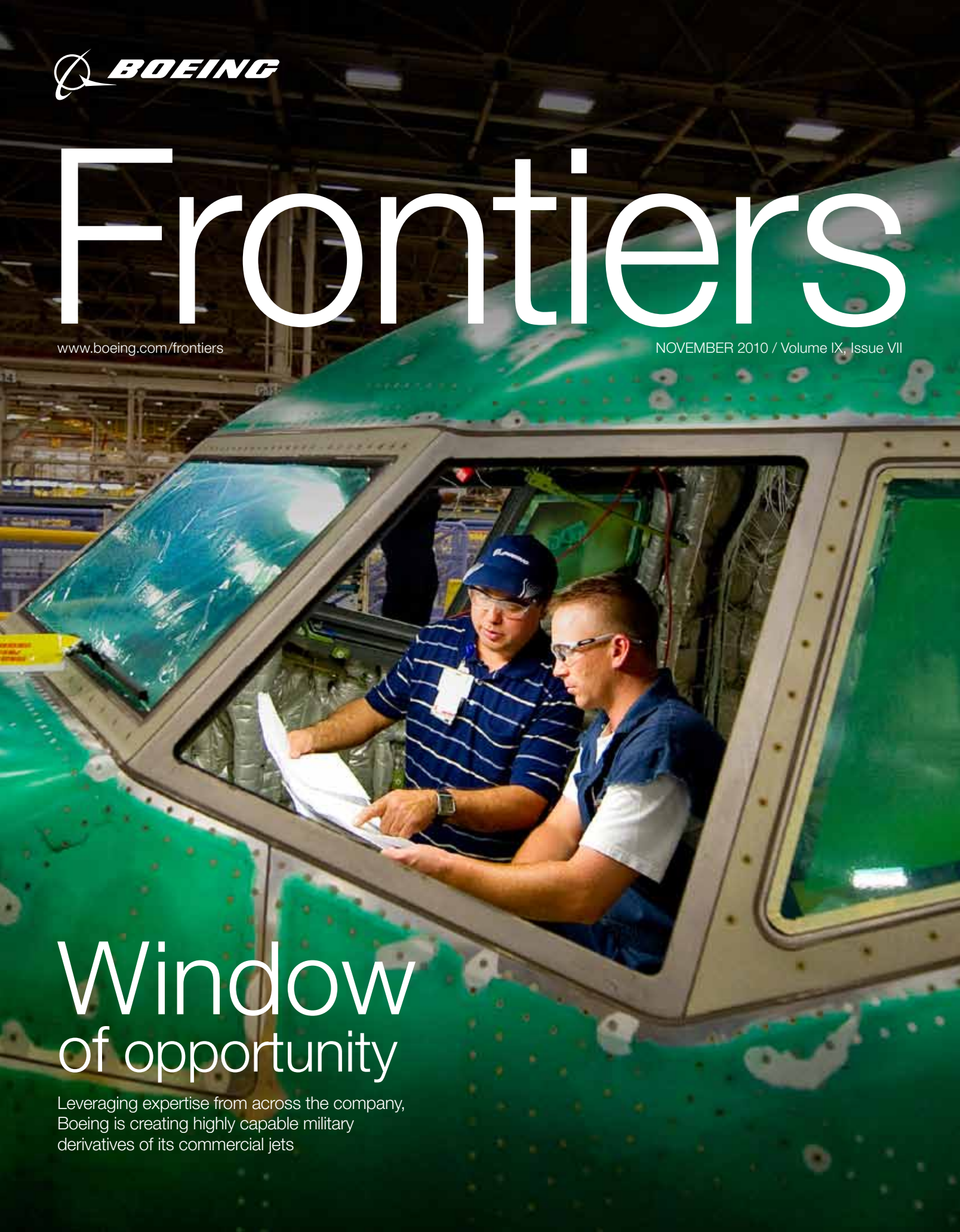

BOEING

Frontiers

www.boeing.com/frontiers

NOVEMBER 2010 / Volume IX, Issue VII

Window of opportunity

Leveraging expertise from across the company, Boeing is creating highly capable military derivatives of its commercial jets

