



Frontiers

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JULY 2011 / Volume X, Issue III

Heading up

The CH-47 Chinook has a bright future and new production line

ENDURING PRINCIPLES

CONGRESS, JULY 4, 1776.
States of America

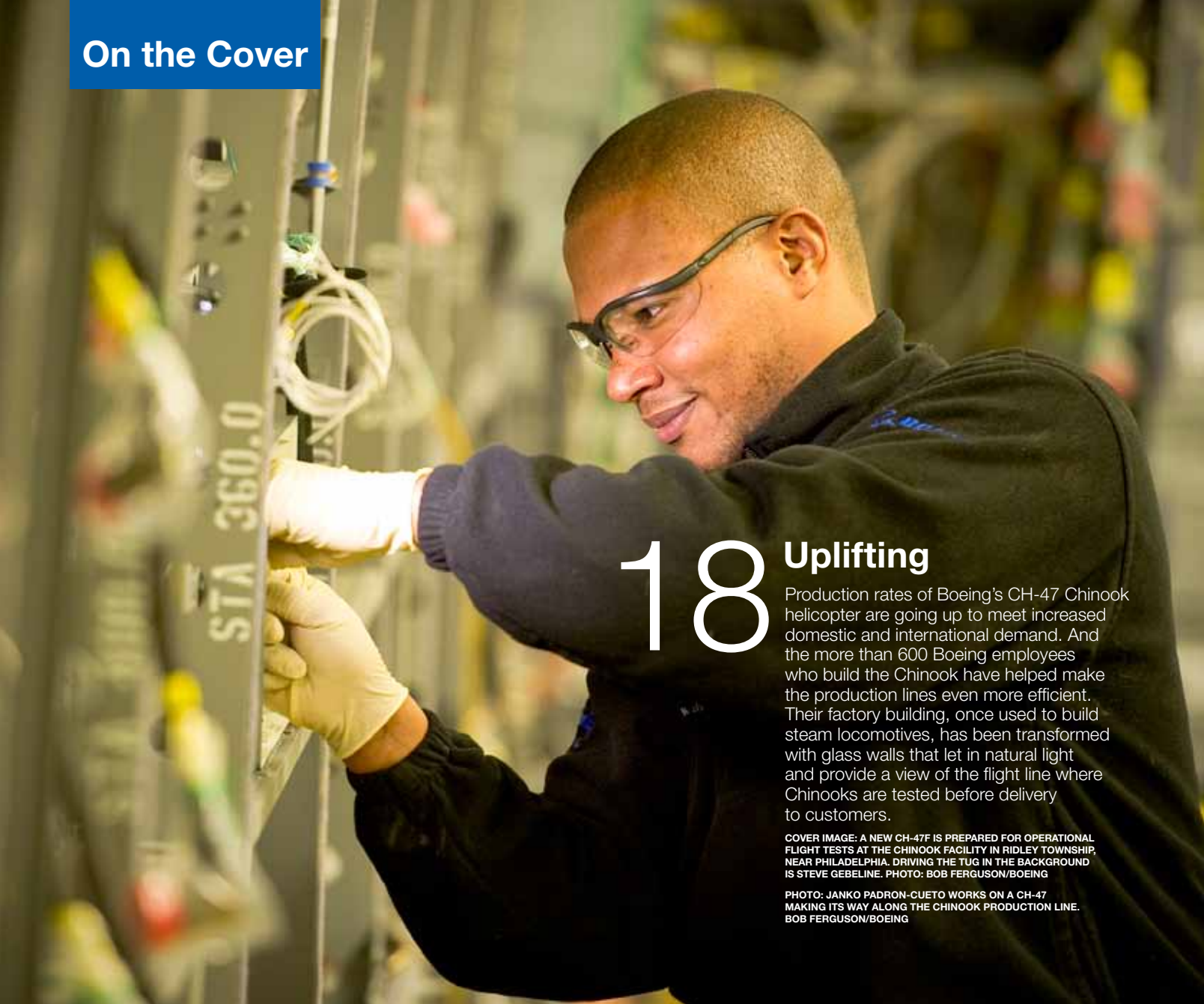
...in the course of human events it became necessary for one people to declare the political bonds which have connected us and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should lay this Declaration on the table of the world.

We hold these truths to be self-evident, that all men are created equal; that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed, that whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Liberty.

But when a long train of abuses and usurpations, without interruption, of a clear and dangerous character, has connected the States with one another, and has evinced a design to reduce them to absolute Tyranny, it is their duty to throw off such Government, and to provide new Guards for their future security. — That the United States, in Congress assembled, solemnly publish and declare, that the thirteen united States of America, are free, sovereign and independent States, that they are absolved from all allegiance to the British Crown, and that all connections therewith are hereby totally dissolved.

Today, we join all of America in celebrating the enduring principles on which our nation was founded. And proudly salute the men and women of our armed forces who defend those principles with courage and honor.





18 Uplifting

Production rates of Boeing's CH-47 Chinook helicopter are going up to meet increased domestic and international demand. And the more than 600 Boeing employees who build the Chinook have helped make the production lines even more efficient. Their factory building, once used to build steam locomotives, has been transformed with glass walls that let in natural light and provide a view of the flight line where Chinooks are tested before delivery to customers.

COVER IMAGE: A NEW CH-47F IS PREPARED FOR OPERATIONAL FLIGHT TESTS AT THE CHINOOK FACILITY IN RIDLEY TOWNSHIP, NEAR PHILADELPHIA. DRIVING THE TUG IN THE BACKGROUND IS STEVE GEBELINE. PHOTO: BOB FERGUSON/BOEING

PHOTO: JANKO PADRON-CUETO WORKS ON A CH-47 MAKING ITS WAY ALONG THE CHINOOK PRODUCTION LINE. BOB FERGUSON/BOEING

Ad watch

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

Inside cover:



As America celebrates Independence Day this month, the men and women of its armed forces continue to protect the enduring principles written in the Declaration of Independence more than two centuries ago.

This ad, featured in *The Washington Post*, celebrates those principles and salutes those who defend them.

Page 6:



Global corporate citizenship refers to the work Boeing does — both as a company and through its employees — to improve the world. This ad recognizes the life-changing advances being made by today's engineers.

Back cover:



This recruitment ad, designed to align with the Boeing UK ad campaign "Together We Fly Higher," highlights career opportunities in the United Kingdom. The ad has appeared in *Aerospace International*,

Pathfinder and *Engineering & Technology Magazine*.



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Historical Perspective

Seventy years ago, the first P-51s began rolling off the North American Aviation assembly line in Los Angeles. The fighter would soon come to be known as the Mustang and dominate the skies over Europe during World War II. The Mustang became a legend, one of the most recognized aircraft ever built, and is still performing at air shows.

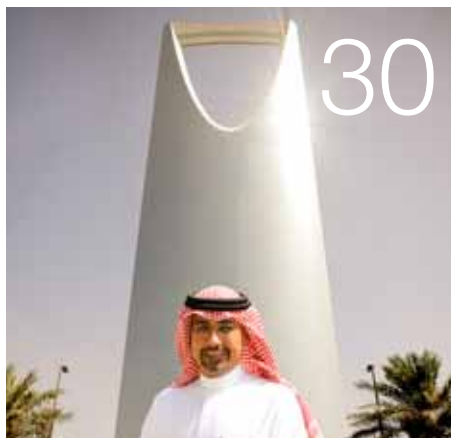
PHOTO: ERIK SIMONSEN/BOEING



Something of value

Production rates for the Next-Generation 737 are going up to 42 airplanes a month. Preparing for this record-setting pace have been employee "value stream" teams that have helped make production of the popular single-aisle jetliner more efficient than ever.

PHOTO: JIM ANDERSON/BOEING



Bright future

Boeing has enjoyed a long relationship with Saudi Arabia, one that's much more than the sale of commercial jetliners and military products. Boeing has increased its presence in Saudi Arabia through industrial participation programs and by building strong ties with local universities. More opportunities are opening up for this key partnership.

PHOTO: ASSOCIATED PRESS

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26 Idea room

It's known as the "innovation cell," a special room at the Boeing site in Huntington Beach, Calif., where employees can go to brainstorm ideas. The space is meant to be a different kind of office that sparks creative thinking—and it's producing results.

PHOTO: PAUL PINNER/BOEING



INSIDE

07 Leadership Message

The strength of Boeing is in the great diversity of its employees, and tapping into the richness of this diversity helps the company succeed, according to Joyce Tucker, vice president, Global Diversity and Employee Rights. Employing a diverse workforce is not only the right thing to do, she writes, but it's the smart thing. Companies with a diverse workforce that create opportunities for all employees to grow and contribute have greater success.

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Journey's end

The space shuttle program will come to a close with the final flight of *Atlantis*, scheduled for this month. But the shuttles have one last mission: being readied for safe and permanent display at several museums around the United States. Boeing employees are helping prepare the shuttles for their final journey. PHOTO: BOB FERGUSON/BOEING



THE DESIGNS OF TODAY LEAD TO THE DESTINATIONS OF TOMORROW.

Boeing proudly supports The Engineers' Council as it recognizes today's brightest engineering achievements. With talent and expertise like this, the possibilities are limitless.

 **BOEING**



Diversity is who we are

Tapping into the strengths of all employees helps Boeing succeed

Thousands of employees of every background recently have read inspiring life stories of Boeing people including:

- Kathy Nguyen, a determined woman who arrived in America with little more than the Asian values of education and perseverance and is now chief engineer for Boeing's P-8 India program
- Brandon Polingyumptewa, who grew up on a Hopi reservation in northern Arizona and now serves as a material management analyst in Mesa
- Luz Virgen, a Boeing manager who was inspired by the famous *Stand and Deliver* calculus teacher, Jaime Escalante, at Garfield High School in East Los Angeles, to become the first in her family to graduate from college
- Syd Abernethy, an African-American, All-American lacrosse player who went on to become a naval flight officer, head of the U.S. Navy's diversity program, an award-winning base commander and now a Boeing manager

Inspired by one of these Diversity Heritage Month stories in Boeing News Now, the company's internal online news service, one employee wrote, "Having come from India and having recently lost my father, I briefly wondered what am I doing here, but I know what I am doing here! I am part of a bigger family, which allows me to excel in whatever I do."

Fostering a work environment where all employees feel respected, included and able to contribute their best is a core Boeing value and an integral part of our Leadership Attributes. We are all expected to help create an atmosphere where all employees see opportunities to stretch, take risks, learn, and contribute their diverse perspectives, experiences and ideas without being blocked by factors that have nothing to do with their ability to perform.

Our leaders understand that employing a diverse workforce, in terms of race, gender, physical ability, sexual orientation and the many other dimensions of diversity, is the right thing to do.

It's also the smart thing to do. Abundant research has

"Fostering a work environment where all employees feel respected, included and able to contribute their best is a core Boeing value and an integral part of our Leadership Attributes."

– Joyce Tucker

Vice president,
Global Diversity and Employee Rights

PHOTO: THE JOHN MARSHALL LAW SCHOOL

shown that companies with diverse workforces are better at solving problems and have higher sales revenues, more customers, larger market shares and greater relative profits than less diverse companies. For Boeing to remain competitive as we work to meet the evolving needs of our varied customers across the globe, we must take advantage of this diversity. Engaged employees contribute innovative solutions to our business challenges and help drive increased growth and productivity.

To guide us in this effort, Boeing has a five-part strategy outlining a holistic and companywide approach to diversity and inclusion. It's designed to ensure that the principles of diversity, equity and fairness are integrated into all policies, procedures and practices across the enterprise; that diversity and inclusion is leveraged as a core value; and that diversity and inclusion is who and what we are as a company. This is a commitment that belongs to each of us. ■

LANDING PATTERNS

It took 27 painters eight days to complete the livery on this new Shenzhen Airlines 737-800, shown landing last month at Shenzhen International Airport in southern China following a delivery flight from Seattle. The festive design features 31 colors and celebrates Shenzhen Airlines' participation as a global partner of 2011 Universiade, an international sports competition for university athletes that will be held in Shenzhen next month. Established in 1992, Shenzhen Airlines also was the first Chinese carrier to order the 737-900. "Our long-term partnership with Boeing has played an essential role for the development of Shenzhen Airlines," said Feng Gang, the airline's president. PHOTO: CHU WENMING/CARNOC.COM



Quotables

“This is our house.
That’s what we call it.”

– Raffie King, referring to Boeing’s new North Charleston, S.C., final assembly facility. King and her fellow teammates will start assembling the site’s first 787 over the summer. From the June 6 Charleston Post and Courier newspaper.

“A helicopter would have had
a hard time doing this....
We had the pedal to the
metal the whole time.”

– Pilot of the U.S. Marine Corps V-22 that rescued the pilot of a downed U.S. Air Force F-15 in Libya in March, referencing the tilt-rotor V-22’s high cruise speed. The rescue mission from the USS Kearsarge, located 150 miles (240 kilometers) offshore, took 90 minutes round-trip. As reported in the Delaware County Times, May 26.

MARVELOUS MUSTANG

The iconic P-51 still inspires and thrills air show crowds, but it almost wasn't built

By Erik Simonsen

Grace and power—just two of the many words that could be used to describe the legendary P-51 Mustang, one of the most popular and recognized aircraft ever built.

But the Mustang's path into aviation folklore was not a conventional one. It easily could not have been produced at all.

The story of the P-51 begins

PHOTO: Wide-angle view of a restored classic P-51D Mustang at the Oshkosh, Wis., air show. ERIK SIMONSEN/BOEING

shortly before World War II, when North American Aviation was mass-producing AT-6 Harvard trainers for the British Ministry of Defence, but also contemplating several new fighter designs. Although the Royal Air Force, or RAF, was impressed with the Harvard and wanted fighters, the Ministry of Defence felt that North American Aviation lacked fighter experience. So the British asked the Los Angeles-based company in February 1940 about producing the Curtiss P-40.

Dutch Kindelberger, president of North American Aviation, had reservations about the P-40's performance, and after conferring with his vice president, Lee Atwood, both were convinced their company could produce a superior fighter using the same Allison engine as the P-40, without increasing unit cost.

Chief designer Edgar Schmued was

asked to come up with a preliminary configuration.

Designated NA-73X, the prototype would utilize a laminar-flow wing that had been developed by the National Advisory Committee for Aeronautics—now NASA—which significantly reduced drag. The new design also featured a unique air scoop on the underside of the fuselage just aft of the cockpit. Based on research into what was known as the “Meredith effect,” it would provide engine cooling but also recover energy from the radiator, with the heated air providing added thrust for improved performance.

Kindelberger and Atwood made several presentations to the British in early 1940 about the new fighter concept. Finally, Atwood convinced Sir Henry Self, director of the British Purchasing Commission, to take a chance on the new design. But there

was a stipulation: North American Aviation would obtain the P-40 blueprints and wind-tunnel and flight-test data from Curtiss to use as a resource. Atwood purchased the documents for approximately \$56,000. (In a July 1998 interview with this writer, Atwood quipped: “We considered the Curtiss data somewhat obsolete and continued with our fresh-start design.”)

In April 1940, British confidence in North American Aviation arrived in the form of a contract for 320 fighters, with a unit price not to exceed \$40,000. The Allison engines and guns would be provided by the British government. A pivotal clause in the contract directed that two fighters be delivered to the U.S. government for evaluation.

The NA-73X prototype was produced in only 102 days and first flew on Oct. 26, 1940. By July of the following year,



70 years ago, the first P-51s began rolling off the North American Assembly line in Los Angeles. Both the RAF and Army Air Corps quickly recognized the potential of the new multi-role fighter and eventually ordered thousands.

The Rolls-Royce Merlin engine, which was incorporated on the P-51 starting in 1942, greatly increased its performance. A series of improved models followed, with the most well known being the P-51D featuring the 360-degree “bubble” canopy.

