more years to keep going and striving to be the best,” he said of wanting to see more work for the site. “We deserve it. As far as we came on the A-10—we had a lot of stuff to overcome—seeing us as a team grow and progress to where we are now, I think it’s more than enough to show that, Hey, Macon has pride. And they’re going to do what they have to do to get it done.” ■

vineta.z.plume@boeing.com

PHOTOS: (Right) In spring, the U.S. Air Force brought a CH-47F Chinook built by Macon employees to the Boeing site in Georgia, where employees enjoyed a rare, up-close look at the aircraft. (Top, from left) Tommy Brown, foreground, Chinook project manager, with C-17 sheet metal mechanic Edwin Callazo, from left, and the Chinook team’s Satish Erramelli and Ed Raines. KEN KRAKOW/BOEING A row of A-10 Thunderbolt IIs from across the U.S. Air Force, shown at Gowen Air National Guard Base, Idaho. The Air Force recently awarded Boeing a $212 million contract to upgrade an additional 56 wings for the aircraft. U.S. AIR FORCE A C-17 Globemaster III, shown during a recent training exercise at Joint Base Charleston, S.C. Macon produces a large number of C-17 assemblies. U.S. AIR FORCE

BRINGING **IDEAS** TO LIFE



PHOTOS: (Above) Ryan Hale (clockwise from top left), Greg Saccone, Louis Bailey and Sean Walden invented the Boeing Wind Updates service (inset photo), which helps airlines improve fuel efficiency by sending tailored wind and temperature updates to operations centers, as well as the flight decks of in-transit airplanes. MARIAN LOCKHART/BOEING

Developing, replicating inventions helps make Boeing stronger and more competitive

By Kathrine K. Beck and Candace Barron

For any Boeing employee, the progression of inspiration to invention can happen anytime, anywhere. The most important part, most will tell you, is making sure to write it down quick.

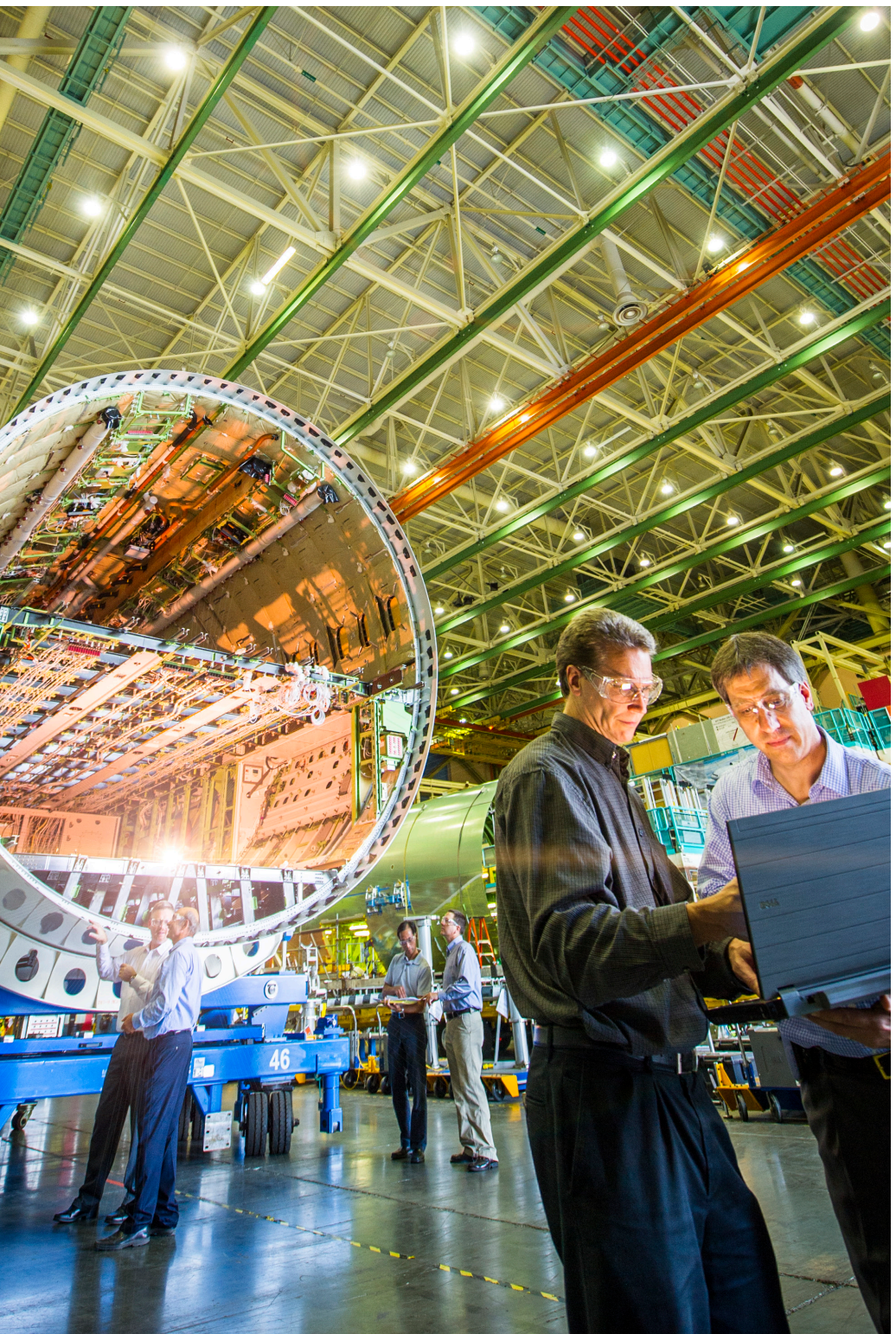
And that's how Louis Bailey took a game-changing concept from a paper napkin to market in 20 months.