800与6000

携手飞翔

第800架波音飞机开始在中国服役，这是波音对中国的承诺。全球约6000架波音飞机安装了中国制造的零部件，这是中国对世界的承诺。

BOEING

On the Cover

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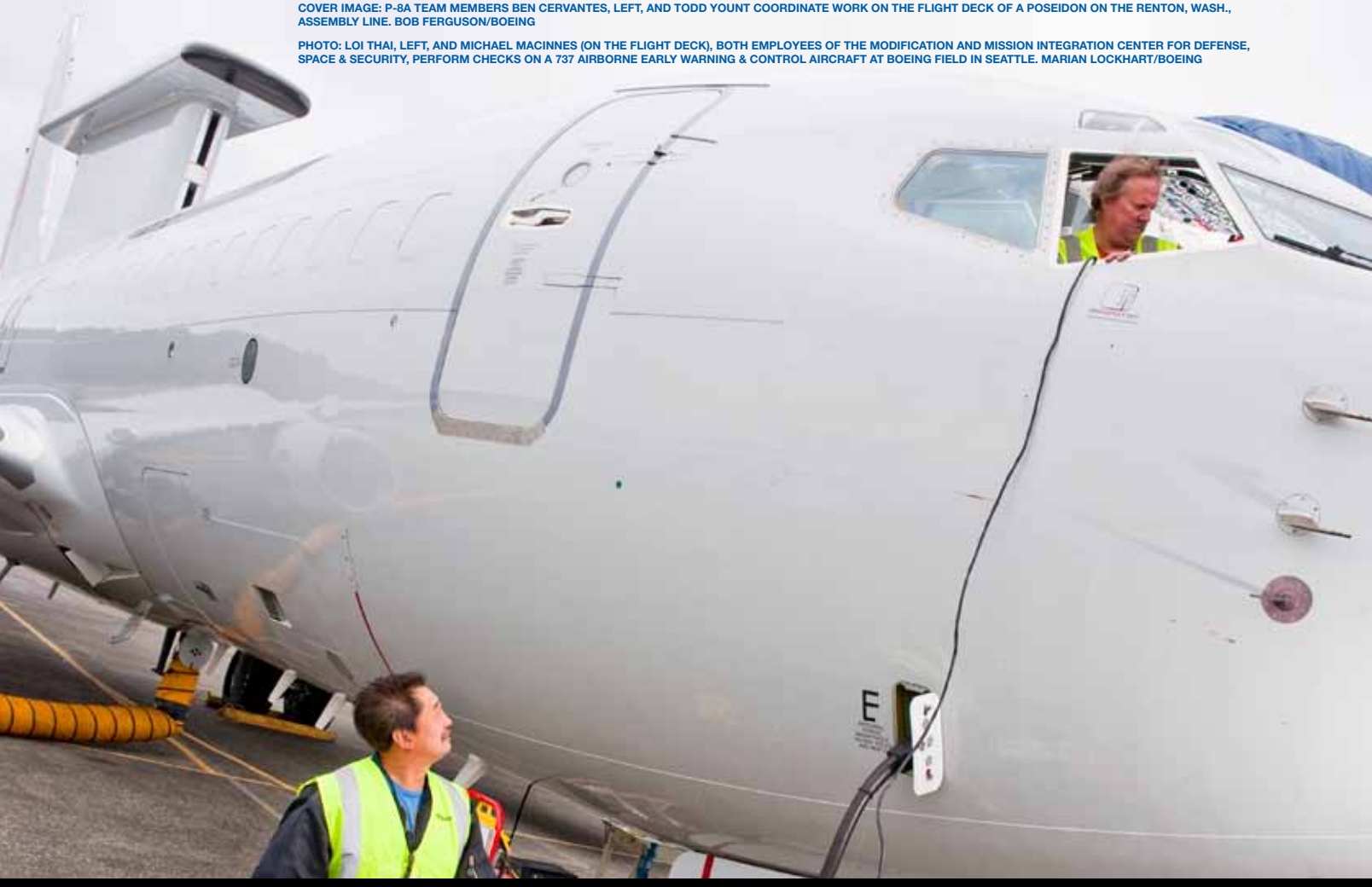
Good pedigree

Boeing is building on the success of its commercial jetliners with military derivatives such as the P-8A Poseidon and the Airborne Early Warning & Control aircraft. Both are based on the popular 737 commercial jet. The success of these derivative programs reflects a “One Boeing” approach that incorporates the best of Commercial Airplanes and Defense, Space & Security.

COVER IMAGE: P-8A TEAM MEMBERS BEN CERVANTES, LEFT, AND TODD YOUNT COORDINATE WORK ON THE FLIGHT DECK OF A POSEIDON ON THE RENTON, WASH., ASSEMBLY LINE. BOB FERGUSON/BOEING

PHOTO: LOI THAI, LEFT, AND MICHAEL MACINNES (ON THE FLIGHT DECK), BOTH EMPLOYEES OF THE MODIFICATION AND MISSION INTEGRATION CENTER FOR DEFENSE, SPACE & SECURITY, PERFORM CHECKS ON A 737 AIRBORNE EARLY WARNING & CONTROL AIRCRAFT AT BOEING FIELD IN SEATTLE. MARIAN LOCKHART/BOEING



Ad watch

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

Inside cover:

This ad, called “Soaring Together,” celebrates Boeing’s long partnership with China. The 800th Boeing aircraft recently went into service in China, an Air China 737-800. Approximately 6,000 Boeing aircraft worldwide have components built in China.

Page 6:

This month, Spectrolab, a Boeing wholly owned subsidiary in Sylmar, Calif., will deliver its 3 millionth gallium arsenide–based solar cell. This ad recognizes this milestone and Spectrolab’s commitment to continue delivering industry-leading solutions to customers. The ad is running in *Aviation Week* and *Space News* publications.

Back cover:

This ad was created to demonstrate Boeing’s appreciation and gratitude to veterans. This print ad will run in *The Washington Post, The Washington Times* and more than 30 regional and trade papers. The campaign will also feature TV and online components.

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FSC

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table o

Point and click

More than a half-million customers visit Boeing's MyBoeingFleet portal each month to find technical and other key information about their Boeing commercial jetliners. Part of Commercial Aviation Services, this invaluable resource is getting a redesign to make it even better and to enhance the customer experience.

PHOTO: BOEING AND SHUTTERSTOCK

A decade above

Ten years ago this month, two Russian cosmonauts and one U.S. astronaut arrived at the International Space Station, marking the start of a continuous presence on this laboratory that circles the earth some 220 miles (400 kilometers) out in space. Boeing built all the U.S. elements of the station and will continue to be a big part of its future as the program's sustaining engineering contractor.

PHOTO: NASA

Help is on the way

Regardless of where or when disaster strikes in the world, Boeing aircraft operators use their fleets in a variety of ways to help, from airlifting supplies to evacuating people from harm's way. This photo essay shows Boeing aircraft, including the C-17 cargo transport, V-22 Osprey and Chinook helicopter, as well as Boeing commercial jetliners, being used on various humanitarian missions.