Initially, the British called the P-51 the “Mustang” and the U.S. Army Air Corps designated its fighter the “Apache.” In a telegraph to Army brass in July 1942, Kindelberger asked that the fighter be officially known as the Mustang.

A true game-changer during World War II, the P-51 Mustang will be forever remembered as the fighter that escorted Allied

heavy bombers deep into Germany and fended off attacking Luftwaffe interceptors—long-range missions made possible by drop tanks and an extra internal fuel tank behind the cockpit. Later deployed in the Pacific theater, the P-51 also escorted long-range B-29 bombers.

In the European theater, the P-51 was credited with downing more enemy aircraft than any other Allied fighter. A total of 15,686 P-51s were built by North American Aviation and under license from 1940 to 1947.

Worldwide, about 150 P-51s are still airworthy, performing at air shows and air races—an inspiring testament to that initial spark of innovation at North American Aviation in 1940 that brought about such a remarkable aircraft. ■

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A TRUE GAME-CHANGER DURING WORLD WAR II.

PHOTO ILLUSTRATION: During World War II, the P-51 Mustang was able to escort allied bombers to Berlin and back from their Royal Air Force bases, and still had 20 minutes’ fuel for aerial engagement over the target. Innovation made the difference. Modern jet fighters are designed to be inherently unstable, allowing for increased maneuverability; advanced computer technology beyond the capability of a human pilot provides in-flight stability. In 1942, altering an airplane’s center of gravity was unheard of, yet North American Aviation chief engineer Raymond Rice proposed doing just that. The goal was to extend the range of the P-51 by installing an internal 85-gallon (320-liter) self-sealing fuel tank aft of the cockpit. Although every other aerodynamicist involved tried to veto the idea, the U.S. Army Air Corps customer agreed with Rice. **BRANDON LUONG/BOEING;** LEFT PHOTO: SHUTTERSTOCK; INSET PHOTO: ERIK SIMONSEN; BOEING

Higher office

For crane operators in the 737 factory, teamwork keeps the production line moving

By Dawsalee Griffin



Anthony "Tony" Ullakko, an overhead crane operator at the Renton, Wash., factory, moves large segments of Next-Generation 737 wings between assembly positions. In this *Frontiers* series that profiles employees talking about their jobs, Ullakko explains how crane operators help keep 737s rolling out the factory door—at more than one a day. PHOTO: JIM ANDERSON/BOEING

We're the ones who connect the dots with the parts.

Every crane move is to make sure that large 737 parts get where they are needed so the mechanics can do their jobs in a timely fashion.

Working as an overhead crane operator 45 to 90 feet (14 to 27 meters) over the shop floor isn't for everyone. But, for the ones who stick with it, it's a rewarding and challenging job. You need to work well with others, pay attention to detail and communicate well with the people you work with.

When I make a lift, I have to pay attention to the people on the floor as well as what's going on in the crane. A lot of precise moves need to be made to position the part and make sure that everything is clear.

In the crane business, safety is one thing we all focus on. It's always on our minds when we move anything.

On the 737 line, we rotate between buildings so we have an opportunity to work in the wings section, on final assembly

and at any place they need crane operators on the Renton site.

All the people on the Renton crane crew where I work have a lot of experience. We all treat our position with a great deal of pride and responsibility. When new people come in, everyone takes part in their training so the new people, too, can meet the challenges of the position. Someone is always willing to help.

The operator is alone up in the crane, but it's really a team effort to make those lifts and keep the 737 line moving. ■

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Stream LINE

Value stream teams are leading the way so 737 production rates can soar

By Kathrine Beck and photos by Jim Anderson and Bob Ferguson

A big improvement was launched by a simple question from a 737 mechanic. He asked Environmental Controls Systems engineers visiting the shop floor, “How come you guys have all this variability?”

He was talking about cabin air systems. They’re made up of hoses that run behind the paneling in the cabin and diffusers that work like an air intake grille in your home. Each Next-Generation 737 airplane included seven different sizes of diffuser and 32 different lengths of hose, and 101 different assemblies made up of hose and diffuser combinations.

Engineers went to the lab and did some testing. They realized that all the diffusers could be the same size—11 inches (28 centimeters). And that all the hoses could be made in 5-inch (13-centimeter) increments. Today, the number of diffuser sizes has gone from seven to one; hoses from 32 to seven; and assemblies from 101 to seven.

The result: a significant savings in time and weight.

Environmental Control System engineers then visited the company that supplied the diffusers. By eliminating variability and making other improvements, the supplier could build the

PHOTOS: Lights reflect off a Next-Generation 737 Blended Winglet as the airplane moves down the Renton, Wash., assembly line. (Insets, from top) Garry Ayers, 737 mechanic, and power plant assemblers Shiree Springfield and Jack Stendahl.



parts more efficiently and save money.

Improvements like this are now routine in the 737 program because of “value stream” teams. They improve processes throughout the value stream—starting with obtaining parts and raw materials from suppliers all the way to Boeing in-service support of 737 airplanes in customer fleets.

Value stream teams are organized around “commodities”—specific parts or areas of the airplane. Examples of commodities include landing gear, avionics, flight controls, floor coverings and fuselage. So far, there are 34 active teams with plans to add one more team this year.

The teams are made up of the people who buy the parts and materials, design the parts and components, install them on the shop floor and service them on finished airplanes for customer airlines. Teams also include a Lean+ coach and a project manager, as well as an executive sponsor and executive “champions.” Value stream teams use value-stream mapping and other Lean+ tools to identify waste and improve processes.

Gail Beisler is an Environmental Control Systems lead mechanic and value stream team member.

“All of us can delve into it and figure out what we need,” Beisler said. “We have such a good working relationship with everyone involved.”

Mark Spillman, a 737 Propulsions Systems lead mechanic, works in an area that builds up engines with everything needed to connect them to the rest of the airplane—engine mounts, hydraulic systems, fire detection systems and more. Value stream teams “get everybody together on the same page so things move smoothly here for us down on the floor,” he said.

Spillman explained how the value stream team in his area prepared for a rate increase with an Accelerated Improvement Workshop. Eighty percent of parts to be installed on engines are on the left side. As a result, the work on the two sides of an engine wasn’t balanced as the engine made its way through two work zones in the engine-buildup area of the Renton, Wash., factory. The value stream team reorganized the flow by creating a third zone, so now the work is balanced.

The number of engines his group can deliver will go from three a day to four, eventually, as the 737 production rate increases to 42 a month, according to Spillman.

Debra Englund, Value Stream Integration leader, said the power of value stream teams is “the ability of the team to work problems cross-functionally on a recurring basis. A value stream team is not a team that solves a problem and then disbands. Instead, it is a formalized structure that has end-to-end responsibility for its commodity.”

Having value stream teams in place makes it possible for process improvements to be implemented more quickly, Englund added.

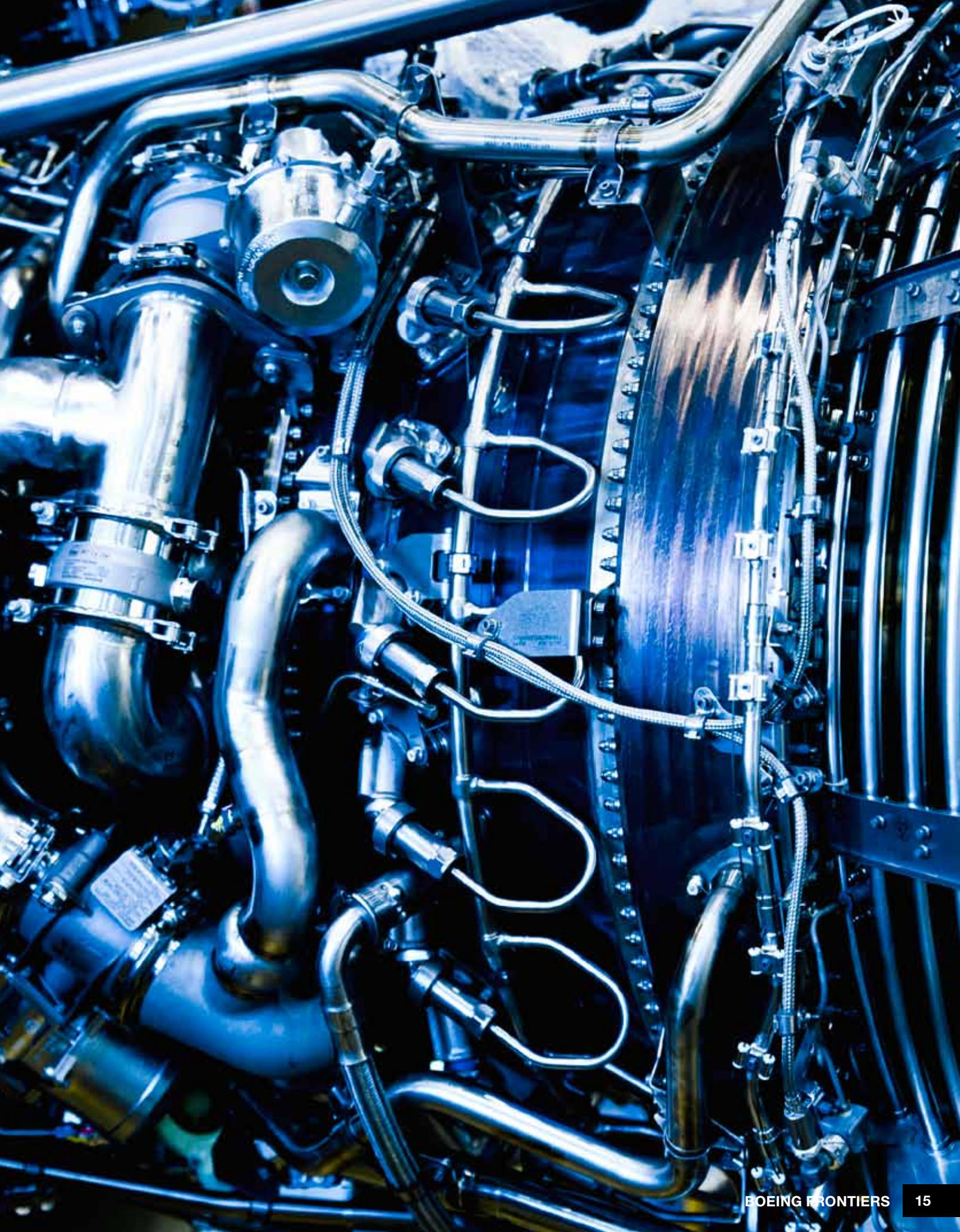
Mechanic Beisler agreed.

“Any issues we have get resolved quicker—much quicker,” she said. “It makes everything flow so much better.” ■

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PHOTOS: Next-Generation 737 engine cores are prepared for installation at the Renton, Wash., factory. **(Insets, from top)** Kelly McKee, power plant assembler; Mark Spillman, power plant assembler specialist and team lead; Tom Yost, 737 manufacturing team lead; and Dong Chon, 737 technical designer.



Answering the call

Boeing volunteers were quick to respond when tornadoes hit Alabama

By Patricia Soloveichik and photos by Eric Shindelbower

When tornadoes cut a 130-mile (210-kilometer) path of destruction across north Alabama, leaving behind ravaged communities, shock and despair, the heart-wrenching loss of homes and loved ones galvanized thousands of volunteers.

Boeing employees were among the first to respond.

"The area looks like it's been through a really long war," said Boeing volunteer Leslie Bradley, describing the neighborhoods hit near Boeing Huntsville Jetplex facilities in north Alabama. Leafless sticks were all that was left of neighborhoods that had once been green with mature trees and populated by homes.

In one day, more than 100 Boeing volunteers showed up in their signature blue T-shirts with little more than 24 hours' notice to perform backbreaking work for shifts as long as eight hours.

Employees returned again and again. And they made a difference.

"It's extraordinary how much determination, commitment and old-fashioned hard work can achieve," said Tony Jones, vice presi-



dent of operations for Strategic Missile & Defense Systems and Huntsville site executive, surveying the neighborhoods more than a month after the storms. "I am continually amazed and impressed by the resiliency of the people here. They work together and they get the job done. That's also why they're so good at their work."

Boeing employees around the globe rallied as well, donating more than \$106,000 to help tornado victims in Alabama, in addition to a local Employees Community Fund contribution of \$20,000 and a Boeing donation of \$100,000.

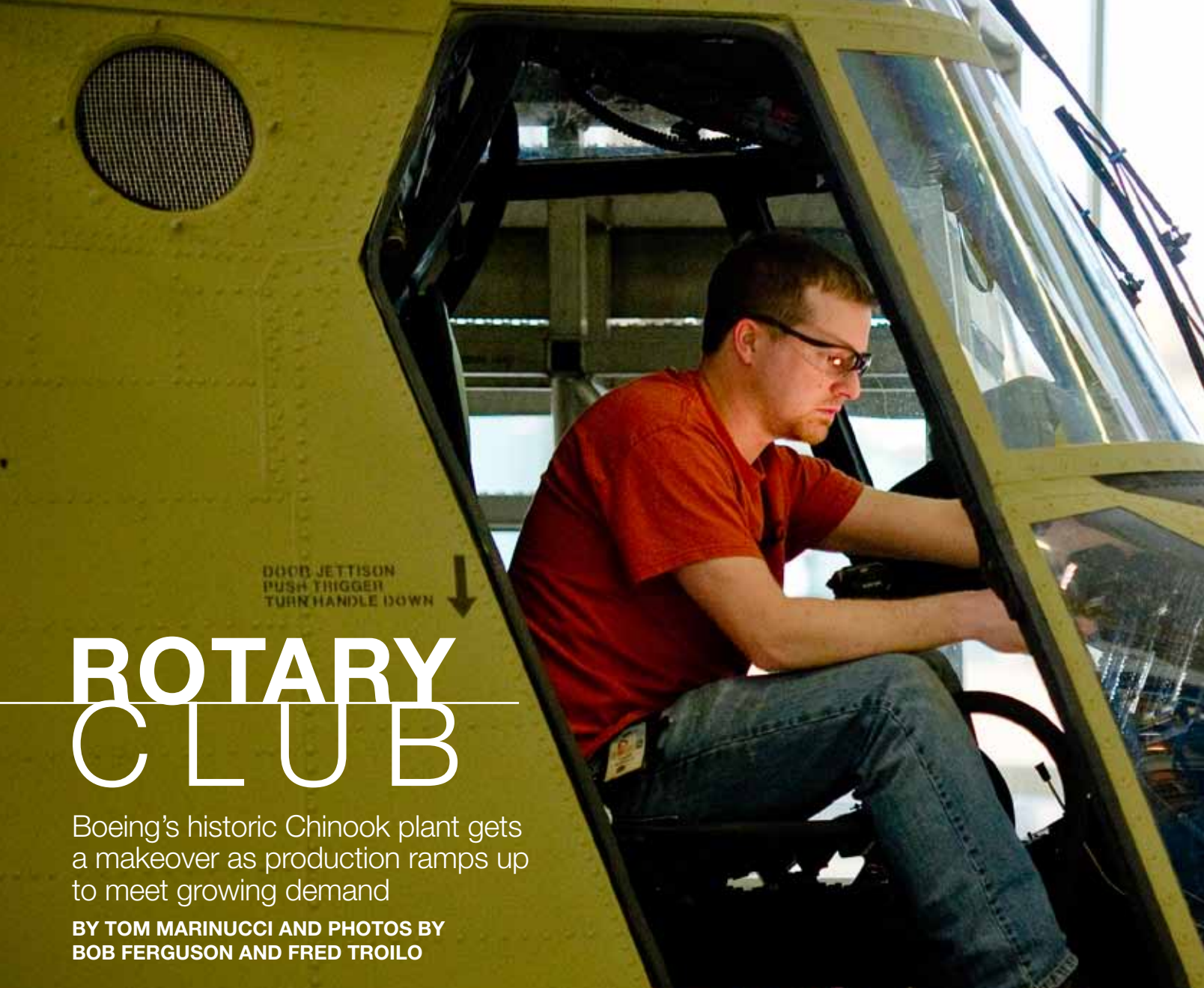
Mike Gillespie, chairman of the Madison County Commission in Alabama, who led response and recovery efforts, recently thanked Boeing for getting out in front to help. "We've always valued Boeing as an economic force and for its community spirit," Gillespie said. "But it's clearer than ever that your people truly are your most valuable asset." ■

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The devastation in north Alabama was not the first time that Boeing employees have been affected by a natural disaster. Parts of Australia endured major flooding earlier this year, and Japan is recovering from a deadly earthquake and tsunami. To read more about how Boeing and its people have responded to these disasters both on and off the job, see Page 36 in the May 2011 issue of Frontiers and the 2010 Corporate Citizenship report online at: www.boeing.com/companyoffices/aboutus/community/2010_report/delivering_aid.html

PHOTOS: Boeing employees from the Huntsville, Ala., site, along with family members, responded quickly and in large numbers when a neighborhood was devastated by a powerful tornado. The Boeing teams hauled debris for hours, and many returned for subsequent shifts.