Bailey, a technical lead engineer for Airspace and Operational Efficiency in Boeing Research & Technology, was having lunch with his counterpart from KLM Royal Dutch Airlines at Amsterdam's Schiphol airport when he doodled a concept that would provide airlines with tailored wind and temperature updates to help improve fuel efficiency.

"Inventing on a napkin sounds like a classic movie cliché, but an idea hits you when it hits you," Bailey recounted about his idea, which resulted in a trade secret and seven patents. "It's improving travel by making arrival times more reliable and helping the environment by reducing fuel burn and emissions."

Within six months of its inception, Bailey and co-inventors Sean Walden, Ryan Hale and Greg Saccone had developed the prototype for dynamic weather updates. Operational development with simulator and flight testing with KLM took another 14 months. This concept led to a change in operational philosophy now being adopted by airlines worldwide.

Today, Wind Updates is a paid service offering from Boeing Commercial



Airplanes, delivering up-to-the-minute forecasts to both Boeing and Airbus airplanes that include *in situ* weather data collected in flight. The current—and therefore more accurate—weather information improves situational awareness for better pilot decisions.

This month, Bailey's invention, along with 21 other technology advancements, will be honored with Boeing's annual enterprisewide prizes for innovation, the Special Invention Award or Technical Replication Award. The honors will be presented at a gala ceremony held at Seattle's Museum of Flight.

"Each of us has our own formula for what provides personal fulfillment," said Boeing Chief Technology Officer John Tracy, senior vice president of Engineering, Operations & Technology, which sponsors the awards.

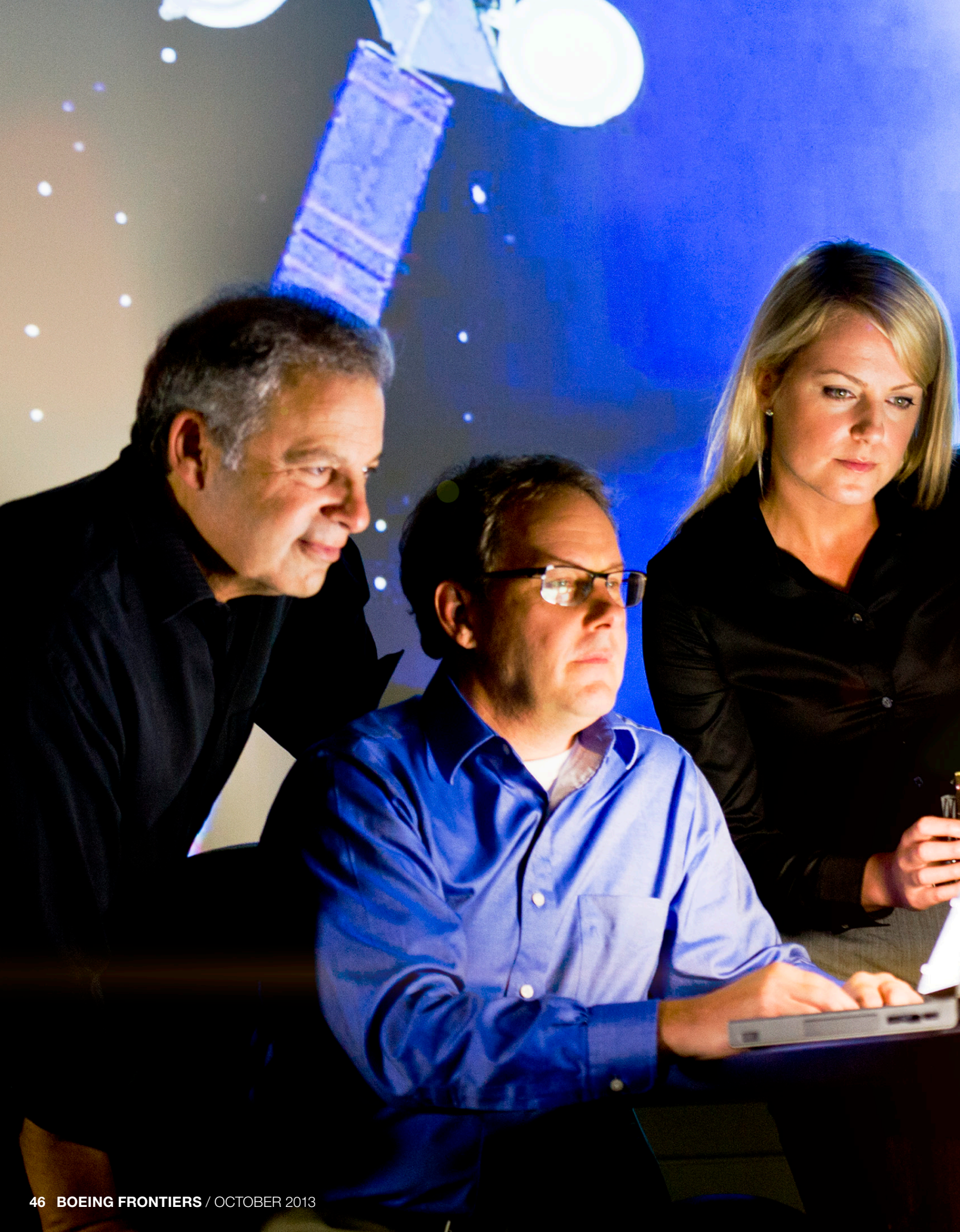
"For the people of Boeing," he added, "much of their fulfillment comes through developing awe-inspiring ideas that make the impossible possible—and through replicating these ideas, to help solve others' hardest problems."