PHOTO: U.S. AIR FORCE

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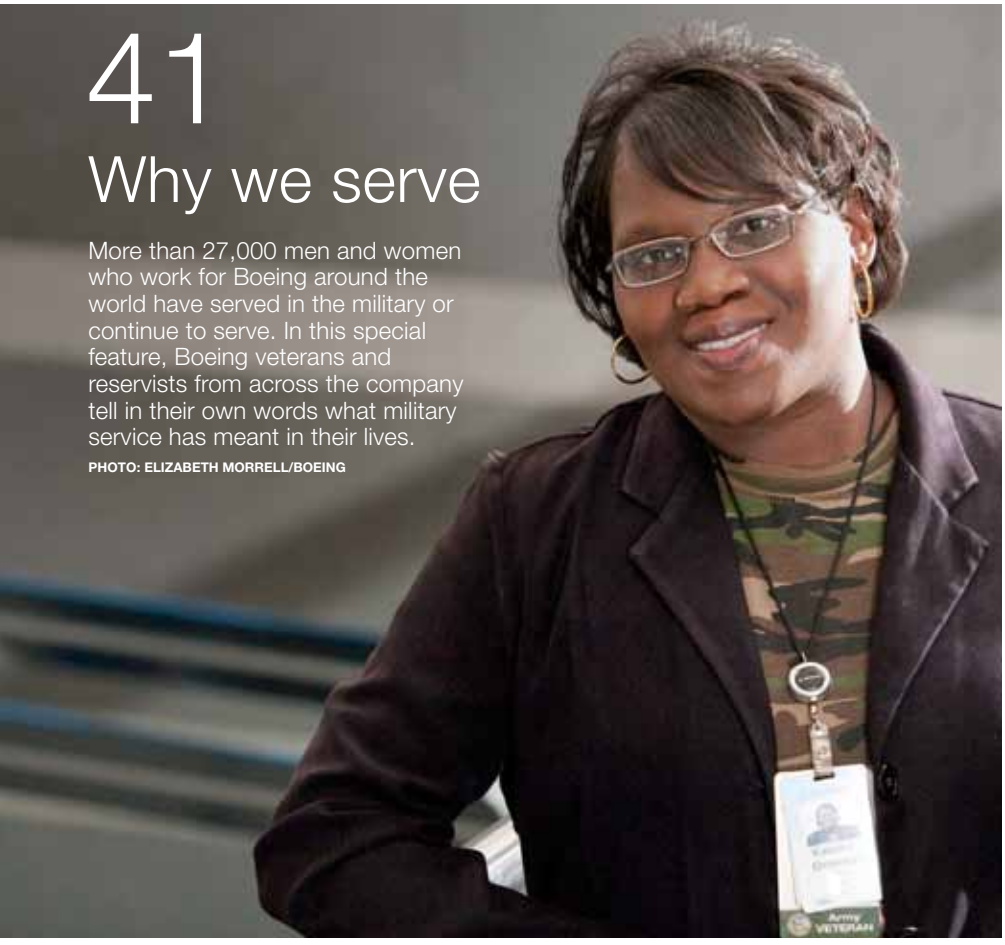

41 Why we serve

More than 27,000 men and women who work for Boeing around the world have served in the military or continue to serve. In this special feature, Boeing veterans and reservists from across the company tell in their own words what military service has meant in their lives.

PHOTO: ELIZABETH MORRELL/BOEING

INSIDE

07 Leadership Message

Boeing commercial jetliners have long life cycles, and once one has been delivered to a customer, the responsibility for that airplane shifts to Boeing Commercial Aviation Services. Lou Mancini, senior vice president of CAS, explains how a restructuring of his organization aligns it to better engage and service a marketplace poised for growth.

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50 Slick ideas

Boeing employees are making a difference and driving environmental gains at the Renton, Wash., site by separating and recycling liquid hazardous oil waste generated by machines and vehicles. This is the first in a series of articles that will focus on what Boeing employees and teams across the enterprise are doing to help the company meet its aggressive environmental goals.

PHOTO: MARIAN LOCKHART/BOEING


3 MILLION
A POWERFUL MEASURE OF CONFIDENCE.
A record 3 million gallium-arsenide solar cells delivered to more than 225 spacecraft. At Boeing Spectrolab, we're proud of this important milestone and all it demonstrates about our continued passion for innovation, quality and unmatched production capability. It's also a measure of the confidence customers place in our advanced technology to help them grow their business.
BOEING

The 24-hour customer

Commercial Aviation Services restructures its business to better align with how customers operate

Lou Mancini
Senior vice president, Commercial Aviation Services
Boeing Commercial Airplanes

PHOTO: ED TURNER/BOEING

How can we best support our customers? The answer is simple: We need to have their sense of urgency and mirror how they operate.

That's what we are doing in Commercial Aviation Services. Earlier this year, we reorganized CAS to be naturally aligned with the four main support and services decision-makers at the airlines: Supply Chain, Maintenance & Engineering, Flight Operations and Information Systems. *How* we're organized is not what's important to our customers; rather, it's about making it easier for them to interact and do business with us. (See story on Page 22.)

I regularly remind my team to envision the long life cycle that a Boeing airplane creates for us. Boeing researches and develops, designs, markets and sells, produces and, finally, delivers airplanes to our customers. Once the airplane is delivered, the responsibility for that product shifts from Airplane Programs to CAS, where we provide support, training, parts, maintenance and modifications. The support we provide to the 12,000-plus Boeing airplanes in service today generates valuable data that circles back to Airplane Programs, allowing them to continually improve on our product line—the best airplanes in the world.

Our new CAS organization is better aligned to engage in a marketplace we know is poised for growth. The market for new airplanes and services over the next 10 years is $2.3 trillion, of which one-third falls into the services sector. To be sure, $735 billion is a large and attractive market for us. We continue to develop new expanded services to address this large market.

So, what's our strategy to compete and remain the services provider of choice now and into the foreseeable future?

Value.

To be successful, we have developed growth plans in each segment of our business. The key ingredient is our engaged and motivated team. It's our people who work with our customers, who convey and demonstrate the values we treasure, and who produce the innovative products and services the entire world needs. Our employees make it happen for us day in and day out.

All together, it's a great business—forming lifetime relationships with customers by providing them the best life-cycle value for their Boeing airplanes while bringing strong financial results back to Boeing. ■

In a typical day in Commercial Aviation Services there are:

- 40,000 hits to MyBoeingFleet.com
- 20,000 Airplane Health Management messages monitored on 1,100 aircraft
- 380 customer support requests
- 460 pilots and 200 maintainers trained by Training and Flight Services
- 8,000 parts shipments from Material Management and Aviall
- 38,000 flight plans and 2.7 million navigation charts provided by Jeppesen

Snapshot

POWER PERFORMER

A Boeing 757, which is owned by Honeywell and used as a flying test bed, is shown over Catalina off the Southern California coast in April while testing Honeywell's HTF7000 business jet engine. Engineers mounted the engine on a pylon on the upper forward fuselage midway between the nose and wing's leading edge. The knowledge gained during these flight tests leads to improvements in materials and processes for the engine. The HTF7000 is flying on the Bombardier Challenger 300 and will be on the new Gulfstream G250 business jet. PHOTO: HONEYWELL

Quotables

"We have access to amazing people at Boeing, and many have helped me along the way. Asking for help is not a weakness, it's a sign of strength."