ROTARY CLUB

Boeing's historic Chinook plant gets a makeover as production ramps up to meet growing demand

BY TOM MARINUCCI AND PHOTOS BY BOB FERGUSON AND FRED TROILO

In another time, when railroads rather than airplanes carried most people across the country, steam locomotives were built here. Today, the historic but now modern factory near Philadelphia is home to production of the latest models of Boeing's workhorse CH-47 Chinook military helicopter.

New glass walls let natural light flood in and allow employees on the assembly line to look out toward the flight ramp and the Delaware River in the distance. From that flight ramp, Chinooks are tested before being delivered around the world to customers—and to U.S. warfighters.

"We look for every opportunity to build it better," said employee involvement team leader and aircraft technician Douglas Hittle, who has been on the Chinook line for three years.

Indeed. Hittle and his Boeing teammates, who number more than 600 on three shifts, are building the twin-rotor, 60-foot-long (18-meter-long) Chinook better than ever at the Boeing plant in Ridley Township, a few miles west of the Philadelphia

International Airport. And building more of them, too.

Production rates are going up to meet increased domestic and international demand for the heavy-lift Chinook. Factory processes, streamlined through Lean+ activities, have helped make the Chinook assembly line so efficient that teams from other Boeing business units have come calling to see what's happening. Employees have come up with innovative ways to save time—and money. And Boeing is investing more than \$130 million on factory and other site improvements. This includes refurbishing the flight ramp, according to Leanne Caret, vice president, H-47 Programs.

The Chinook is Boeing's longest-running aircraft program in continuous production, and it has outlasted every commercial jetliner model and even the B-52 bomber.

A new line to produce the CH-47F model for the U.S. Army became operational in late May. It has room for up to 11 assembly positions rather than eight on the old line. An alternate line for

“WE HAVE GLASS WALLS AND CAN WATCH OUR CHINOOKS FLY!”

– BRETT MACKRELL, FINAL ASSEMBLY SUPERVISOR AND
26-YEAR VETERAN OF CH-47 PRODUCTION



PHOTOS: (Top) New glass walls allow natural light into the renovated Chinook factory as Jason Willmot works inside the cockpit of a CH-47. **(Employee insets, from left)** The Chinook manufacturing team includes Hugo Deshagette and Jerry Cook.



production of Chinooks for international customers is expected to be ready by the end of the year.

“In addition to the excitement over the new line and improved conditions, there is a real sense of pride for the work we do,” said Paul Bruno, a final assembly supervisor on second-shift positions where the Chinook is fitted with wiring and hydraulic lines.

That message is not lost on the military customer.

“The Chinook provides a lifeline to our soldiers,” Lt. Gen. William Phillips, principal deputy to the assistant secretary of the Army for Acquisitions, Logistics and Technology, told employees during the delivery ceremony a year ago for the 100th CH-47F.

“There are soldiers who are alive today because of the dedication of this team,” he said.

Boeing teams have been building Chinooks at the plant since 1966 after the land was purchased by Boeing-Vertol. The factory dated back to 1929, when it was built for General Steel Casting Corp., which made its reputation building steam locomotives

for the Pennsylvania Railroad and many others in the United States and overseas.

At peak production during the Vietnam War, Boeing produced one Chinook and one smaller CH-46 Sea Knight twin-rotor helicopter per day at the plant. The facility has been in continuous production of Chinooks since Boeing took it over.

Through the 1970s, earlier models were upgraded and international aircraft were produced. With 50 deliveries scheduled this year, the production rate is the highest in more than 20 years.

In addition to Chinooks, Boeing employees at the Ridley Township site produce fuselage assemblies for the Bell-Boeing V-22 Osprey tilt-rotor aircraft, though that work is in a different building.

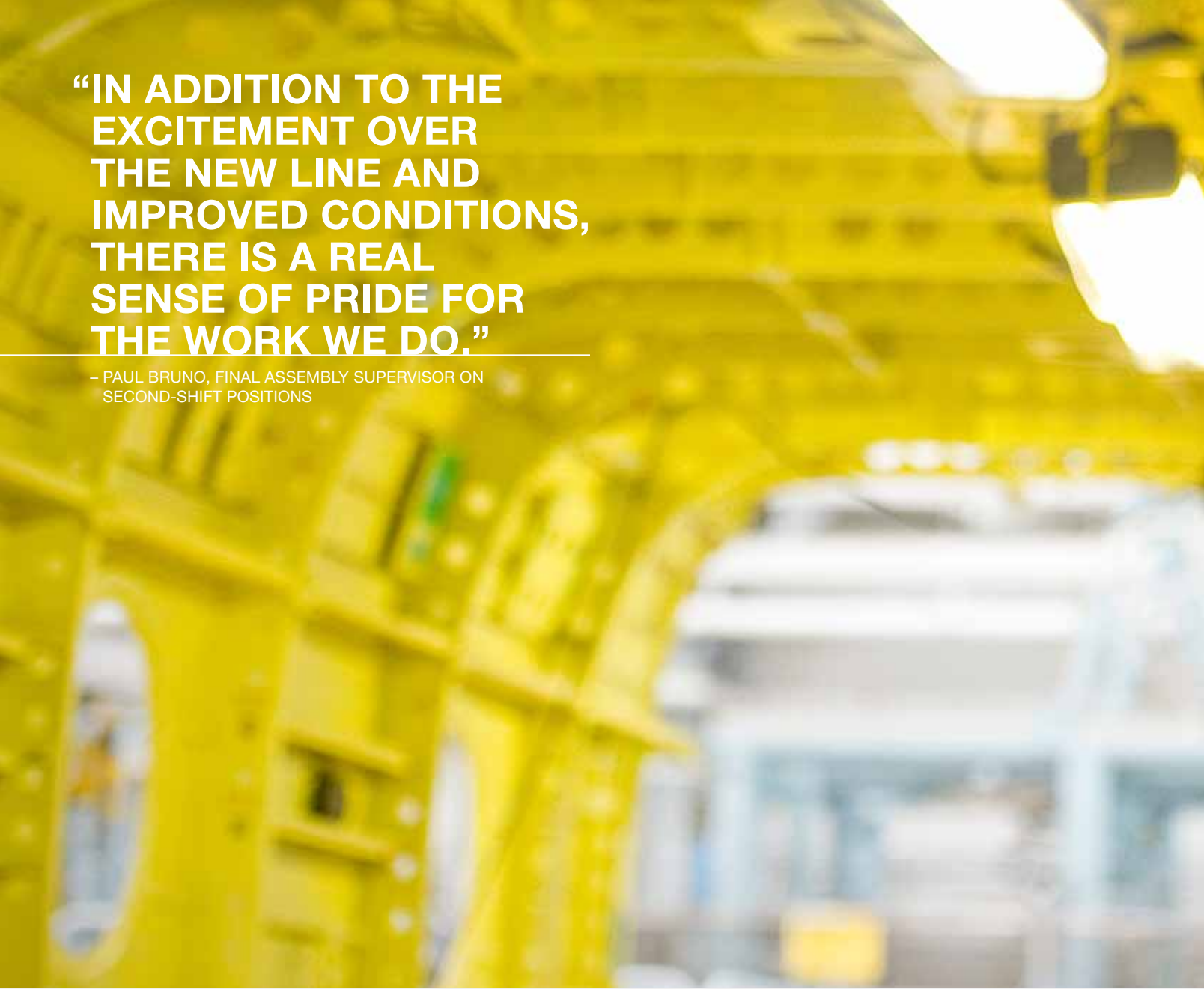
Tooling and production processes were continuously improved over the years, but the Chinook building was largely

**“WE LOOK
FOR EVERY
OPPORTUNITY
TO BUILD IT
BETTER.”**

– DOUGLAS HITTLE, EMPLOYEE
INVOLVEMENT TEAM LEADER AND
AIRCRAFT TECHNICIAN



PHOTOS: (Top) A CH-47 Chinook moving down the newly opened production line. **(Employee insets, from left)** Chinook team members include Walter Brown and Douglas Hittle.



**“IN ADDITION TO THE
EXCITEMENT OVER
THE NEW LINE AND
IMPROVED CONDITIONS,
THERE IS A REAL
SENSE OF PRIDE FOR
THE WORK WE DO.”**

– PAUL BRUNO, FINAL ASSEMBLY SUPERVISOR ON
SECOND-SHIFT POSITIONS

unchanged from when it was used to build locomotives. Railroad tracks were still embedded in the floor.

The aim of the renovation project is a state-of-the-art facility that fully supports the increasing demand for Chinooks. The improvements have already increased production rate from three to five aircraft per month, and when complete, the factory production rate will climb to six aircraft each month. Major improvements will be completed by the end of this year. All phases of the project are scheduled to be finished by 2014, added Caret.

The Chinook facility will have a modern climate-control system and will be Boeing's first factory certified Leadership in Energy and Environmental Design, or LEED, an internationally recognized environmental building certification system.

Factory workers praise the renovation results so far, especially the views through the wall of windows.

“For a view, we used to walk out to the end of the factory

to what we called the ‘concrete beach,’” said Brett Mackrell, final assembly supervisor and 26-year veteran of CH-47 production. “Not anymore. We have glass walls and can watch our Chinooks fly!”

Almost 20 countries operate a worldwide fleet of more than 470 Chinooks. The first international version of the CH-47F for the Netherlands is in flight testing. The first of 15 Chinooks for Canada will enter production this summer, followed by Chinooks for Italy. The program is midway through the first multiyear contract award for nearly 200 Chinooks for the U.S. Army.

“This awesome team delivered critical aircraft ahead of schedule to the U.S. Army during this major renovation,” Caret said.

Employee teams continue to find innovative ways to save time and further speed production. Working with the parts warehouse, for example, teams revised the way aircraft wiring harnesses were delivered to the factory floor. Assemblers would



PHOTOS: (Top) Doris Zappacosta performs tasks inside the fuselage of a Chinook. **(Employee insets, from left)** Alex Valentino; Frank Gallucci, left, and Eugene Brockbrough; Don Martin; and John Lent, left, and Anthony Notte.



typically search through a pallet of boxes for each harness. Now, each harness is delivered in open part trays in sequence for installation, which has greatly simplified the process.

“We knew how to improve,” said Frank Stricker, a final assembly lead with 26 years on the Chinook line. He noted the significant improvements in workflow achieved by increasing the readiness of parts. An automated schedule means parts arrive in a timely manner and keep pace with the team’s rate.

Hittle, the aircraft technician, leads the employee involvement team for the tube shop, which produces the hydraulic lines and fuel lines where the fuel cells are assembled. His team created a tracking system so workers can now account for caps removed from tubing during installation and eliminate the possibility of pieces being left behind as foreign object debris, or FOD. In addition, employees went one step further and added recycle bins for the used caps.

Tim Barrett, a six-year Chinook veteran, works the first

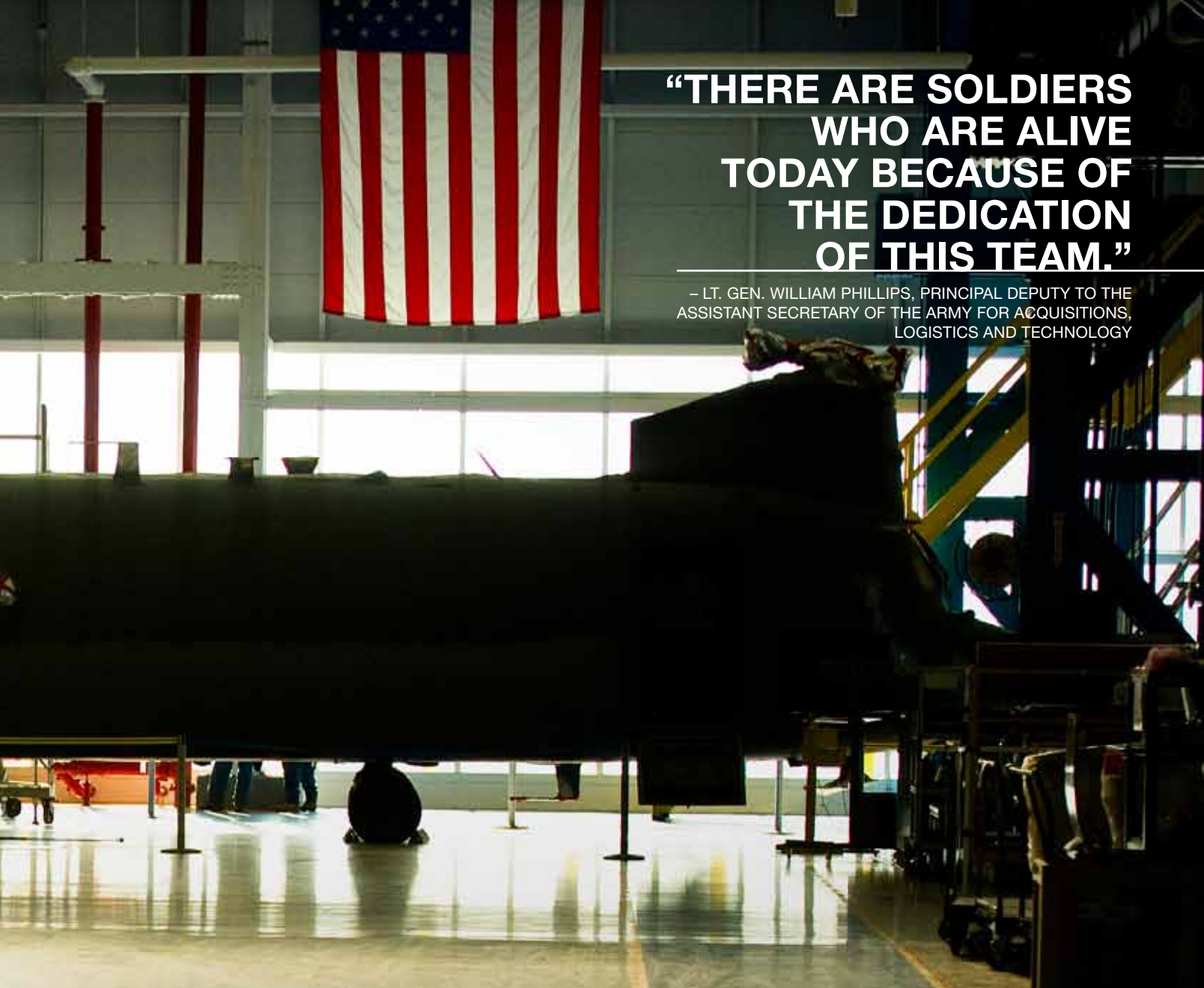
shift. His team has been recognized twice as Foreign Object Debris Prevention Team of the Month. By implementing an audit system for tools, and accounting for every tool in every tray, the team’s efforts resulted in a 70 percent reduction in FOD over the past year.