Each year, Boeing uses a formal review process to determine Technical Replication honors among nominations by Enterprise Technology Strategy executives. Special Invention winners are also chosen using a formal review process, but from among nominations submitted by employees and endorsed by senior executives.

These awards recognize employees and teams whose ideas are deemed to have played an integral part in devising an innovative way to help make Boeing a stronger company. Some of the criteria include innovation, degree of implementation, business value to Boeing and to customers, and the invention's external licensing value.

But one of this year's winners is strictly for internal use because it gives Boeing such a competitive edge. It's parametric modeling software that saves hundreds of engineering hours and has other advanced capabilities. Its quirky acronym was also purposefully creative—General

PHOTOS: (Top) Tuan Nguyen, left, and Lee Firth look at stanchions that support the cargo floor of the 787 Dreamliner. (Left) Around stanchions at 787 final assembly in Everett, Wash., are Kevin Davis (from left), Mostafa Rassaian, Nguyen, Firth, William Koch and Thomas Baxter. **BOB FERGUSON/BOEING**



"For the people of Boeing, much of their fulfillment comes through developing awe-inspiring ideas that make the impossible possible."

– John Tracy, Boeing chief technology officer, and senior vice president, Engineering, Operations & Technology

Environment for Optimization and Development Using a Common Kernel, or GEODUCK, the name of a giant clam native to U.S. Northwest waters.

"To put it very simply, it allows you to generate and process geometry. It does a lot of math and enables multidisciplinary design optimization," said Jan Vandenbrande, senior manager of Geometry and Optimization with Boeing Research & Technology.

GEODUCK (pronounced "gooey duck") is used by engineering, marketing, support, production and test organizations across Boeing. Through an innovative standard process of testing and releasing new add-ins, GEODUCK also allows users to share and reuse one another's models.

Another winning innovation used shared skills and resources from across the enterprise to enable Boeing to take the next big leap in aerospace—to build a mostly composite airplane that uses less fuel and offers passengers an outstanding flying experience.

The invention was the energy-absorbing structure for composite materials that provides increased safety for passengers. This novel technology required close cooperation by members of the Boeing Technical Fellowship and other talents from Boeing Defense, Space & Security, Boeing Commercial Airplanes, and Engineering, Operations & Technology.

One aspect of the innovation is the use of crush zones composed of composite stanchions. The stanchions support the cargo floor of the aircraft, so that it can function as an energy absorber for the aircraft. This capability greatly reduces the acceleration levels experienced by the passengers in the cabin area, thus protecting them from possible injury.

Another winning idea focused on what has been a difficult problem to solve—how to dramatically cut the cost of a rocket launch to meet the challenge of providing low-cost access to space. Boeing's solution? A way to offer two launches for the price of one.

Senior Technical Fellow Glenn Caplin, Systems engineer Anna Tomzynska and Technical Fellow Richard Aston, all from Defense, Space & Security, share a pending patent for their concept of launching two or more all-electric propulsion spacecraft on one launch vehicle. This eliminates the need for an inner fairing structure and a fairing separation system. That benefit, coupled with the fact that an all-electric satellite is half the mass of a conventional chemical-propulsion satellite, means more revenue-generating payload can be accommodated.