– *Mike Cave, president, Boeing Capital Corporation, speaking last month at an event sponsored by the Boeing Hispanic Employees Network at BCC's Renton, Wash., headquarters*

"Every day, the military is finding new ways to implement this game-changing technology, all in an effort to increase mission success and keep warfighters safe."

– *Robert Moses, president of iRobot's Government and Industrial Division, speaking to* Defense Daily *last month about the Boeing and iRobot team winning a contract to supply the U.S. Air Force with Small Unmanned Ground Vehicles, or SUGVs*

Training to be best

Preparing a high-performing work force starts with good instruction

By Rob Gross and photo by Alan Marts

Tony Walters is a workplace coach at the Boeing South Carolina site, which is preparing to be a production and delivery center for the 787 Dreamliner. In this *Frontiers* series that profiles employees talking about their jobs and the way their work fits into Boeing's goals, Walters explains the feeling of accomplishment that comes from working with and helping train technical employees to be among the industry's best.

As Boeing South Carolina ramps up production rates and moves toward becoming a final assembly and delivery center for the new 787 Dreamliner, we know the only way to get there is with a work force that compares with the best in the industry when it comes to technical skill, knowledge and capability. That's where my Enhancement Training Center co-workers and I come in.

I am an Employee Development specialist, also known as a workplace coach. It's my responsibility to help the technical team members get to the top of their game and stay there. The people here at Boeing South Carolina are really proud to be a part of Boeing, and they know that when you are Boeing, nothing less than the best will do.

After 22 years in the U.S. Air Force, I came to work for Vought in Charleston in 2006, drilling and filling holes on the 787 aft body section. Eventually, I accepted a training opportunity with readySC at Trident Technical College, helping prepare Boeing trainees to fabricate and assemble 787 aft and midbody sections. A work force training program, readySC is part of the South Carolina technical college system. When the Enhancement Training Center position came open, I jumped at the opportunity.

The Enhancement Training Center is a part of the final phase in the training process of becoming a Boeing South Carolina technician. I spend a lot of my time in the production cells working directly with the mechanics, team leads and managers.

I act as a skills coach with the mechanics as needed and as a skills adviser to leads and managers. Our new hires have a wide range of experience, and the Enhancement Training Center helps bridge any gaps between earlier training and actually working on the airplane.

The best part of my job is when you're working with someone on a particular activity that they are struggling with, and all of a sudden you see the light bulb come on and know that they've "got it." As an instructor, I share the pride and accomplishment that they feel. It's awesome to know that I'm making an impact, not only on the individuals here but also on the future of this business for generations to come. ■

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Presidential wings

As *Air Force One*, the 747 transformed air travel for U.S. presidents and became a symbol of democracy

By Jarrod Bartlett and Forrest Gossett

Twenty years ago, U.S. President George H.W. Bush ushered in a new era of presidential travel when he flew from Washington, D.C., to Topeka, Kan., aboard a heavily modified Boeing 747-200B making its first flight as *Air Force One*.

The new airplane's capabilities allowed the president to effectively run the nation 24 hours a day, seven days a week, from anywhere in the world—a significant advancement over the modified Boeing 707 models that had served as *Air Force One* since 1959.

"I was overwhelmed by its size and beauty. I still am. It's an impressive plane, which is a bit of an understatement," former President Bush said in response to questions for this story.

"When that beautiful plane lands in a foreign country, it means so many things: freedom, friendship and, yes, power. But the power of democracy," he added.

The U.S. Air Force designation for these unique Boeing 747-200Bs is VC-25A. The aircraft is a fully functioning Oval Office, connecting the president and his staff with events around the world. "Air Force One" is a radio call sign used only when the president is aboard any U.S. Air Force aircraft.

Retired Air Force Col. Danny Barr was chief pilot for both former President Bush and former President Bill Clinton. He was at the controls for that first flight to Topeka on Sept. 6, 1990.

"Everything associated with presidential air travel took a step forward when the 747 made its arrival, and the actual presence that it imposed when it arrived became that much greater," Barr said.

Former President Bush said the new plane was like "taking the Oval Office with me" while flying to conduct the nation's business.

"There was nothing we could not do, which means no time was lost while in the air," he said. "I also don't want to undervalue the bed! I could fly all night and land in Europe and be ready to go to work."

With some 4,000 square feet (370 square meters) of interior space, the plane is equipped with state-of-the-art communications, conference and dining rooms, quarters for the president and the first lady, a senior staff office area, an office that converts into a medical facility,

"I was overwhelmed by its size and beauty. I still am. It's an impressive plane, which is a bit of an understatement."

– Former President George H.W. Bush to *Boeing Frontiers*

Seal of approval

Boeing airplanes have carried heads of state from around the world, but they have an especially long association with U.S. presidents.

Franklin Roosevelt was the first sitting president to fly, and in 1943 he flew in a Boeing 314 Clipper to Casablanca, Morocco, where he and U.K. Prime Minister Winston Churchill mapped out war strategy against Germany. During the flight, Roosevelt celebrated his 61st birthday in style in the 314's spacious dining area. Roosevelt also was the first to have a dedicated presidential airplane, a Douglas C-54 (DC-4) nicknamed Sacred Cow.

President Harry Truman used a Douglas VC-118 (DC-6) called Independence, after his hometown.

Jets were introduced to the presidential fleet while Dwight D. Eisenhower was president. Three Boeing 707-120 aircraft were purchased and given the designation VC-137A. The first flew on April 7, 1959.

In 1961, the first aircraft built just for the president was ordered from Boeing. Based on the intercontinental 707-320B, the aircraft was designated VC-137C and given the serial number 26000. First lady Jacqueline Kennedy selected interior and exterior colors, including the distinctive exterior blue that identifies the aircraft.