“All of us have the unique privilege of touching every Chinook that flies off the flight ramp and into the hands of our Army customer,” Barrett said. “That in itself inspires everyone to build it better every day.” ■

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“THERE ARE SOLDIERS WHO ARE ALIVE TODAY BECAUSE OF THE DEDICATION OF THIS TEAM.”

— LT. GEN. WILLIAM PHILLIPS, PRINCIPAL DEPUTY TO THE ASSISTANT SECRETARY OF THE ARMY FOR ACQUISITIONS, LOGISTICS AND TECHNOLOGY



PHOTOS: (Top) Expansive new factory windows silhouette a CH-47 Chinook under construction inside the Ridley Township factory near Philadelphia. **(Employee insets, from left)** Janko Padron-Cueto, Ralph Highley Jr., Rich Fetterolf and Rich Burns.

Serious play

These Boeing employees have a place where they can be creative and 'game'-storm

By Peggy Mason and photos by Paul Pinner

Welcome to the “innovation cell” at Boeing’s Huntington Beach, Calif., site. Let the games begin!

Coming up with creative ideas that provide solutions for a diverse customer base is what Boeing is all about. To that end, one Boeing leader encourages his employees to experiment fearlessly, think outside the box and play games. That’s right—play games.

The games inspire creativity, and it’s creativity that will propel Boeing forward in fiercely competitive markets, according to Charles Toups, vice president and general manager of Network and Tactical Systems.

It was Toups who put in place the innovation cell. Inspired by the entrepreneurial spirit of companies

like Google and IDEO, the space is very different from a typical Boeing meeting room.

“There is no meeting table, any and all ideas are displayed on the walls, there are health-oriented drinks and snacks, and there’s even a PlayStation 3,” said Jason Brandstetter, a strategy and integration engineer with Network and Tactical Systems.

Added software engineer Lance

Fluger, also with Network and Tactical Systems: “Employees from every level of talent and experience come together in a relaxed environment to produce new solutions.”

Employees use the room on their own time, but Toups provides funds for small purchases if an idea shows promise. One team came up with an idea to add Boeing capability to a toy that takes off and lands vertically, can be flown using an iPhone or iPad, has multiple embedded sensors, and requires almost no training.

The team hopes to “produce a lightweight, small device that is now so inexpensive (only \$500), that nearly every soldier could have one,” Toups said of the idea that evolved from a capability



“Employees from every level of talent and experience come together in a relaxed environment to produce new solutions.”

– Lance Flugler, software engineer, Network and Tactical Systems



PHOTOS: (Far left) Charles Toups, vice president and general manager, Network and Tactical Systems. **(Left)** Toups (center, facing screen), talks with Huntington Beach, Calif., employees who frequent the innovation cell. Clockwise from top center are Michael Hogan, Kevin Meredith, Ryan Whitaker, Gabriel Santander, Jason Brandstetter, Lance Flugler and Scott Buyan. **(Above)** It's liftoff for the team's current project—a toy the group is adapting for potential warfighter use. Controlling the vertical liftoff is Michael Hogan (from left) with Kevin Meredith, Sarah Kamilaris and Lance Flugler.

that the U.S. Army canceled—the Class I Unmanned Aerial Vehicle.

The original purpose of the unmanned craft was to hover near an area of interest and relay real-time information to soldiers. The Boeing team took that idea and added refinements that may eventually lead to a new product for the customer.

Ultimately, the purpose of the innovation cell is to identify people who are passionate about solving critical problems, produce solutions that can be funded and offered to customers, and develop talent within Boeing, particularly with younger employees who are eager to work on interesting projects and provide creative solutions.

Toups expressed concern that the newest generation of employees may not stay with Boeing if they aren't allowed

to be creative: "We often hear feedback from employees who leave the company within their first five years that they get frustrated because they don't get the chance to work on anything as exciting as they'd hoped.

"Too often, companies become constrained by their own successes," he added. "The bigger the program of record, the more we tend to focus on meeting requirements and the less we focus on innovation. Merely fulfilling contract requirements isn't necessarily all that is needed. We really have to think outside the box and figure out what the customer needs, even if that varies from the formal requirements. We need to work better and be more in line with the needs, not just the requirements of our customers."

Adam Weiss is one of Boeing's newly hired aerospace engineers. He described the innovation cell as "an amazing opportunity," noting that he is free to express his own ideas with others who have more experience.

"The concept of 'no bad ideas' has created a nurturing environment where we can feel free to do what we came here to do: engineer," said Weiss, who hopes to expand on an idea that he's been talking about with his mentor.

That's the kind of feedback about the innovation cell that Toups loves to hear.

"Every now and then, I'll stop by to see what they're up to," Toups said of those who use the innovation cell. "I see the amazing things they're coming up with, and I get inspired, too!" ■

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PHOTOS: Game play is one of the tools used in the innovation cell to generate ideas that could turn into new products for Boeing. **(Left)** Ryan Whitaker concentrates on his aim. **(Above)** Lance Fluger (from left) watches as Jason Brandstetter and Sarah Kamilaris compete.

High finance

RBS Aviation Capital marks a decade of success in commercial airplane leasing and financing **By Bill Seil**

Since its founding 10 years ago, RBS Aviation Capital has forged a strong niche in a changing commercial airplane market.

The Dublin-based company is one of the world's top five commercial airplane lessors by fleet value and a global leader in aircraft finance. Its leasing business focuses on providing advanced, investor-friendly narrow-body aircraft to robust low-cost carriers.

RBS Aviation Capital's transactions include both Boeing and Airbus airplanes. It has purchased 63 Next-Generation 737-800s directly from Boeing, with deliveries scheduled through 2015. RBS also has shown an interest in expanding its investments to include the 787 Dreamliner.

Peter Barrett, the company's CEO, notes that when he entered the aviation

RBS Aviation Capital has customers in 38 countries, and in addition to leasing aircraft to 100 airlines, the company sells airplanes to 40 investor customers. Over the past seven years, the company has profitably sold 170 commercial aircraft valued at more than \$6.4 billion. Marlin Dailey, Boeing's senior vice president, Sales and Marketing, said the RBS Aviation Capital team's deep understanding of the leasing business and the global finance environment is a great benefit to its airline customers.

"RBS has successfully established itself in the leasing market for low-cost carriers by specializing on the unique needs of that segment," Dailey said. "By leasing to some of the world's leading single-aisle low-cost carriers,



Boeing has "a great team that is very customer-focused."

— Peter Barrett, chief executive officer of RBS Aviation Capital

PHOTO: RBS AVIATION CAPITAL

PHOTO ILLUSTRATION: A Boeing Next-Generation 737 in RBS livery. BOEING

finance business more than 20 years ago, leased airplanes made up roughly 10 percent of airline fleets. It has since passed 30 percent and is continuing to grow at a steady pace.

In challenging economic times, airlines are finding new ways to manage their balance sheets and manage their fleets, Barrett said. Leasing has emerged as an attractive option.

"Rather than making a commitment to buying an aircraft for 25 years, airlines are leasing planes for five years or more, then reviewing the market," Barrett said. "Leasing companies are in a much better position to manage risks involved in ownership because we have teams that fan out around the world looking for new opportunities to place aircraft."

RBS has grown into one of the top five commercial airline leasing companies. Boeing 737s have played a major role in its success."

Barrett said RBS Aviation Capital is looking ahead as design improvements add value to commercial airplanes. The 787, he said, is a great example of new technology and ideas. Beyond its history of investment in Next-Generation 737s, RBS Aviation Capital is looking to the company's future advancements in single-aisle airplanes.

"I'm a big fan of The Boeing Company," Barrett said. "They make great airplanes. They also have a great team that is very customer-focused, proactive and has a long-term view of relationships." ■

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Saudi Arabia at a glance

Official name: Kingdom of Saudi Arabia

Location: On the Arabian Peninsula between the Red Sea and the Arabian Gulf; neighbors include Yemen, the United Arab Emirates, Qatar, Bahrain, Oman, Kuwait, Iraq and Jordan

Area: 784,000 square miles (2 million square kilometers), one-fifth the size of the continental United States

Population: More than 27 million people

Official language: Arabic

Capital: Riyadh

Other key cities: Jeddah, Mecca, Medina and Dammam

Gross domestic product, 2010 estimate: \$622.5 billion (U.S. dollars)

GDP growth rate, 2010 estimate: 3.8 percent

Largest export partners: Japan, South Korea, the United States, China, India

Military spending as part of GDP, 2005: 10 percent

Sources: U.S. government

PHOTO: The skyline of Riyadh, Saudi Arabia's capital city, with the Kingdom Centre—the nation's tallest building at almost 1,000 feet (300 meters)—in the foreground. Boeing Saudi Arabia's headquarters is located in the city.

SHUTTERSTOCK



NEW WHO



“Boeing has a golden name in Saudi Arabia. It is a company that’s regarded to be at the cutting edge of technology.”

– Ahmed Jazzar, president of Boeing Saudi Arabia

PHOTO: ASSOCIATED PRESS

EMPLOYEES: Click here to view a video interview with Ahmed Jazzar, president of Boeing Saudi Arabia.

Boeing and Saudi Arabia have a strong partnership that goes beyond defense and commercial products

By Eric Fetters-Walp

The discovery of huge oil reserves established Saudi Arabia as an economic force in the 20th century. In the 21st century, the nation is counting on technology to do the same, and Boeing is certain to be involved.

“I don’t believe Boeing’s ever been in a position with the kingdom that’s better than it is now,” said Ahmed Jazzar, president of Boeing Saudi Arabia. “With the economy booming, opportunities are opening up.”

In 2010, Saudi Arabia signaled its intent to the U.S. government to proceed with the single largest acquisition of defense products in Boeing’s history. The purchase includes 84 new F-15 jet fighters, upgrades to 72 of Saudi Arabia’s existing F-15s, 70 Apache helicopters and 36 AH-6i light attack helicopters. Other defense products and services also are included in the proposed deal.

Boeing continues to work closely with the U.S. government and the Kingdom of Saudi Arabia on these programs, which are designed to strengthen security in the region.

The nation’s flag carrier airline also has ordered eight 787 Dreamliners and 22 777s and will take delivery of some of them this year.

Those new orders build on a solid foundation dating back decades. The kingdom’s fleet of older F-15s and its Apache helicopters are a crucial part of Saudi Arabia’s defense forces.

Over the past 50 years, Boeing Commercial Airplanes has delivered 138 jetliners to Saudi customers. The nation also has been one of the most active markets for Boeing Business Jets and other VIP airplanes.

But the relationship between Boeing and Saudi Arabia isn’t limited to buying aircraft.

Boeing has invested in the aviation industry, technology research and education in the nation for nearly 30 years. In 1982, Boeing established Boeing Middle East Limited, or BMEL, in Saudi Arabia’s capital of Riyadh, giving the enterprise full commercial contracting and employee sponsorship rights equal to any other Saudi-owned and registered company.

A few years later, when Boeing won a large contract to provide Saudi Arabia with Airborne Warning and Control System, or AWACS, aircraft and other ground-based defenses, it launched a large industrial participation program that created Alsalam Aircraft Co., a profitable modification, repair and overhaul business.

“The confidence that Saudi Arabia has put in Boeing, on both the commercial side and the defense side, is really significant,” said Shep Hill, president of Boeing International and senior vice president of Business Development and Strategy. “And over time, we’ve increased our presence in Saudi Arabia to the point where we have strong partnerships there, from Alsalam to the universities.”

Boeing is a founding member of Alfaisal University, the first private university in Saudi Arabia. Since it began teaching classes in 2008, the school has attracted world-class teaching and research talent in engineering, science, business and medicine. At the newly established King Abdullah University of Science and Technology, Boeing is a member of the public institution’s

(Text continues on Page 34)

ORIZONS

With strong ties to local universities, Boeing is growing its opportunities in Saudi Arabia

Saudi Arabia isn't shy in its ambition to become a world-class hub for technology. At the new King Abdullah University of Science and Technology on the nation's western coast, state-of-the-art laboratories and research equipment are drawing researchers from far and wide.

In this case, starting an initiative from scratch is proving to have benefits, said Pete Hoffman, director of Global Research and Development, Boeing Research & Technology.

Describing the university's newly installed electron microscopes, magnetic resonating machines and more, he said: "The infrastructure is definitely a draw for bringing in great minds from around the world. [The school is] successfully attracting world-renowned scientists who are experts in key areas of interest to the kingdom."

In a country where relationships are valued, Boeing has grown strong ties to a number of universities and industrial businesses to help train new generations in engineering and aerospace.

"Our partnerships in Saudi Arabia are typical, I think, of those we establish all over the world," Hoffman explained. "They're driven by the opportunity to tap into the best technology, to co-invest and to establish a presence in key markets."

That's what Boeing did more than 20 years ago when it helped launch Alsalam Aircraft Co., a joint venture between Boeing, Saudi Arabian Airlines, Saudi Advanced Industries Corp., Gulf Investment Corp. and National Investment Corp.

Alsalam provides modification, repair and overhaul services for commercial and military aircraft as well as completion installations for VIP aircraft, technical support, manufacturing and training. Boeing owns half of the business, which has 3,500 employees throughout Saudi Arabia and neighboring Bahrain. First created out of Boeing's industrial participation pledge to Saudi Arabia, Alsalam has become a profitable, important venture that benefits Boeing, said Mohammed Fallatah, president and chief executive of Alsalam Aircraft.

"Our cost structure and local character often give us a competitive advantage, and having reach-back capability to Boeing allows Alsalam to leverage Boeing's strengths to enhance our mutual position in the market," Fallatah said. "The vision of Boeing back in the 1980s—to have a strong link to the Saudi market through developing the joint venture—has paid dividends not just from a monetary view but from the perception of commitment to the growth of Saudi national talent."

With that track record, Boeing is a welcome partner on other ventures and at research institutions in Saudi Arabia, Fallatah said. At King Abdullah University of Science and Technology, the company is involved in research to develop new tools to analyze the long-term performance of composite materials. Additionally, Hoffman said, Boeing is ramping up a new project to create the next generation of aircraft interior plastics with a Saudi Arabia-based company and helping Saudi scientists design new thin-film solar cell technology.

"They're very excited that Boeing is investing in technology and not just showing up when there's an order to be placed," Hoffman said of the scientific community in Saudi Arabia. "They also know we have a great record of living up to the commitments we make."





Boeing helps individuals and communities throughout Saudi Arabia

Early childhood education, training for families that have autistic children and increasing awareness on breast cancer are among the important causes in Saudi Arabia receiving support from Boeing's Global Corporate Citizenship organization.

Boeing helps a number of organizations across the nation, including the Saudi Autistic Society's early intervention program, which teaches caregivers how to recognize autistic symptoms in children; the Zahra Breast Cancer Society; and the Early Childhood Center/Gulf Women Association, which trains teachers for quality early child education programs.

Omar Shesha, Boeing International and Global Corporate Citizenship leader in Saudi Arabia, said the company's giving is focused on critical education, health and human services needs there.

"Our contribution to local nongovernmental organizations in the kingdom is part of a commitment to help individuals and communities deal with issues and needs," Shesha said. "These organizations in Saudi Arabia are making great efforts through well-designed programs, and we are delighted to take part in these initiatives."

Global Corporate Citizenship also supports the Learning Disability Program at Prince Salman Center for Disability Research, which conducts research into improving language proficiency among disabled Arabic speakers. Boeing has worked closely with the Hope Center for Exceptional Needs, the National Home Healthcare Foundation, the First Welfare Women's Society, Gulf Women Association, King Abdulaziz Charitable Association and Al-Nahda Philanthropic Society in Saudi Arabia.

"The contribution made by Boeing lays the ground for the development of necessary instructional tools to serve disabled children," said Uzma Raheem, director of the Hope Center for Exceptional Needs, which provides skills training for children with Down syndrome, autism, learning disabilities and related conditions. "This helps us create knowledge and awareness among families who need to recognize the disability symptoms in order to help their children."