Their 2013 Special Invention Award is a special thrill for Tomzynska, who has been dreaming about space since childhood. Her work is very much part of the progress toward making space accessible to all. And it's brought business value along with it.

"When we were awarded a contract for an eight-satellite deal, the *L.A. Times* said it would provide a $1 billion boost to the Southern California aerospace industry," Tomzynska said. ■

kathrine.k.beck@boeing.com
candace.k.barron@boeing.com

Employees can find a list of the 2013 Special Invention and Technical Replication awards winners on the Boeing intranet: http://ipm.web.boeing.com/2013_SIA_TRA_Brochure.pdf

PHOTO: Glenn Caplin (from left), Richard Aston and Anna Tomzynska devised a more efficient way to launch multiple all-electric spacecraft on one vehicle. PAUL PINNER/BOEING

GOING *THE DISTANCE*

Angola Airlines expands its fleet and service with new 777s and 737s

By Dan Mosely

Nov. 11 is a special day in Angola—the anniversary of its independence from Portugal. The date also has special significance for the growth of commercial aviation in this southern African nation.

On that day in 2006, Angola's flag carrier, TAAG Linhas Aéreas de Angola, known as Angola Airlines, accepted a record delivery of five new airplanes from Boeing. It was the start of an ambitious fleet renewal.

Over the course of an hour, TAAG welcomed three Next-Generation 737-700s and two 777-200ER (Extended Range) jets into its fleet. The first 777 had made a delivery flight of 8,060 nautical miles (9,275 miles, or 14,900 kilometers) from Seattle to TAAG's base at Quatro de Fevereiro International Airport in the Angolan capital of Luanda. The flight lasted 16 hours 47 minutes.

Over the years, the fleet has grown to include four 737-700s, three 777-200ERs and two 777-300ERs. When the first 777-300ER was delivered to TAAG in 2011, the carrier had the distinction of being the first African airline to purchase, own and operate the model.

In April 2012, the airline announced an order for an additional three 777-300ERs.

"The Boeing 777 is recognized by airlines and passengers alike as the No. 1 choice for long-distance travel," said Joaquim Teixeira da Cunha, the airline's executive chairman. "Coupled with our short-haul fleet of modern Next-Generation 737s, it has cemented TAAG's position as the carrier of choice for travel throughout Africa and beyond."

The 777-300ER has enabled TAAG to significantly expand its route network across Asia, Europe and South America, he said. TAAG now flies to 15 international cities, including Dubai and Beijing. It has an extensive domestic and regional African network, with more than 20 destinations served by 737s.

The airline was founded in 1938 to operate regional flights out of Luanda, and took delivery of its first DC-3 a decade later. After Angolan independence in 1975, TAAG acquired its first 707s and 737s and rapidly expanded into the international market. Today, TAAG operates an all-Boeing fleet of Classic and Next-Generation 737s along with 777s.

Teixeira da Cunha said the additional Boeing planes that will join the fleet will enable the carrier to take advantage of the Angolan government's recent multimillion-dollar investment in renovating, upgrading and building new airports throughout the country.

"As we prepare our airline to meet increased demand for travel to and from Angola," he said, "adding three more Boeing 777-300ERs to our current fleet of five 777s will keep us well positioned as one of Africa's leading airlines." ■

daniel.mosely@boeing.com

PHOTO: A Boeing 777-300ER (Extended Range) in the Angola Airlines livery.

BONE DRY

A U.S. Air Force B-1 bomber, right, gases up from a Boeing KC-135R tanker during a training mission over New Mexico last year. The tanker was from the 97th Air Mobility Wing at Altus Air Force Base, Okla., and the B-1 from the 7th Bomb Wing at Dyess AFB, Texas. Boeing is manufacturing a next-generation tanker based on its 767 to replace aging KC-135s operated by the U.S. Air Force. The B-1 (B-One) was designed and built by Rockwell International's aerospace operations, which joined Boeing in 1996, and is affectionately known by its aircrews as the "Bone." To download this image as a wallpaper for your computer screen, visit www.boeing.com/frontiers/downloads.

PHOTO: JIM HASELTINE/HIGH-G PRODUCTIONS


DY
124

BOEING E BRASIL.
OPORTUNIDADES INFINITAS.

A Boeing é criação e transferência de tecnologia para o Brasil.
Uma parceria que começou há 80 anos, com a chegada da aeronave F4B-4,
e nunca mais parou. Hoje a Boeing possui vários acordos e projetos
de defesa e pesquisa, inclusive com a Embraer. Parcerias que vão contribuir
para que o Brasil se consolide no topo da aviação mundial.

BOEING

www.boeing.com.br