– Mike Lombardi

PHOTOS: (Left) The Boeing 747 has been serving as *Air Force One* since 1990, entering service under George H.W. Bush and still serving today. SHUTTERSTOCK **(Inset)** President George H.W. Bush arrives at Forbes Field in Topeka, Kan., on the inaugural flight of the 747 as *Air Force One* on Sept. 6, 1990. TOPEKA CAPITAL JOURNAL

work and rest areas for the presidential staff, media representatives and Air Force crews, and two galleys that can provide 100 meals at one sitting.

Boeing delivered two VC-25 aircraft in 1990 to the Air Force to serve as the primary presidential aircraft. Both airplanes were built in Everett, Wash., and modified into a flying Oval Office at Boeing facilities in Wichita, Kan.

Boeing people who helped transform the 747-200s into *Air Force One* say they still feel pride and accomplishment whenever they see the airplanes.

"I'm an old military man and I get sentimental when 'The Star Spangled Banner' is played, and when I saw that plane fly away 20 years ago, it touched me," recalled Bob Banta, a quality assurance administrator in Wichita who worked on the first plane.

Added Pam Breece, a supplier management analyst who also worked on the first VC-25:

"We worked endless hours all the time, but we didn't care because it was just something we wanted to do. It was just phenomenal working on it. A lot of us just can't explain it. … it's just a feeling we have in our heart."

Boeing employees continue to provide maintenance, modification and contractor logistic support for the two airplanes that serve as *Air Force One*. ■

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A healthy unc

Know the changes resulting from health care reform before making annual enrollment decisions

By Jill Godschall

This article is part of a series to help Boeing employees and their families understand how changes in health care may affect them in 2011 and beyond.

Several provisions of the new health care law will take effect Jan. 1, 2011. During annual enrollment, which takes place Nov. 4 through Dec. 3, employees will see how these changes may affect their benefits. Among the changes detailed in the enrollment materials sent to employees' homes:

- **Change in eligibility provisions for adult children.** Employees' biological children, adopted children or stepchildren may now be covered until the end of the month in which they turn 26. They need not be dependent on the employee for support, live with the employee, be a student or be unmarried, provided, in most cases, that they are not eligible for coverage through their own employer. This change applies to medical, dental and supplemental life insurance, as well as accidental death and dismemberment plans. Because of the new eligibility provisions, children who were previously dropped from coverage after reaching the age limit may be eligible for coverage under Boeing plans again. Coverage rules for other children are described in the enrollment materials.
- **Removal of lifetime maximum.** The most that a health plan will pay in benefits during an individual's lifetime has been eliminated. If an employee or a dependent previously reached the lifetime maximum under a Boeing medical plan, he or she may now re-enroll in that plan.
- **Removal of annual maximums on certain benefits.** Boeing medical plans no longer have an annual limit on preventive care.
- **Changes in health savings accounts.** The PPO+*Account* is the only Boeing medical plan with a health savings account. Employees can pay their medical bills with the tax-free money or save it for future expenses—even in retirement, because the balance in a health savings account automatically rolls over at the end of each year. Effective Jan. 1, 2011, expenses for over-the-counter medications (with the exception of insulin) won't be reimbursable without a prescription from a physician. In addition, penalties will increase for withdrawals from a health savings account if funds aren't used for qualified medical expenses.
- **Changes in flexible spending accounts.** By contributing to a flexible spending account, employees can pay for eligible health care expenses using tax-free money. As with the health savings account, effective Jan. 1, 2011, expenses for over-the-counter medications (with the exception of insulin) won't be reimbursable without a prescription from a physician. Employees should carefully estimate their 2011 health care expenses because any money left in a flexible spending account at the end of the year is forfeited, as required by law.

Boeing continues to work with the government to get clarification on other provisions of the new law. As guidance is provided, Boeing will comply by applying any additional changes to its benefit plans. For late-breaking changes during enrollment, go online to the Healthy Decisions website via your enrollment link in Tasks and Reminders on the Boeing TotalAccess home page.

Other changes will also apply, including changes in the deductible, copayments and coinsurance in various nonunion plans. In addition, all of the medical plans administered by Regence Blue Shield will transition to BlueCross BlueShield of Illinois. As a result, employees will receive new ID cards and will go through TotalAccess to contact a new customer service center; the network of providers will remain the same, since both groups are part of the "Blues" organization.

In the past, almost half of all Boeing employees have not enrolled and their benefits default to prior selections. However, benefit provisions in many of the plans will change next year, so it's important to make sure the plan that made sense in 2010 is still the best fit for 2011. ■

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PHOTO: THINKSTOCK

derstanding

Tools and resources help employees choose well

Employees need to understand their benefits to make informed choices for 2011. Boeing provides an array of tools on the Your Benefits Resources website so employees can:

- View a side-by-side comparison of 2011 medical plan choices.
- Locate network doctors and hospitals, which offer services at negotiated rates.
- See health care claims to date, including the expenses the employee paid last year and year-to-date.
- Determine which plan offers the best value based on the employee's personal situation.
- Calculate how much a flexible spending account can help save on eligible expenses in 2011.

Building on success

Boeing's commercial jetliners make an ideal platform for a variety of military derivative aircraft

By Eric Fetters-Walp

As Boeing commercial jetliners crisscross the globe every day, military and government aircraft based on those planes are transporting state leaders, patrolling the skies and assisting warfighters.

For more than a half-century, Boeing and its heritage companies have designed and built more than 1,000 specialized aircraft based on commercial airplanes. With growing international demand for military derivatives, and the recent success of the P-8A Poseidon, these programs are garnering significant attention.

"We have a historic window, both domestically and internationally, where you have tired iron [aging military airframes] and the need for new capabilities, and Boeing's poised to provide the new generation of replacements," said Chris Chadwick, president of Boeing Military Aircraft, part of Boeing Defense, Space & Security.

For the P-8, a derivative of the popular 737 commercial jet, Boeing expects to build 117 planes for the U.S. Navy and is already on contract for eight from India. Australia, Turkey and the Republic of Korea have purchased a total of 14 new 737-based Airborne Early Warning & Control (AEW&C) models. And Boeing Military

Aircraft sees huge potential in modifying the Next-Generation 737 platform for a host of other military missions. Boeing also is competing to have its 767-based NewGen Tanker replace hundreds of aging KC-135 tankers operated by the U.S. Air Force.