PHOTOS: (Clockwise, from top) Alsalam employees perform an operations check on a Saudi F-15, one of the many aircraft models that the Saudi Arabia-based maintenance, repair and overhaul company supports. **ALSALAM AIRCRAFT** Two Alsalam Aircraft technicians perform maintenance and refurbishment on a transport aircraft cockpit. Boeing owns half of the business, which was created more than 20 years ago to satisfy an industrial partnership obligation. **ALSALAM AIRCRAFT** Students in a lab class at King Abdullah University of Science and Technology in Saudi Arabia. Boeing has partnered with the university on research in several fields, including composite materials. **ALFAISAL UNIVERSITY**

industrial collaboration program. Boeing also is the aerospace sector partner with the Saudi Arabian General Investment Authority.

Jazzar said his fellow Saudi citizens notice Boeing's commitment to helping the nation advance. "It is a fact that Boeing has a golden name in Saudi Arabia. It is a company that's regarded to be at the cutting edge of technology," Jazzar said.

Majed Al Harbi, Information Technology Business Engagement manager for Boeing Saudi Arabia, said the company's reputation attracts some of the kingdom's best talent.

"Boeing is recognized as a strong and reputable company, and I desired being a part of it since starting my education and career in technology," he said. "Boeing continues to seek out and foster new business relationships that benefit all parties involved. These continued contributions will hopefully push the Saudi economy into the forefront of technologically advanced nations."

Saudi Arabia will reap benefits for Boeing as well. Only recently has Saudi Arabia begun to encourage private airlines, and there will be more potential airplane customers as that industry grows. As a result, Boeing Capital Corporation sees the nation as a logical place to expand investment in commercial aircraft financing. It has presented aircraft financing seminars in both Riyadh and Jeddah during recent years, said John Matthews, Boeing Capital's

managing director for the Middle East, Africa and South Asia.

"Commercial aircraft investments have outpaced other asset classes, due to an aircraft's long, useful life and its extremely mobile nature," he said. "This isn't lost on the savvy Saudi investors with capital looking to connect with great opportunities in the aviation financing market. Also, aircraft are ideal assets for Islamic financing, which must be asset-based."

Boeing's active investment in educating Saudi Arabian financiers distinguishes it among other aviation industry competitors, Matthews added.

Jazzar, who was born and raised in Saudi Arabia and earned an engineering degree in the United States, said the company's past and present willingness to invest time, effort and money into Saudi Arabia is important for its future there.

"What's unique about Saudi Arabia, and you can say it's the case with almost all the Gulf countries, is that it's all about relationships," Jazzar said. "There are a very few decision-makers, with lots of responsibility and authority."

That makes the trust Boeing has built with the nation's leaders vitally important, he said.

It has also made the "One Boeing" approach used by Boeing Saudi Arabia's 300 employees a necessity, Hill said.



The company's major organizations—Commercial Airplanes; Defense, Space & Security; Engineering, Operations & Technology; as well as Boeing Capital Corporation, the Shared Services Group and Global Corporate Citizenship—are all active and working together in the Boeing Saudi Arabia offices in Riyadh.

"I'm very proud of the one-company approach we have in Saudi Arabia," Hill said. "It's not always been so, but there is a sea change in how we operate there."

As a growing nation—with one of the largest populations in the Middle East, about half under 20 years old—Saudi Arabia is poised to be an important and strategic power in the coming decades. With that prospect, and the resulting potential for great economic growth, Hill said Boeing's longtime interest and investment in Saudi Arabia is well-placed.

"We're following a strategy that is very sound," Jazzar added. "We're involved and active in the country. By doing that, by working with the country and listening to their aspirations and helping them reach goals, we're creating a differentiator for us." ■

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From the DC-3 to the 787

It started with a Douglas DC-3 presented by U.S. President Franklin D. Roosevelt to the late King Abdulaziz Al Saud, founder of modern Saudi Arabia. Sixty-six years later, Saudi Arabian Airlines is the second-largest carrier in the growing Middle East market.

"Before that, there was no aviation in the kingdom," said Ahmed Jazzar, president of Boeing Saudi Arabia. "That airplane became the nucleus of Saudi Arabian Airlines."

Saudi Arabian Airlines, the nation's flag carrier, is still the dominant airline. And it has remained an important Boeing customer. In 1961, it became the first Middle Eastern airline to enter the jet age by taking delivery of a Boeing 707.

In all, Saudi Arabian Airlines has taken delivery of 114 Boeing airplanes, and its fleet now includes four 747-400s, nine 747-300s, one 747-200, 23 777-200s, four MD-11s and 29 MD-90s. This year, Boeing and Saudi Arabian Airlines are scheduled to finish a major interior modernization project of the airline's 777-200ER (Extended Range) airplanes.

Additionally, Saudi Arabia has ordered a dozen 777-300ERs, with options for 10 more 777s. It has ordered eight 787 Dreamliners.

In the past five years, the government has changed regulations to allow for more airlines to compete more easily with the national carrier. The first new private airline, Nasair, flies an all-Airbus and Embraer fleet.

"The environment is still changing, so it will become more attractive for more players," Jazzar said, noting that the nation of 27 million represents the largest market in the Arabian Gulf region. "You have the market, the population and the demand. Mark my words: The future is still coming."

Boeing Commercial Airplanes also has found customers in Saudi Arabia outside of the traditional airline market. Aramco Aviation, the world's largest corporate airline, has owned and operated a fleet of Boeing 737-300s and, more recently, 737-700 aircraft to transport the oil company's employees around the region.

Outside of its airlines, Saudi Arabia is a notable market for Boeing Business Jets and other VIP aircraft. In the past three years, Boeing has sold more than \$1 billion worth of such aircraft to Saudi customers. Overall, the kingdom represents about 70 percent of the BBJ sales to the Arabian Gulf area and has the dominant market share of business jets in the Middle East region.

PHOTOS: (Left) A 707 military aircraft in an Alsalam Aircraft hangar near Riyadh's King Khalid International Airport. **ALSALAM AIRCRAFT (Above)** A Saudi Arabian Airlines 777-200ER (Extended Range). The airline has more than a dozen new models on order, with eight 787s. **BOEING**



BY SEA OR BY AIR

**At age 40,
Harpoon
anti-ship
missile is
more capable
than ever**

By Garrett Kasper

In October 1967, a surprising event changed military maritime strategies around the globe. A tiny, unassuming gunboat sank a 1,700-ton (1,540-metric-ton) destroyer with a Soviet-built Styx anti-ship missile at a then-incomprehensible range of 15 miles (24 kilometers).

During World War II, the German Luftwaffe experienced some success deploying radio-controlled missiles against Allied ships at short range. The Soviet Union advanced this concept into the 1960s with the development of the Styx. And although the United States had been developing anti-ship missiles throughout the 1960s, there now was an urgent need to compete with this new threat.

Originally called the Air-Launched Ship Attack Missile, or ALSAM, the U.S. Navy wanted to create an all-weather, long-range anti-ship missile but with one critical advantage: It wanted the flexibility to launch the same type of missile either by sea or by air. In January 1971, Naval Air Systems Command announced it would take bids for what would aptly become known as "Harpoon."

In June 1971, Secretary of the Navy John Chaffee announced that Boeing heritage company McDonnell Douglas Aeronautics had been awarded a \$60 million development contract as the prime contractor for the Harpoon missile system.

Since then, Boeing has built more than 7,200 missiles for the U.S. and 30 international navies, and Harpoon now accounts for more than \$200 million in annual business for Boeing Military

Aircraft's Missiles and Unmanned Airborne Systems division, headquartered in St. Charles, Mo.

"I've worked almost exclusively on the radar seeker for 26 years, and I've watched Harpoon evolve from its earliest models," said Mike Kelly, Harpoon Test and Evaluation lab technician. "It's very impressive to see current the Harpoon version's improved longevity and reliability and imagine what's yet to come if we're only halfway through this program."

In 2011, as Boeing celebrates the program's 40th anniversary, Harpoon has long been considered the world's premier anti-ship missile.

"Our 40-year relationship with the U.S. Navy on the Harpoon program is a testament to Boeing's commitment to understanding and responding to the warfighter's needs, while consistently delivering results," said Debbie Rub, vice president and general manager for Military Aircraft's Missiles and Unmanned Airborne Systems. "Our workforce's adaptive and versatile spirit continues to keep Harpoon as relevant today as it was when we first introduced it."

Harpoon is more than just the missile, emphasized Jim Young, program manager for Harpoon and its derivative cousin, Standoff Land Attack Missile Expanded Response (SLAM ER). It is an entire system for launching and training the warfighter on a variety of delivery platforms, including more than 600 ships and 180 submarines, 12 different types of

aircraft and even land-based launchers.

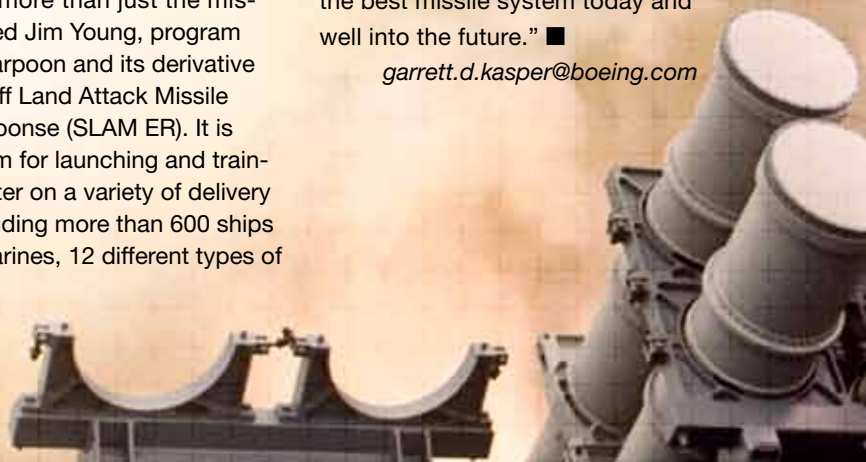
Nearly 300 Boeing team members develop, build, maintain and provide operational support for Harpoon at the St. Charles facility, which opened in July 1979.

"As world threats have evolved, Boeing has improved Harpoon's capabilities," Young said, noting that the latest Block II Harpoons are modern, accurate and reliable and incorporate improvements such as a data link to enhance interoperability.

Boeing's Harpoon team also is working with the Navy to finalize an innovative trade-in process known as the Harpoon Recapitalization Program. As part of this new chapter in Harpoon's life cycle, the Navy can return unused Harpoons to Boeing for refurbishment and recycling in exchange for credits toward the purchase of enhanced missiles, lowering its weapon modernization costs.

"After many decades of cooperation," Rub said, "we continue to find innovative ways to help our Navy customer meet their warfighting needs while enabling Boeing to affordably develop and deliver the best missile system today and well into the future." ■

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PHOTOS: (Below) First Harpoon Block II test launch from USS *Decatur* in May 2001. U.S. NAVY **(Insets, from left)** U.S. Navy sailors load a Harpoon missile onto an aircraft; Boeing employees assemble a Harpoon missile at the St. Charles, Mo., facility, which opened in 1979; the 4,000th Harpoon missile was delivered to the U.S. Navy on Dec. 17, 1986.

BOEING ARCHIVES



As soon as Boeing decided to bid on the U.S. Air Force KC-46 tanker contract, the deadline started for a complete proposal package and the Shared Services Group's Creative Services team went to work.

When the Air Force awarded a development contract in February for 179 next-generation aerial refueling tanker aircraft worth upward of \$30 billion, it represented a major win for Boeing that included more than a year's worth of hard, behind-the-scenes work by Creative Services' Enterprise Proposals Services.

The team was instrumental in putting together the 8,000-page tanker bid that described every aspect of the product and the program. The paperwork eventually filled 32 cardboard boxes.

customers," Nicks said, adding that her satisfaction comes from "knowing you're bringing a lot of opportunities to Boeing and that all your hard work paid off, and it's done and it's out the door."

For the tanker proposal, Nicks said, team members waited for the official Request for Proposal, or RFP, to arrive from the customer. As soon as it did, the team swung into action. They set up servers and provided training for the subject-matter expert authors, led by "book captains." These people, nicknamed "book bosses," worked on specific sections of the proposal. A multi-user Web-based publishing tool, electronic Desktop Proposal System, managed the growing document as it was created.

Making changes is a huge part of

"We were constantly going in and reformatting," Nicks said.

The last big push was printing and binding—seven copies of five separate volumes, with each copy requiring 27 three-ring binders.

Finally, on July 9, 2010, Boeing hand-delivered the proposal for the KC-X tanker competition to the U.S. Air Force at Wright-Patterson Air Force Base in Dayton, Ohio. But the Proposals team wasn't finished.

After the proposal was submitted, the Air Force customer sent in hundreds of requests for additional information, called Evaluation Notices. Nicks said her team worked on these "nonstop" throughout the summer and fall.

"We were doing crazy-fast turnarounds,"

The Proposal

How Boeing won the \$30 billion tanker competition in 8,000 pages—and many weekends of work

By Kathrine Beck

Delivering a \$30 billion winning proposal is all part of the job for Enterprise Proposals Services. In 2010, the team produced 356 other proposals.

"Our folks are frequently asked to work weekends and after hours at a moment's notice," said Roy Okamoto, manager of Enterprise Proposals Services. "They travel a lot. Any personal plans get thrown out the door. These people make so many personal sacrifices. I don't really think that gets recognized."

Kelly Nicks worked most holidays in 2010. But it was worth it, according to the St. Louis proposal coordinator.

"I really like being super busy, and I really like the interaction with our

the process, Nicks said.

"We had over 1,345 graphics and there can be 25 changes on just one graphic," Nicks said. Creative Services graphic designers in St. Louis and at other Boeing sites created the charts and technical drawings.

Some changes came from three team reviews, designated pink, red and gold. The teams attached comments to the document to be addressed by authors. Throughout the process, Creative Services editors in Puget Sound and Electronic Publishing employees in St. Louis pored over every page, correcting grammar, spelling out acronyms and ensuring that formatting and templates were correct.

she recalled. Then came a proposal update, or Final Proposal Revision, which was submitted in February.

Mike Scholes, KC-X Capture Team leader, said Creative Services was a "critical resource" that helped Boeing win the tanker competition.

"I can't tell you how important that was," he said, "and to know our team had that kind of talent and experience leading our proposal development." ■

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“I really like the interaction with our customers ... knowing you’re bringing a lot of opportunities to Boeing.”