Meanwhile, the U.S. president and congressional leaders fly on specially outfitted 747s, 757s and 737s.

Modifying commercial aircraft for military and government uses is not novel. Boeing heritage company Douglas Aircraft produced the first airplane used regularly by a president in 1944, when Franklin D. Roosevelt began flying on a modified DC-4. The first modified 707 jetliner used as *Air Force One* began service in 1962.

"We started with the president's airplane 50 years ago, and we've added to that portfolio ever since," said Steve Wade, general manager of Global Transport & Executive Systems, based in Wichita, Kan., where he also is the site executive. That site modifies and supports Boeing Business Jets, 707s, 737s, 757s and 747s used by state and military leaders around the world.

"Our platforms are the most capable, and they're the most flexible in the world," said Fred Smith, director of P-8 Business Development. "We must continue to show compelling value to our customers." The development of the new 737-based P-8A for the U.S. Navy offers an ideal model for how that can be accomplished, he added.

The Poseidon team is using an in-line production process—the industry's first for derivative aircraft—based on the Boeing Next-Generation 737 production system to build P-8 aircraft. "It is the most affordable and efficient way to build military derivative airplanes, and no one else in the world has this capability," Smith said. "By incorporating the best of BDS and Commercial Airplanes, we are able to produce a unique product line that is well-suited to replace any large military aircraft in the world today, no matter the mission set."

Traditionally, a commercial airplane destined for military use

PHOTO: The first P-8A Poseidon flight-test aircraft passes Seattle's Mount Rainier on its way to the Naval Air Station at Patuxent River, Md., last April. The P-8 is a derivative of the Boeing 737 commercial jet. JEREMIAH SCOTT/BOEING

“The P-8 is not the same as a commercial 737 by any stretch, but it’s produced in the same production system.”

– Fred Smith, director of P-8 Business Development

is fully assembled, delivered to a separate facility and then extensively modified. With the Poseidon, Boeing showed it could incorporate modifications from the start of production. The P-8 Next-Generation 737 fuselage is shipped by rail from Wichita, Kan., to Renton, Wash., with the weapons bay and other body modifications already in place. The submarine-hunting airplane then is put together on 737 Production line No. 3 in Renton’s Commercial Airplanes facility.

“The P-8 is not the same as a commercial 737 by any stretch, but it’s produced in the same production system,” Smith explained. “So when it gets to Renton, they never cut another hole in it.”

Bob Feldmann, vice president and general manager of Surveillance and Engagement, said the importance of that process change can’t be overemphasized. “At the start of the P-8A program, the in-line process was just a theory,” Feldmann said. “Boeing had to prove that we could conquer the challenge of integrating our design teams on a complex program.”

Tools and processes between Commercial Airplanes and BDS had to be harmonized for the P-8 program. “When the team saw

the success on the first P-8, it brought forward an avalanche of ideas on how to do it even better," Feldmann said.

The integrated process has cut P-8 production cost and provided a model for how Commercial Airplanes and BDS can work together on military derivatives. Smith calls it a "180-degree change" from the previous way Boeing's two biggest business units worked together on such programs.

John Pricco, Commercial Airplanes vice president for the P-8 program, noted the joint team must still address challenges, but the process clearly has been beneficial for Boeing. Not only does it advance BDS' military aircraft programs, but using the 737 as a platform helps Commercial Airplanes' business as well, he said.

"This opens up a new market for us that we might otherwise not get," Pricco said. "We can do things for our customers that no one else can."

Pat Shanahan, Airplane Programs vice president and general manager for Commercial Airplanes, sees lasting value in having more people from both sides of the company work together on derivatives programs.

"In the past, teams were often focused on the differences between commercial and defense," Shanahan said. "Now, the words are different, the language and tone much more collaborative, with a focus on 'how can we take advantage of our similarities?' The teamwork is very visible and tangible, and I believe we are well-postured to take commercial-military development to the next level."

Such cooperation is advancing the biggest military derivative program being pursued by Boeing: the $35 billion competition to replace aging aerial refueling tankers for the U.S. Air Force. A

PHOTOS: (Above) The P-8A Poseidon is assembled in Boeing's Renton, Wash., factory using an in-line production process based on Boeing's Next-Generation 737 production system. Commercial 737s are assembled in a separate part of the factory. JIM ANDERSON/BOEING

(Insets) Members of the P-8A Poseidon team at the Renton factory include, from left: Thad Atkins; Alfred Wheeler (left) and Loi Le; Ben Cervantes; Donna Bromley; Chantz Relerford; and Frederick Marshall. BOB FERGUSON/BOEING

"I believe we are well-postured to take commercial-military development to the next level."

– Pat Shanahan, Airplane Programs vice president and general manager for Commercial Airplanes

cross-enterprise team is leading Boeing's bid to provide the Air Force with the NewGen Tanker, based on the 767 commercial jet.

The "One Boeing" approach also has extended to smaller derivative programs. While the P-8 program is set to build at least 125 aircraft during this decade, Global Transport & Executive Systems sells just a few airplanes per year, sometimes with radical modifications.

"Modifications can take three months to two years. It all depends on how much militarization they want to do," explained Wade, Boeing's general manager of Global Transport & Executive Systems in Wichita. "Sometimes we take it all the way down to the hull and build it back up. These modifications often can drive up costs, so finding a new way to deliver results to the customer was imperative."

While the international market for executive-style derivatives is growing, Wade's organization has its eye on another major contest. It's gearing up to chase the Presidential Airlift Recapitalization—the upcoming bid process to replace the *Air Force One* fleet, possibly with new 747-8s.

"We've got a capture team lead, and we're working really hard for a successful bid," Wade said.

Meanwhile, with the significant investment already made, the P-8's unique design and production process could be used for other future derivatives, Feldmann said.

Possible variants on the P-8 model include the Enhanced Capability Configuration as a replacement for highly specialized electronic surveillance and intelligence collection aircraft such as the U.S. Navy's EP-3; the P-8 Airborne Ground Surveillance, which could replace the Northrop Grumman E-8C; the P-8 Rivet Joint, to replace the RC-135 Rivet Joint fleet; and a P-8 AEW&C that expands the current 737-based programs in Australia, Turkey and Korea with new multi-mission capabilities.

Other specialized surveillance and intelligence variants are being explored, Smith added.

Boeing's focus is to continue to build on the versatile 737 platform, develop new derivatives of other models, possibly including the 787, and to make sure the company can offer reliability, value and capabilities that exceed competitors', according to Chadwick.

"We have a good strategy of creating differentiating value that no one else can easily match," Chadwick said. "We can provide the right aircraft for the right mission at the right price." ■

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PHOTO: Australia's Wedgetail program uses Boeing's 737 platform for its Airborne Early Warning & Control aircraft. CHAD SLATTERY

Military derivatives, front and center

Boeing and its heritage companies have produced many different derivative aircraft. Listed and pictured here are a few major ones.

BOEING:

Model 367-80 – Known as the "Dash 80," this was the basis for the KC-135 Stratotanker. Boeing built more than 700 KC-135s.

707 – Boeing's first production jetliner was the platform for the E-3 Airborne Warning and Control System (AWACS), of which 68 were built, and the first jet-powered *Air Force One*. The E-6A and -B Mercury airborne command post, produced for the U.S. Navy, also is based on the 707.

737 and Next-Generation 737 – This popular commercial jet is the platform for the P-8A Poseidon; Airborne Early Warning & Control aircraft for Australia, Turkey and Korea; the C-40A U.S. Navy transport; the C-40B combatant commander transport; and the C-40C, used to transport members of the U.S. Congress and senior leaders.

747 – Boeing's largest commercial airplane is used as *Air Force One* to carry the president; the E-4B Advanced

Airborne Command Post; and the Airborne Laser Test Bed.

757 – Four models of the military version of this airplane, the C-32, were built for the U.S. Air Force. They are used to provide transportation for U.S. leaders, including the vice president and first lady.

767 – This airplane serves as the basis for the 767 tanker for Japan and Italy, as well as the E-767 AWACS used by Japan. It is also the platform for the NewGen Tanker being proposed to replace the U.S. Air Force's fleet of KC-135 Stratotankers.

DOUGLAS AND MCDONNELL DOUGLAS:

DC-2 – The U.S. Army ordered dozens of staff transports in the 1930s based on this airplane.

DC-3 – By the 1940s, the military derivative, called the C-47 Skytrain, or Dakota, became the standard military transport aircraft for the Allies. It also played a critical role in the Berlin Air Lift.

DC-4 – The military version of the C-54 Skymaster transport was widely used during and after World War II. A specially built Skymaster, nicknamed Sacred Cow, became the first U.S. presidential aircraft.

DC-6 – This late 1940s–era airplane had a successful civilian life, but also served as the platform for the C-118A Liftmaster, used for cargo, personnel transport and aeromedical missions.

DC-9 – Forty-seven C-9 versions of this airplane were produced, including the C-9A Nightingale, used by the U.S. Air Force to transport injured military personnel.

DC-10 – Sixty KC-10 tanker/cargo aircraft were built on this platform.

PHOTOS: (Above) Boeing's 707 is the platform for the Airborne Warning and Control System aircraft, known as AWACS, with more than 60 built. They serve with the air forces of the United States, United Kingdom, NATO, France and Saudi Arabia. SHUTTERSTOCK

(Insets, from left) The Airborne Laser Test Bed, a Boeing 747-400F; a KC-767 aerial refueling tanker for Italy; a Douglas C-47 Skytrain; the 707-based E-6A airborne command post; a T-43A Bobcat, based on the 737, used as a navigational trainer; the Boeing 707, which was used as *Air Force One*. BOEING

Leading the fleet

Boeing enhances the customer experience of its MyBoeingFleet information portal

By Marcy Woodhull

Point and click—online shopping just keeps getting easier. And soon Boeing customers using the MyBoeingFleet portal will have an Amazon.com-like experience.

Part of the Information Services organization in Commercial Aviation Services, MyBoeingFleet serves about a half-million customers who visit each month seeking technical and non-technical data and services. Celebrating its 10th anniversary this year, MyBoeingFleet is undergoing a makeover aimed at making the user experience more streamlined, more accessible and uncomplicated.

"MyBoeingFleet is evolving as our company and technology change," explained Dustin Cox, customer experience manager for e-Commerce at Commercial Airplanes.

The redesign has three major focus areas:

- Improved user experience
- Improved e-commerce and subscription services
- Global search—having one search engine that spans MyBoeingFleet's applications to cover the information most frequently accessed by Boeing customers (similar to a Google or Yahoo search)

MyBoeingFleet is the source for airplane owners and operators, maintenance, repair and overhaul operators, and other third parties to find information essential to operating Boeing aircraft. Before it existed, customers received paper copies of essential information such as maintenance documents; engineering drawings; flight operations, data and services catalogs; product standards; fleet reliability statistics; and warranty claims. These copies had to be inserted into color-coded binders, which was time-consuming and could lead to costly, even dangerous situations if misplaced or inadvertently omitted.

With the advent of MyBoeingFleet, all documents became available digitally to a global customer base.

The portal also serves as a gateway to the Part Analysis Requirements Tracking page for procuring spare parts. Other features include digital profile drawings, tracking and prioritizing resolution of in-service issues, online and e-mail notices of new service bulletins, a maintenance tooling online ordering system, technical media tracking, and airplane loadable software information.

More than 1,300 customer organizations have access to MyBoeingFleet, totaling about 47,000 users.

"We started with three applications 10 years ago, and now we are up to 180 applications," Cox said. "With the launch of our project to redesign MyBoeingFleet, we want to weave together these applications and make them easier to use from the customer perspective and make them more productive internally to Boeing."

Available around the clock, MyBoeingFleet also generates significant revenue for Boeing and is the secure host for Commercial Aviation Services subscription-based services such as Airplane Health Management, which uses real-time airplane data to help customers reduce schedule interruptions and increase maintenance and operational efficiency.

Cox said the redesign will align MyBoeingFleet with customer workflow and productivity, with the aim of an enhanced customer service experience. The redesign team has been gathering customer feedback and engaging in research to offer the most comprehensive and easy-to-use site for Boeing customers.