– Kelly Nicks, St. Louis proposal coordinator

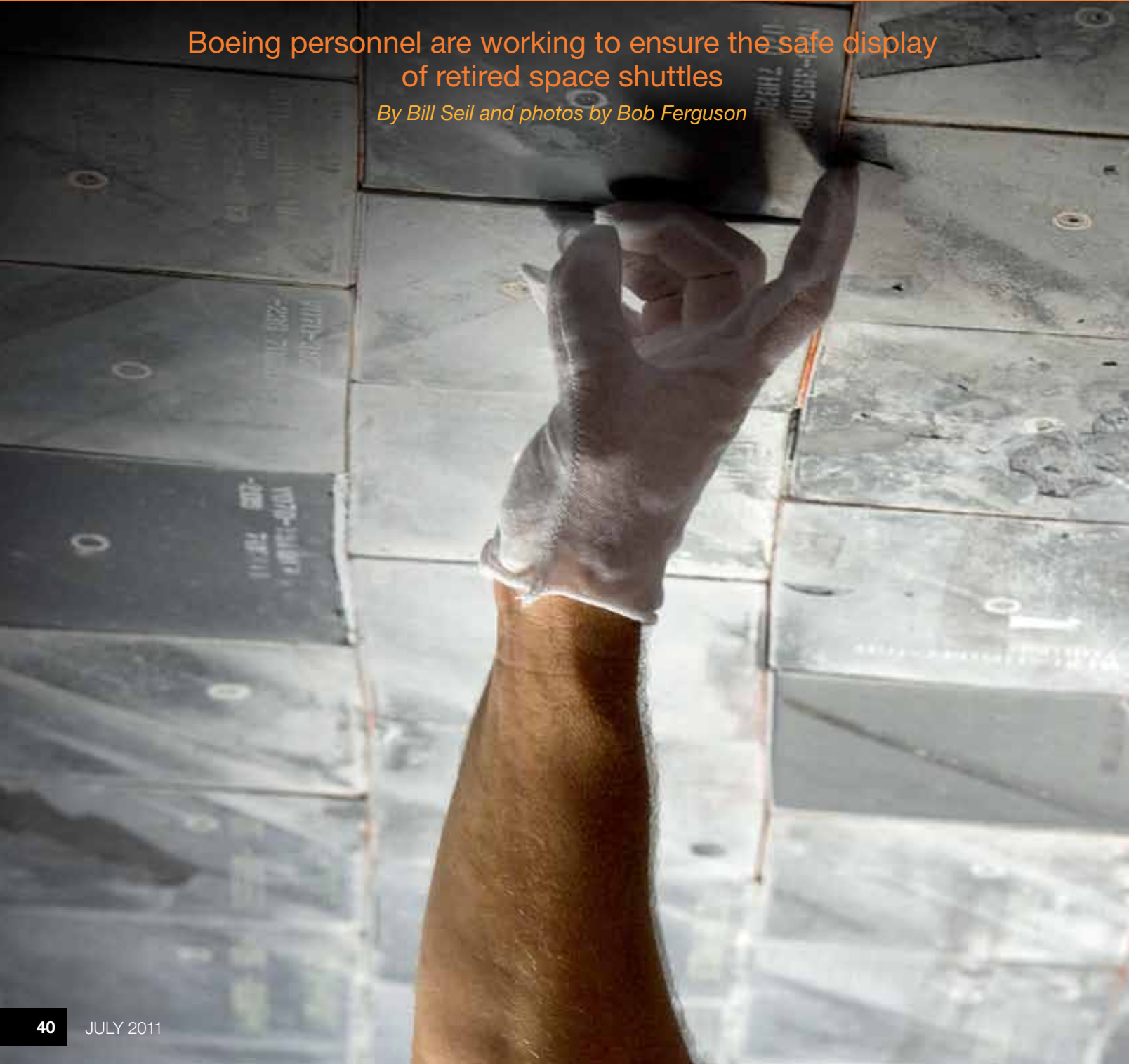
PHOTO ILLUSTRATION: (Top) Boeing team reviews of the KC-X tanker proposal were designated pink, red and gold. **CASS WEAVER/BOEING; BINDER PHOTOS: SHUTTERSTOCK. PHOTOS: (Above, from left)** Boeing St. Louis employees Dave Dolson (from left), Randy Roberds, Mike Scholes and Kelly Nicks box up the finished 8,000-page KC-X tanker proposal in July 2010. **RICH RAU/BOEING**

EXHIBIT

READY

Boeing personnel are working to ensure the safe display of retired space shuttles

By Bill Seil and photos by Bob Ferguson



The final chapter in the space shuttle's long journey of discovery will conclude when the four shuttles are on permanent public display at facilities around the United States.

In April, NASA announced which of a number of competing facilities would exhibit the retired shuttles. Boeing technical leads are working at Kennedy Space Center to support the "safing" of the shuttles as they complete their final missions. Technicians from the United Space Alliance, the joint venture

between Boeing and Lockheed Martin that oversees the day-to-day management of the space shuttle fleet, are following safing procedures that were developed by Boeing.

Bill Roberts, based at Huntington Beach, Calif., is project lead for the Transition & Retirement of the Space Shuttle Orbiter Fleet, a position he has held since 2005. His expertise includes 18 years as vehicle project manager for the shuttle *Discovery* and project manager for recertification of the shuttle

fleet after the *Columbia* accident.

Roberts and his team of transitional technical managers—former subsystems managers for the program—spent more than five years searching every piece of equipment in the shuttle design to identify potential hazards. The goal is to ensure that the retired spacecraft pose no threat to museum staff or the public while on display.

"One key challenge was to write

(Text continues on Page 44)



PHOTO: Boeing space shuttle engineer Randall Carter inspects *Discovery*'s thermal protection tiles at Kennedy Space Center in Florida as part of a detailed process of preparing the shuttle for eventual display at a museum.



PHOTOS: Boeing employees prepare *Discovery* for eventual display at the Smithsonian National Air and Space Museum's Steven F. Udvar-Hazy Center at Dulles Airport near Washington, D.C. Clockwise, from top left: Mike Tseghai, Rachel Wiedemann, Jim Melnick, Essam Esmail, Randall Carter and John Frazer. Also pictured is one of *Discovery*'s tires; the tires will be kept in the condition they were in following the shuttle's final landing earlier this year.

PHOTO ILLUSTRATION: (Far right) Boeing's proposed Crew Space Transportation, or CST-100, vehicle is shown approaching the International Space Station. If selected by NASA, it would ferry astronauts to low Earth orbit destinations. The space station photo was taken by a *Discovery* crew member. NASA



The **next** frontier

The space shuttle program is a tough act to follow, but Boeing visionaries are looking ahead to what comes next in manned spaceflight.

As NASA plans its spacefaring strategy for the coming decades, near-term programs are focused on immediate needs. One of the most pressing requirements is to have a U.S. spacecraft capable of transporting people to and from the International Space Station.

Boeing is competing to build a Commercial Crew vehicle—a reusable spacecraft capable of holding up to seven people. It will dock at the space station, serving as both a round-trip transport and, if needed, a lifeboat to return astronauts to Earth in case of emergency. It will also be available for other destinations in low Earth orbit.

Mike Burghardt, Boeing's manager of spacecraft development for Commercial Crew, said space enthusiasts will notice similarities between the Commercial Crew vehicle and the Apollo command and service modules of the 1960s and early 1970s. But the mission is different and the technology is new.

In April, the Boeing Commercial Crew concept passed an important hurdle when NASA selected

the company to continue into the second round of the vehicle's development program.

"Boeing has the experience and technology to support both NASA's near-term plans and help NASA to be successful in the long term as we reach out to explore beyond Earth orbit," Burghardt said.

Burghardt, who was part of the space shuttle team from 1987 to early 2010, notes that military programs also are setting the stage for future space exploration capabilities.

The X-37B orbital test vehicle, which Boeing built for the U.S. Air Force, is a good example of reusable spacecraft technology, he noted. Like the space shuttle, the X-37B is a winged vehicle that lands on a runway after returning from orbit. But the X-37B is unmanned and much smaller than the shuttle. It completed its first successful de-orbit and landing late last year after a 220-day experimental test mission.

Boeing will continue to work with NASA and the U.S. military to advance the future of space exploration, Burghardt said. But future programs could also involve more international collaboration and privately funded projects.

EXHIBIT

READY

the requirements for safing the vehicles without disturbing their airworthiness,” Roberts said. “After the safing operations are completed at Kennedy Space Center, most of the orbiters must be ferry-flown by 747 to the areas where they will be displayed.”

In 2004, then-President George W. Bush announced that the shuttle fleet would be retired following the completion of the International Space Station. *Discovery* and *Endeavour* have already been retired, and *Atlantis* is scheduled

to complete its final mission this month. *Enterprise*, which was not designed for orbital flight, has been on public display for several years and is not part of the current safing program.

Discovery will be displayed at the Smithsonian National Air and Space Museum’s Steven F. Udvar-Hazy Center at Dulles Airport near Washington, D.C. *Enterprise*, which is currently on exhibit at the Udvar-Hazy Center, will be moved to the Intrepid Sea, Air & Space Museum in New York City. *Endeavour* will be dis-

played at the California Science Center in Los Angeles. *Atlantis* will only require ground transportation, since it will go on permanent display at the Kennedy Space Center Visitor Complex in Florida. The current schedule calls for all four shuttles being moved to their display locations during 2012.

Roberts said Boeing engineers also will be involved in the movement and final display of the shuttles. One of their chief responsibilities will be to ensure that the shuttles are protected



and that nothing is done to disturb their structural integrity.

“Positioning the orbiters for display is likely to be very challenging, because each display site will probably want to orient the vehicle in a different way,” Roberts said. “As the vehicle is being prepared for display, our design team will be available to help resolve any issues.”

Roberts noted that Boeing is preparing a data pack for each of the shuttles that will include a complete history of the vehicle—from assembly

through its various missions. The packs will be presented to the facilities that are displaying the vehicles.

“I look forward to getting out to the display sites and making sure that each of these vehicles is, number one, safe for display,” Roberts said. “Secondly, I’d like to see them displayed in a manner that highlights their design, because this vehicle is unlike any other vehicle that has ever been constructed by man.”

Jim Melnick, a Boeing mechanisms engineer, is among the technical leads

who are preparing the shuttles for display. The son of former shuttle astronaut Bruce Melnick, he has been working on shuttle missions since graduating from college in 2003.

“It kind of brings closure to the whole thing,” Melnick said. “I’ve been able to see the program through to completion, and now I get to see the orbiters off to their final homes.” ■

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PHOTO: John Frazer, Boeing Main Propulsion Subsystem Engineering manager, inspects *Discovery* at Kennedy Space Center for possible damage after its final flight.

SERVICE AWARDS: Boeing recognizes the following employees in July for their years of service.

55 years

Elton Schmitt

50 years

Ralph Brown
Dean Hillard
John Volk

45 years

Delano Aspa
Kent Beran
Michael Bond
Bennie Bowell
Roy Catron
Loren Criss
Frank Friet
Charles Hall
James Hook
Tom Jensen
David Larson
Larry Marshall
Robert Mitchell
Terry Purtle
Linda Reed
Robert Simonds
Max Whittlesey

40 years

Georgia Barnett
William Bower
Philip Cowell
Alexis Cunningham
Melissa Dodson
James Forte
Richard Johnson
Barbara Jones
Carol Joslin
Neil Kessler
Doris Lenox
Leif Logan
David Maynard
Lou Terry
Sandra Wilson
Curtis Wooley

35 years

Richard Austin
Nicholas Baker
Larry Barner
Olyn Boyle
Ronald Brown
Larry Butler
Dennis Cardenas
Marsha Clark
Cynthia Cohens
Jacqueline Collier
William Collins
William Cribb
Lawrence Dawson
Mark Dooley
James Dyke
Russell Evans
Gasper Fatta
David Force

Anita Gale
Jan Graham
Michael Green
Julius Gurly
Michael Hand
Donna Hanneken
Kathryn Hay
Gary Helm
Gary Hunley
Donald Jacoby
Stanley Jankowski
Donna Joiner
David Kawai
John Keich
Thomas Kihlken
Kenneth King
Larry Kinney
Christine Kung
Charles Lee
Geraldine Lewis
Richard Lewis
Robert Maddex
Charles Matlock
Michael Matsumoto
Darr McClure
Earl Moore
Lyle Neal
Don Norris
Janet Oakes
Edward O'Leary
Cynthia Oshiro
Cathy Palio
Thomas Pappas
Ronald Paul
Eugene Peterson
Samuel Piacentini
Michael Plomski
John Redwine
Christian Rice
Raymond Robin
Mary Rodgers
Kenneth Russworm
Clifford Ryffel
Bradley Scott
Eugene Seiffert
Britt Sheets
William Slanina
James Spears
Donald Stone
Carol Trendley
Gerard Trepagnier
George Ward
Pichit Wongchinda
Bruce Wyciskala
Jerome Zlaket
Maurice Zollner

30 years

Ronald Adams
Steven Ai
Kevin Aleshire
Michael Alexander
John Allen
Thana Alusi
Macedonio Anaya

David Anderson
Robert Anderson
Lawrence Anzalone
John Arnts
David Adler
Daniel Bailey
Larry Barber
Paul Barrett
Susan Barrett
John Benning
Michael Bentz
Steve Berg
George Berry
Danny Bienvenu
Anne Blaikie
Thomas Boulanger
Paul Brenner
Herbert Bridgeman
Larry Brossart
Nick Buenbrazo
Richard Calverley
Jeffrey Campbell
Matthew Cawthorne
Richard Chao
Jimmy Chase
Leih-Wei Chen
Gary Clark
Sharon Collier
Edgar Collins
Ricky Conzelman
Douglas Crawford
Michael Davis
Steven DeCoux
David Dessenberg
Randall Dick
John Dickinson
Douglas Dietz
Roy Dillon
Dennis Dobrowski
William Dolezal
Ronald Dorband
Jonathan Duquette
Stephen Dutrow
David Earle
Michael Eckles
James Edwards
Charles Elmer
Mark Elsemore
Edward Emery
Steven Eng
Kevin Escue
Glen Evans
Vernon Evans
Steven Exe
John Fang
Stanley Feldman
Michael Florian
Gail Foley
Scott Foster
Richard Fowler
Karin France
James Freebury
Rick Funkhouser
Patricia Gaddy
Pamela Giroux
Ronald Glover

David Gonzalez
Bryan Goodier
Brent Gorman
Jefferson Gough
Guy Granger
Donald Graves
Steven Gray
John Griffith
Ronald Grimes
John Gunderson
Cindie Gunwall
Jerome Gurke
Hamilton Ha
Lisa Hagmaier
Clifford Halstead
James Hamilton
William Hanna
Susan Hansen
Bruce Harkness
Barbara Hawkins-
Johnson
Richard Hawkinson
David Haworth
Joel Hays
David Heck
Michael Hegger
Harry Hertzberg
Daniel Higgs
David Hoffman
Lissa Hollenbeck
James Holloran
Robert Holz
Jung Howe
Peter Hughes
Daniel Hull
Darrell Huntley
Steven Hutchings
Lynne Ichiyama
Ricky Inman
Bryan Jobs
Kelly Johnson
Larry Johnson
Marty Jolly
Richard Juneman
Peter Jung
Steven Kakalecik
James Kayser
Robert Keever
Paul Kiehn
Daniel Kim
Derrick Kimbrough
Lane Kinoshita
Stephen Kirsch
Istvan Kiss
Karl Knickrehm
Wyatt Knox
Fredrick Knutzen
John Kocina
Neil Kocina
Stephen Kosar
Kenneth Kragness
Jim Kramer
Joel Krohn
Carl Kunstmann
Garland Kurz
Wieslaw Kwiecien

David Kwong
Cynthia Landry
Walter Langkait
Marijane Lansing
Glen Larocca
Glenn Laroya
Charles Le
Kathleen Lechner
Don Lee
Loren Lee
Stanley Lefever
James Leigh
Craig Leroy
Leroy Lewis
Connie Licciardone
Mark Liffing
John Linden
Bruce Lindstrom
Jean Liu
Alejandro Lopez
Deborah Lorvick
Michael Lucas
Mark Macke
Christopher Maddox
Richard Madison
Joseph Magdaleno
Mark Magnuson
Deborah Matthai
Dennis Mayfield
Brian McGrath
Irene McCallister
James McClaffin
Susan McClelland
Rudy McDaniel
Patrick McGee
Dennis McInnis
Derek McLuckey
Timothy McMahan
Daniel Meadows
Ronald Medlin
Gary Meier
Susan Meisch
Cathleen Mettler
Antonio Micale
Bruce Micklewright
Robert Miksit
Paul Miller
James Mills
Randy Mincks
Luke Montoya
David Moore
William Moorefield
William Moritz
Douglas Mosier
Timothy Murphy
Lorraine Neff
Chris Nelson
Jay Nelson
Roxanne Nelson
Timothy Nelson
Robert Newell
Anthony Newman
Ha Nguyen
Viet Nguyen
Edward Nicholls
Scott Ohrberg

John O'Leary
Patricia Orf
Susan Orlicky
Leslie Otterson
James Ouderkirk
Bruce Owens
Charles Packer
Ronald Patton
Alan Pennell
Barbara Perry
Jerry Perry
Gregory Phillips
Jeffery Pierce
Robert Piszker
Brian Plotkin
Roger Poortvliet
Charles Powell
Dinesh Pradhan
Teresa Preston-Patella
Steven Raddatz
Bret Ransom
Susan Reid
Gregory Rensch
Paul Richter
Clyde Ring
William Roach
Sandra Rominger
Christopher Rood
Kenneth Rossitto
Martin Ruddy
Mark Ruhl
Roney Rustia
Joseph Samocho
Damien Sanchez
James Schinke
Marylou Schoolcraft
Thomas Schulz
Eric Schulze
Ernest Schuster
Eric Schwartz
David Searcy
Kip Sears
Edward Segura
Richard Shaw
Steve Sheeran
Paul Simonsen
Richard Sites
Karen Skaggs
Kenneth Slade
Douglas Slater
Kevin Smith
Roger Smith
Steven Smith
William Smith
Kurt Sontag
Michael Spirko
Doraine Stafford
Robert Steele
Michael Stevens
John Stoesz
Donna Stribling
Elwood Stringer
Rebecca Stults
Mark Sullivan
Kenneth Sun
Robert Swanson

SERVICE AWARDS: Boeing recognizes the following employees in July for their years of service.

Raymond Swindler
Steven Swope
David Thomas
Perry Tominaga
Daniel Towns
Vernon Toyoda
Simon Tran
Robert Troll
Sandra Trueman
Kevin Turnbull
Jane Uchimura
Eugene Vanbreusegen
Andrew VanDress
Janet Vannoy-Galm
Howard Veith
Melodie Vogt
John Vreuls
Dau-Sing Wang
John Waters
Cecelia Watkins
Mark Weeks
Robert Weinmann
Lynda Weldon
Philip White
Bruce Wight
Peter Wilcox
Stephen Wilkening
Loretta Wilkinson
Arthur Williams
Ralph Wilson
Roger Winiecki
John Wittenberg
Arlen Woods
John Woolworth
John Wroe
Frances Yamasaki
Gretchen Yoder
Grant Zenkner
Dennis Zimmerman
George Zivojnovich
Eric Zube

25 years

Kent Achelpohl
Robert Adams
Jon Akers
David Albano
Ricki Alderson
Bradley Alley
Samuel Almelia
Dwayne Amaral
Charles Anderson
James Anderson
Sean Anderson
Catherine Andrews
James Angelos
Patricia Armstrong
John Atwell
Chris Au
Waddah Awad
Harold Bailey
James Baker
Melissa Baker
George Balbin
Karen Baldtrip

Alexander Baldwin
David Barker
Michael Barnett
Dean Barron
Darryl Barton
Paul Battraw
Scott Beabout
Walter Beauchamp
Andrew Beck
Steven Beland
Douglas Benson
Richard Benson
John Berglund
Glen Bergman
Kathy Bergman
Duane Bickham
Linda Billig
Roger Birkner
James Biteman
Deborah Blomberg
Royal Boggs
James Boileau
John Bonato
Gary Bond
Richard Boren
Paul Bornais
Micheal Borsheim
Delbert Bostwick
Karen Bower
Stanley Bozarth
Frances Bradley
Robert Brannon
Suzan Brennan
Carol Brickman
Eddie Bright
Ernesto Briseno
Elizabeth Brison
Franklin Bromley
Wayne Brough
Charles Brown
Stanley Brown
Charles Broyles
Robert Buffo
Lanh Bui
Cynthia Buldis
Ray Bullock
Ian Burford
Robert Burkentine
Matthew Bush
James Butz
John Byington
Dennis Cajili
Turgut Cakiraga
Daniel Calhoun
Michael Callahan
Michelle Callaway
Forrest Callicutt
Victor Cao
Dana Carlson
Roger Carlson
Matthew Carter
Anthony Case
Isidro Casillas
Corey Cassell
Vincent Castagna
Diana Castano

Brent Cawley
Michael Cebula
Daniel Cetkovski
Fai Chan
Kou-Chuan Chang
Kwun-Wing Cheung
Brian Chippendale
Steven Chisholm
Mark Chrestler
Randy Christenson
Jin Chun
James Clark
Lynn Clark
Colleen Clemons
Christopher Cline
Ron Coke
Meiling Colie
William Conchi
Corey Cooley
Steven Cooper
Robert Corfman
Michele Cornell-Potts
Delven Corpuz
Anne Coxon
Michelle Crivella
Floyd Cruz
Sandra Cunningham
Donald Dagostino
Teena Dalit
Regina Daly
Keith Dana
Mark Dana
Sok Dang
Myrna Dasalla
James Davenport
Betta David
Louis Davidson
Sergio Davila
Brian Davis
Donna Davis
Kevin Davis
Gregory Davison
Fernando De La Torre
Dorothy Deangelis
Kathleen Delong
Rowena Deluz
Samuel Denham
John Denzer
Saverio Desimone
Greg DeWilde
Elizabeth Dietz
Paul Dimario
Joseph Dinan
Sheila Dixon
Karlin Dodd
Steven Dodd
Todd Doerflinger
Douglas Donnelly
Danny Doronio
Barry Dougherty
Joseph Dougherty
Terrence Douglas
Dennis Doutre
Thomas Downey
William Downs
David Dressel

Stuart Duckworth
Gary Dudley
Mitchell Dugger
Amanda Duncan
Carl Dunn
Patrice Dupass
Charles Dutch
Donald Duyungan
William Eckberg
Scott Edmunds
Stephen Edwards
Edward Eisen
Thomas Elliott
Gary Ellsberry
Gina Emery
Ronald Engelhardt
Ralph Engstrom
Tina Escobar
Clifford Esguerra
Alberto Estaililla
Rebecca Evans
Robley Evans
Michael Evens
Daniel Farrell
Michael Faucher
Brenda Fehr
John Ferguson
Sam Ferguson
Jerry Fernandez
Robert Fiano
Larry Finch
Dale Fitz
Robert Flowers
Richard Floyd
Eugene Flynn
Jeffrey Forbes
Ronald Fornator
Robert Fortin
Timothy Fratus
Cynthia Frenette
Lois Friedrich
Robert Funke
David Funsinn
Ildefonso Galimba
Stuart Galt
Mark Gamel
Cindy Garay
Jay Gettis
Jeffrey Gibson
Chris Gimbernat
Douglas Glanzer
Terri Gleason
Kyle Goff
Renato Gonzales
Rebecca Gorman
Geoffrey Gouette
Robert Gousy
Salvatore Gracy
Stephen Graham
William Graham
Brandon Grazionale
Phillip Green
Gary Grimes
Richard Gross
Christy Groves
David Gubbels

Mark Gucker
Richard Guth
Steven Guynn
Hans Gyswyt
David Haab
Vincent Haag
Larry Hall
Noah Ham
Randall Hamline
Barry Hance
Paul Handel
Cornelius Hang
Thomas Hankley
Richard Hanna
Paul Hansen
Lynn Hanson
Donna Harper
Randall Hasebe
Hal Hay
Patricia Haycock
Donna Heckart
Timothy Hell
David Henderson
Mark Henderson
Rae Henderson
William Hermann
Charlene Herron
Timothy Herzer
Stephen Heskett
Frank Hess
Yukie Higashi
Brian Hill
Claire Hillis
Jon Hinchliff
Charles Hix
Peter Hoang
Matthew Hodges
Rachel Hofferbert
Donna Hoffman
David Holland
Christopher Honer
Russell Hossack
George Huddleston-
Kohler
Thomas Humphrys
Mike Hund
Dale Huselton
Max Hussey
David Inman
Kevin Isdell
Steven Ivy
Susan Jacintho
Diane Jackson
Arne Jacobsen
Diane Jacobson
Hamid Jamshidiat
Victor Jarosz
Wayne Jensen
Kathy Johanning
Mark Johanson
Douglas Johnson
Eric Johnson
Ronald Johnson
Scott Johnston
Patty Jones
Michael Judkins

Douglas Keating
Paul Kegley
Kenneth Kehnemund
Alan Kernik
Benjamin Kershman
Mary Kesterson
Shirley Keys
Charles Kiley
Jason Kim
David Kinney
Melinda Kleine
Dean Kloes
Jolinda Knight
Bruce Kolarik
David Koon
Brian Kopp
Gregory Korando
Kristen Koscal
Scott Kozak
Daniel Kredit
Jennifer Kressbach
Judith Kross
David Kulp
Timothy Kuo
Margaret Lacher
Angie Lam
Frederic Lambert
Craig Lamm
Adam Lange
Dale Larson
Paul Larson
Stuart Laughlin
John Lauman
John Lawrence
Tuan Le
William Leavitt
Joseph Lee
Michael Lempke
William Leonard
Lee Lepper
Robert Levy
Michael Lincoln
Carolyn Loew
Steven Lohe
Vicki Lord
Henry Loureiro
Carol Love
Leslie Lovett
Antonio Loya
William Lueker
Patrick Lui
Ba Luong
Tai Ly
Edward Lynch
Leona Lyon
Junis MacDonald
Ronald Maesner
Gary Maher
Nicholas Marble
Jeffrey Marker
Alan Markus
Susan Marth
Brian Martin
Larry Masden
Thomas Mast
Michiko Masters

SERVICE AWARDS: Boeing recognizes the following employees in July for their years of service.

Antone Matkovich
 Jeffrey Matzdorf
 Annette Mauldin
 Laurie Mayorquin
 Nancy McBride
 Donald McCann
 David McCartney
 Michael McClintock
 Colleen McClure
 Edward McClure
 Shawn McConville
 Steven McCraney
 Brian McDaniel
 Patrick McDonald
 Daniel McGinty
 Mark McKay
 Linda McKenzie
 Victor Melville
 Raymond Messer
 Patrick Michaud
 Charles Mifflin
 Daniel Miller
 Roger Mills
 Susan Mize
 Steven Monson
 Wendy Montgomery
 Florian Moody
 Gabriel Moore
 Margaretta Moore
 Thomas Morris
 Nicholas Morton
 Joel Moser
 Jeff Mugler
 Csaba Mullner
 Rebecca Munro
 Ken Murabata
 Daniel Murphy
 James Murphy
 Kenneth Murray
 Timothy Mushkin
 Terry Myers
 Manuel Nacario
 Mark Nakamura
 Patrick Nangle
 Joyce Neiman
 Joseph Nelson
 Rae Nelson

Richard Nelson
 Paul Nesbitt
 Long Nguyen
 Carolyn Nichols
 Joe Nichols
 Lori Nicolaus
 Kenneth Niedermeyer
 Robert Nielsen
 Glenn Niemela
 William Niemez
 Vincent Noice
 Kenneth Norris
 Dale Oberender
 Margaret O'Donnell
 Ancel Offutt
 Robert Ogden
 Michael Oittinen
 Cheryl Okunrinboye
 James O'Loughlin
 Shelly O'Sullivan
 Lawrence Otani
 Troy Ottele
 Edmund Owens
 Jennifer Pagnotto
 Gil Palanca
 John Palmer
 Leta Patterson
 Mitchell Paynter
 Mark Pearia
 Martha Pearson
 Timothy Peebler
 Thomas Pelikan
 William Pepper
 Forrest Peringer
 Allen Perkins
 Michael Petersen
 Melvin Peterson
 Michael Pham
 Dzung Phan
 Katherine Phan
 Hue Pierce
 Gregory Pierre
 Gary Poage
 Linda Potter
 Mark Prejean
 Susan Presley
 Deborah Prickett

John Rader
 Scott Radford
 Bennett Rael
 Jose Rams
 Steven Rankin
 William Rankin
 Timothy Ranta
 Oscar Rarama
 Philip Ratcliff
 Richard Rawls
 Darryl Redmond
 Catherine Reed
 Brad Reeves
 Craig Renfrow
 Gilbert Reyes
 Gregory Reynolds
 Todd Rhodes
 Matthew Riley
 Darrell Ringer
 Tony Rios
 Dennis Robb
 Geoffrey Robinson
 Andres Rodriguez
 Richard Roebke
 Christine Roemer
 John Rose
 Kevin Rose
 Robert Rothschilds
 John Rowley
 Jeffrey Rudolph
 Joan Rusch
 Richard Ryan
 Dale Sadoski
 Edward Sadvar
 William Saindon
 Thomas Salinas
 Harminder Saluja
 Maryanna Sanders
 Daniel Sargent
 Karen Sawyer
 Dennis Scherping
 Jerry Schiazza
 John Schlachtun
 Leland Schmidt
 Clayton Schneider
 Douglas Schuster
 Mark Schwarztrauber

Richard Scott
 Richard Scurr
 Lisa Segesta
 Dean Sepstrup
 Marek Serda
 Raj Shah
 Patrick Shea
 Roger Sherwood
 John Shih
 Glenn Shilman
 Larry Shreve
 David Shuck
 Kelly Shuping
 Gerald Sides
 Rocky Siegel
 Shannon Siegel
 Jack Simko
 Leslie Simons
 Deborah Simpson
 Timothy Skilton
 Michael Sloup
 Steven Smiley
 David Smith
 Michael Smith
 Shawn Smith
 Stephen Smith
 Mark Smock
 Randy Soderstrom
 Richard Sorby
 Michael Sorenson
 Gregory Southard
 Michele Southern
 Lew Spencer
 Steven Stadick
 Gregory Staloch
 Richard Stanifer
 James Stapelman
 Brian Starkey
 Jay Steck
 Robert Stevens
 Billy Stevenson
 Thomas Stewart
 Douglas Still
 Sherman Stockie
 Dean Stowe
 Bennet Strauss
 Fred Stringham

Joseph Stumpf
 Craig Sundine
 Gregory Swallow
 Steven Sweet
 Paul Swett
 Carla Swihart
 Duane Tahrán
 Deborah Talbott
 Brian Talley
 Yutak Tang
 Lester Tardiff
 Gene Tascione
 Bradley Taylor
 Michael Teal
 Darcy Terin
 Gloria Terry
 Robert Thoma
 William Thoma
 James Thomas
 Matthew Thomas
 Bruce Thompson
 Dennis Tilzey
 Paul Toland
 Muriel Tolerico
 Jeffery Toolson
 Thomas Tosch
 Michael Toso
 My Thi Tran
 Joseph Tseng
 David Tucker
 Daniel Tulcan
 Alfred Turnbull
 Roger Tushoski
 David Tweed
 Jeffery Udd
 Michael Umbach
 Russell Unruh
 Mark Uyeda
 John Uzarski
 Shelby Valliant
 Doug Van Wey
 Pamela Vangerpen
 Robert Varas
 James Vaux
 Darlene Vestre
 Stephen Vickroy
 Randy Vierra

Quang Vu
 Keith Wachter
 Scott Walker
 Terry Walter
 Robert Ward
 Thomas Warne
 Dennis Warner
 Janice Waters
 Christelle Watkins
 Rhonda Watkins
 Mark Wattis
 Debora Weaver
 Gary Weber
 Paul Weber
 Phillip Weible
 Louis Weiser
 Jennifer West
 Richard West
 Cathy Whiddon
 David White
 Kevin White
 Lorrie White
 Yvonne White
 Russell Whitten
 Robert Whittington
 Lawrence Wickline
 Debora Wigley
 James Wilce
 Sheldon Wildermuth
 Michael Williams
 Patricia Williams
 Harold Wilson
 Joe Wilson
 Steven Winn
 Laramie Wright
 Brian Wutzke
 Theodore Yeung
 Kab Yoon
 Celeste Young
 Steven Ytterboe
 Paula Zarich
 David Ziegler

RETIREMENTS: The following employees retired in May from The Boeing Company.

Elaine Abel, 24 years
 Abdul-Aleem Ahmed, 33 years
 Catherine Allen, 18 years
 Daniel Almond, 22 years
 Ronald Almond, less than 1 year
 Mykal Amare, 27 years
 Kathleen Anastasiadis, 6 years
 Alan Anderson, 42 years
 Robert Arne, 39 years
 Robert Arvizu, 42 years
 Deborah Askew, 22 years
 Craig Baarstad, 32 years
 Richard Bailey, 23 years
 Dennis Baird, 31 years

Robert Baker, 19 years
 Elaine Balentine, 6 years
 Bruce Baranick, 36 years
 Dale Barnhart, 32 years
 Sharon Barnhart, 32 years
 Leroy Basher, 33 years
 Jane Becker, 26 years
 Forrest Beckwith, 22 years
 Daniel Beilman, 42 years
 Terri B'Hymer, 25 years
 Ronald Blouin, 32 years
 Mary Boles, 22 years
 Daniel Bourdon, 10 years
 Timothy Braxmeyer, 31 years

Cathy Bunker, 43 years
 Eugene Bunker, 20 years
 Ronald Burton, 40 years
 William Bytheway, 21 years
 Steven Campbell, 30 years
 Duane Case, 33 years
 David Clingan, 29 years
 Linda Coffin, 26 years
 Susan Cox, 25 years
 Glenn Crawford, 33 years
 Bonita Crumpton, 3 years
 Sharon Culbertson, 19 years
 Glynis Day, 10 years
 Wayne Denningmann, 29 years

David Doering, 32 years
 Gary Doty, 22 years
 William Dykes, 25 years
 Euliojio Flores, 33 years
 Steve Fried, 5 years
 Russell Gale, 24 years
 Gary Geddes, 23 years
 Karon Gilbertson, 25 years
 John Gjerdrum, 34 years
 Walter Gutsche, 19 years
 Stefan Haller, 29 years
 Gregory Hammond, 11 years
 Janet Hampton, 25 years
 Paul Hebert, 19 years

RETIREMENTS:

The following employees retired in May from The Boeing Company.

Clifford Hensley, 22 years
 Edwin Hesner, 25 years
 Richard Hilscher, 27 years
 Edward Hinojosa, 11 years
 John Hulbert, 30 years
 Sherman Jaffe, 22 years
 Toni Jilek, 30 years
 Beverly Johnson, 13 years
 Richard Johnson, 22 years
 John Kaeshoefer, 36 years
 Merlin Katolas, 32 years
 Thomas Keating, 28 years
 Anthony Keeton, 31 years
 James King, 5 years
 Charles Kitzmiller, 37 years
 David Knapp, 8 years
 Robert Knievel, 32 years
 Dean Koecke, 25 years
 Charles Korba, 44 years
 Jean Krissman, 39 years
 James Landry, 27 years
 Marjory Langdahl, 33 years
 Robert Langsdorf, 37 years
 William Larsen, 34 years
 Edward Latimer, 33 years
 Ellis Latimer, 20 years
 Chamnian Leangsongchai, 18 years
 Larry Ledford, 18 years

James Lee, 25 years
 Ernest Lefebvre, 37 years
 Charles Lohse, 33 years
 Rosemary Loper, 30 years
 Michael Lovelace, 44 years
 Patricia Lunderman, 38 years
 Roberto Maanao, 22 years
 Kathy Marler, 36 years
 Patrick McClelland, 38 years
 Rita McCorkle, 17 years
 Vincent McFaddin, 36 years
 Earl McIntyre, 33 years
 Emma McLemore, 20 years
 Robert Meek, 30 years
 Steven Meintz, 32 years
 Viola Meintz, 40 years
 William Mitchell, 21 years
 Charles Moore, 45 years
 Kay Moore, 40 years
 Michael Mueller, 25 years
 Mitchell Munday, 31 years
 Daniel Murphy, 30 years
 David Nearing, 30 years
 Brenda Oishi, 20 years
 Melvin Overhulser, 25 years
 Shelly Parks, 31 years
 Arie Passchier, 43 years
 Sharon Peters, 33 years

Mark Pethe, 30 years
 Thomas Pfaff, 32 years
 Cheryl Platzer, 21 years
 Howard Porter, 31 years
 Bruce Quinn, 31 years
 Gilbert Ramirez, 12 years
 Anton Ranuio, 5 years
 James Ratley, 21 years
 James Reno, 28 years
 Gerald Rohr, 33 years
 Mary-Lou Ross, 14 years
 Jon Ruopsa, 22 years
 Joseph Ruzowicz, 13 years
 Richard Sackman, 38 years
 Hattie Sapp, 21 years
 Steven Sargeant, 34 years
 Evelyn Schauner, 29 years
 Ann Scott, 15 years
 Elizabeth Scott, 21 years
 Harold Scott, 25 years
 Bharat Shah, 30 years
 Tilak Sharma, 32 years
 Jen-Mei Shih, 28 years
 Steven Shimamoto, 28 years
 Thomas Simco, 14 years
 Jacqueline Smith, 25 years
 Steven Stanford, 20 years
 Sandra Stedman, 38 years

Michael Stollings, 24 years
 Daniel Straney, 28 years
 Thomas Sutherland, 35 years
 Hong Tang, 24 years
 Ruben Tarin, 27 years
 Jewel Tate, 32 years
 Andrew Thompson, 26 years
 James Timmons, 7 years
 Kwan Tong, 32 years
 Steven Trainer, 17 years
 Kathryn Treiber, 30 years
 William Tucker, 25 years
 Gary Unterwegner, 28 years
 James Vacca, 47 years
 Barbara Vennman, 13 years
 Solita Villaflor, 20 years
 Richard Vonwald, 37 years
 Ramon Warren, 32 years
 John Webb, 23 years
 Deborah Wellman, 29 years
 Bonnie Whiting, 25 years
 Earnest Williams, 38 years
 John Williams, 32 years
 Michael Williams, 12 years
 Warren Williamson, 33 years
 Wilfredo Yee, 23 years
 Yen Yee, 8 years

If you have an anniversary or retirement approaching and do not want your name printed in Boeing Frontiers, please send an email to boeingfrontiers@boeing.com at least 90 days prior to your milestone date.

IN MEMORIAM:

The Boeing Company offers condolences to the families and friends of the following employees:

Leroy Baker, machinist; service date Nov. 13, 1980; died June 3

Dorothy Bybee, procurement coordinator; service date March 2, 1970; died April 9

Gregory Coleman, factory service attendant; service date Sept. 24, 2010; died May 27

John Dechene, assembly mechanic; service date April 21, 1988; died May 31

Lawrence Gusa, manufacturing planner; service date July 18, 1988; died April 9

Michael Hoag, procurement; service date July 4, 1983; died April 10

Lewis Howells, project manager; service date Oct. 24, 1997; died May 25

Dae Kim, engineer; service date Jan. 14, 2001; died May 29

Arthur Lowell, engineer; service date July 12, 1982; died May 30

Verlyn McGrath, accountant; service date Sept. 20, 2005; died April 8

Robert Nowak, engineer; service date July 7, 1985; died May 28

Scott Shearer, staff analyst; service date Aug. 22, 1983; died May 27

Robert Spires, system engineer; service date June 22, 2000; died April 9

Robert Susanka, technical data designer; service date June 30, 1980; died April 5

Sarah Wall, accountant; service date Feb. 11, 2011; died June 5, 2011

ETHICS QUESTIONS?

You can reach the Office of Ethics & Business Conduct at 888-970-7171; fax: 888-970-5330; website: <http://ethics.whq.boeing.com>

IAM PROMOTIONS

No promotions listed for periods ending May 27 and June 3, 10 and 17.

RETIREE QUESTIONS?

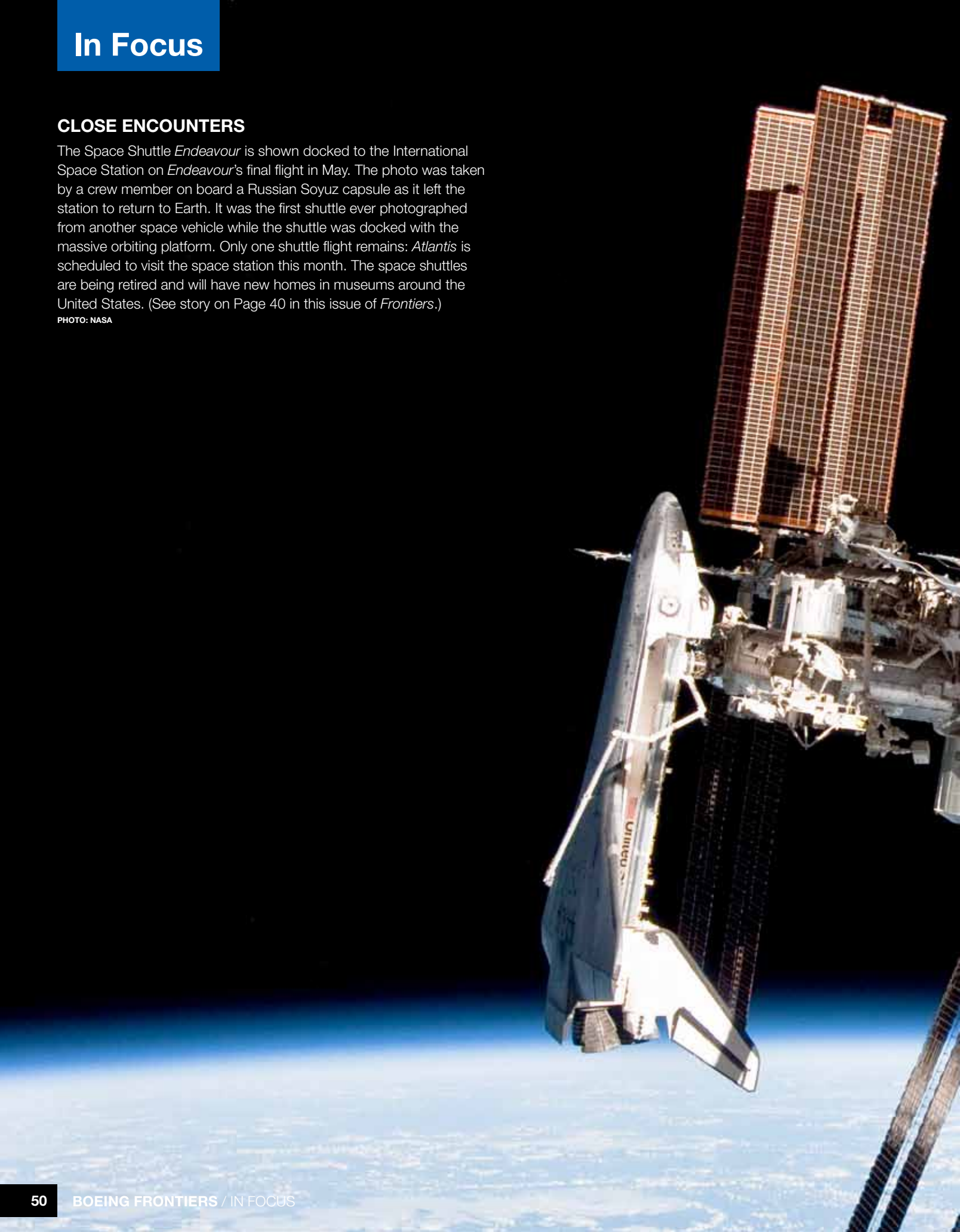
Call Boeing TotalAccess at 866-473-2016 and enter your BEMS ID or Social Security number. When asked, "How can I help you today?" say "Health & Insurance" or "Savings" or "Pension" and enter your TotalAccess password. If you do not know your password, say "Password Administration" and follow the instructions.

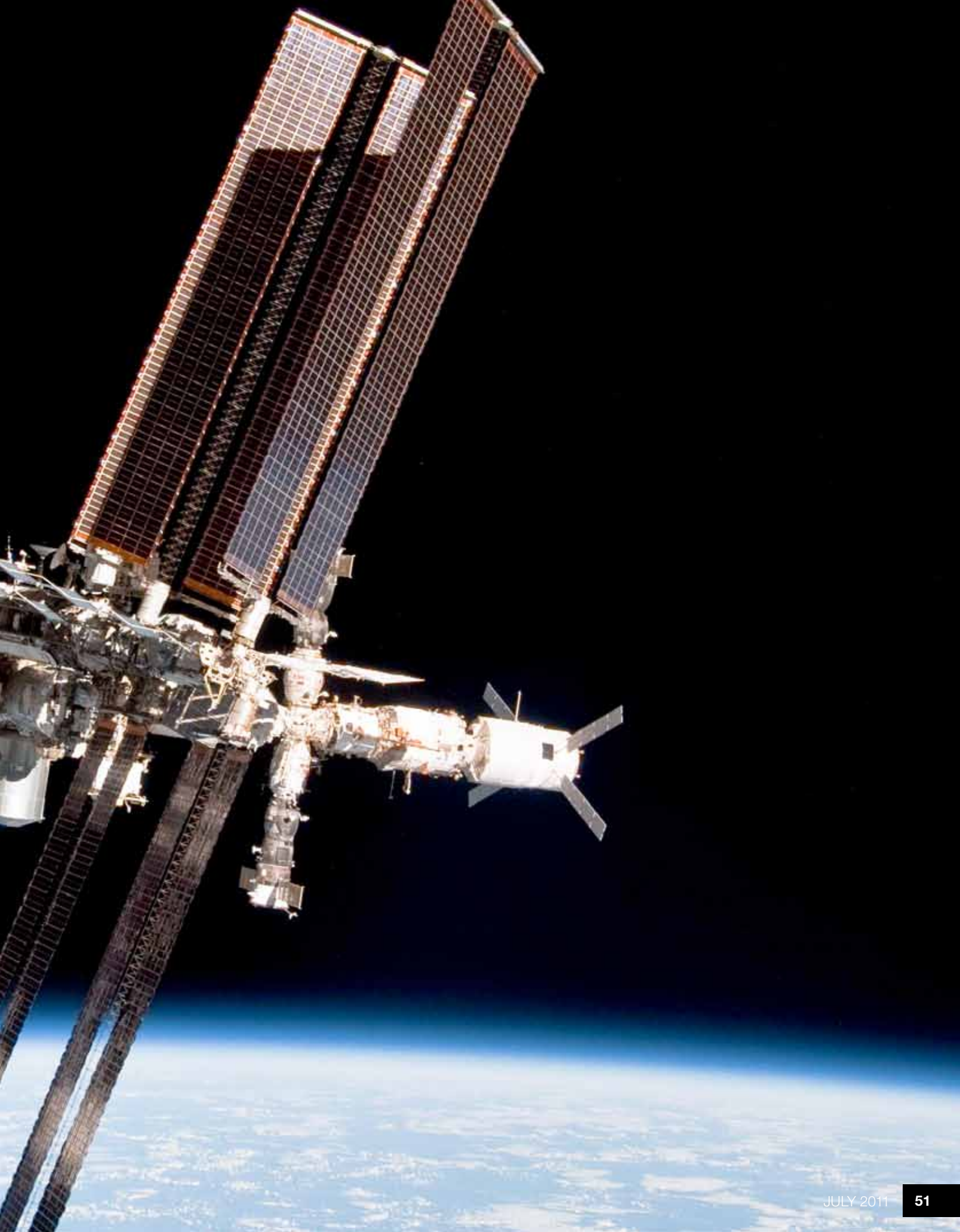
Hearing-impaired callers with a telephone typewriter can access TotalAccess TTY/TDD services at 800-755-6363.

CLOSE ENCOUNTERS

The Space Shuttle *Endeavour* is shown docked to the International Space Station on *Endeavour's* final flight in May. The photo was taken by a crew member on board a Russian Soyuz capsule as it left the station to return to Earth. It was the first shuttle ever photographed from another space vehicle while the shuttle was docked with the massive orbiting platform. Only one shuttle flight remains: *Atlantis* is scheduled to visit the space station this month. The space shuttles are being retired and will have new homes in museums around the United States. (See story on Page 40 in this issue of *Frontiers*.)

PHOTO: NASA







**TOGETHER
WE FLY HIGHER.**

Boeing is undergoing rapid growth in the UK developing next generation advanced technologies supporting various MoD programmes. We have unique opportunities in engineering, IT, supply chain, business and finance. Join us and together we'll reach new heights.

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