Scheduled passenger carriers make up the majority of the

service's customers. But others include repair and modification centers, cargo carriers, charter private carriers, suppliers, governments, leasing companies and regulatory organizations.

Four high-level contact areas make up MyBoeingFleet:

- Research of technical data, which includes maintenance, flight operations, engineering and supplier information
- Collaboration for fleet support and reliability, supplier performance, and the 787
- Service catalogs for parts, modifications, and data and services
- Operator services for e-enabled services, Airplane Health Management, Toolbox and electronic logbook products

The collaboration feature is particularly important for the new 787 Dreamliner. "There is a social element in this feature for the 787," Cox said. "Because it's an all-new airplane, there is a need for collaboration tools and forums specific to the 787 to keep information flowing between customers and Boeing." ■

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PHOTO ILLUSTRATION:
The MyBoeingFleet portal provides a wealth of information to customers of Boeing commercial jetliners such as the 787 Dreamliner, shown here.

BRANDON LUONG/BOEING; AIRPLANE PHOTO: BOEING; MAN HOLDING SCREEN: SHUTTERSTOCK

Continuing journey

People have been living and working aboard the International Space Station for a decade—will they be there in 2020?

By Eric Fetters-Walp

Ten years ago this month, on Nov. 2, a Soyuz spacecraft carrying two Russian cosmonauts and one U.S. astronaut arrived at the International Space Station some 220 miles (407 kilometers) above the earth.

It was a significant milestone in the exploration of space—the start of a continuous human presence aboard a laboratory circling the planet at 17,000 mph (27,360 kph).

Once the Expedition One crew had settled into their new home, American astronaut and skipper Bill Shepherd told the world in a live TV broadcast: "There are a lot of people behind us to keep the station going. And we're just starting a long journey."

It has been a journey—with many different space station crews—and one that continues today, an achievement Boeing can take great pride in.

Boeing is the prime contractor for the design, development, integration and now sustainment for all the U.S.-built elements of the International Space Station (ISS), which is expected to be structurally completed in 2011. Boeing's team also developed the station's critical thermal control, life support, navigation, power, communications and tracking systems, and integrated components provided by the station's international partners. Additionally, Boeing is responsible for the integration of all ISS payloads.

"Each year, with multiple missions going back to the station and making it grow to where it's now nearly 1 million pounds [453,600 kilograms] floating in space, it's been quite an achievement for the team and the company," said Mark Mulqueen, ISS vehicle director for Boeing. "It's also a huge, remarkable accomplishment for

the U.S. and international partners to reach this milestone."

NASA officially accepted the space station from Boeing in March of this year, at the conclusion of a review process that verified the delivery, assembly, integration and activation of all hardware and software required by the contract. The acceptance signified the transition from assembly of the station to utilization.

"The International Space Station is one of mankind's greatest accomplishments, and we are beginning to make great progress with a six-person crew to increase its utilization," said Mike Suffredini, NASA space station program manager. "We will be counting on Boeing to help us maintain the station at peak performance levels so the full value of the unique research laboratory is available to NASA, its international partners, other U.S. government agencies and private companies."

Boeing will continue to be part of the space station's future, having started a new five-year, $1.24 billion contract in September to continue as the program's sustaining engineering contractor. The contract also includes purchasing spare components and modifying current systems. Boeing has more than 1,250 employees and about 1,700 contract employees at four sites—Houston, Huntsville, Ala., Huntington Beach, Calif., and Cape Canaveral, Fla.—supporting the station.

"This is a flagship NASA program, and it has put Boeing in a very unique position to support NASA," said Rick Golden, extension proposal manager for the Boeing ISS contract. "It also has given us insight and strengthened our human spaceflight

By the numbers

International Space Station

Average orbit altitude: 220 nautical miles (407 kilometers), at an inclination of 51.6 degrees to the equator

Length: 170.6 feet* (50.2 meters)

Solar array wingspan: 356.5 feet (108.7 meters)

Weight: 875,847 pounds (397,278 kilograms)

Living and working space: Equivalent to a five-bedroom home

Crew size: Six

Partners: The International Space Station is a partnership among five space agencies representing the United States, Canada, Japan, Russia and multiple European states

** Measurement when completed in 2011*
Sources: Boeing, NASA

PHOTO: The bright sun greets the International Space Station in this image taken from the Russian section of the orbital outpost. NASA

core competencies from which to bid on other NASA programs."

In return, Boeing's considerable experience in managing complex systems helped to ensure that parts built around the globe all fit together when joined in space. "Boeing's systems integration expertise is an important piece of the ISS program's success," Golden said.

As the station's crew stays busy in daily operational tasks and scientific pursuits, Boeing's space station team on the ground helps the NASA flight control team by sustaining and monitoring the systems that keep the station running normally. Additionally, the Boeing engineering team warns and advises NASA and the crew members when problems arise. When an ammonia pump that helps cool the space station failed in August, Boeing's team was the first alerted to the fault by NASA. The pump was replaced during several emergency spacewalks.

Boeing also assists with the scientific activities that take place within the space station. Amanda Rice, an ISS Payloads engineer in Huntsville, is part of the team that helps coordinate research equipment transported to the station. While 297 research investigations have taken place on the station since 2001, there is plenty of room for more research equipment on board, she said.

"What I'm excited about is now that it's truly built, it can function as a research lab. It can now do what was intended—provide an 'out-of-this-world-class' research laboratory." Rice said, noting that NASA in 2005 designated the U.S. segment of the ISS as a national laboratory available for use by public and private entities. Unique conditions exist on ISS for research and development in the areas of physics, chemistry and biology. The station's environment provides microgravity, extreme heat and cold cycles, ultra-vacuum, atomic oxygen and high energy radiation, as well as an incredible vantage point to Earth—a low altitude and orbital path that passes over 90 percent of the world's population.

Boeing is conducting studies to determine whether the space station's "life" can be extended well into the next two decades, said Joy Bryant, vice president and program manager for Boeing's ISS Program. Originally, the station was to be used only until 2015. U.S. President Barack Obama has proposed extending that through at least 2020, an idea that quickly won support from the station's international partners.

Mulqueen, Boeing's space station vehicle director, noted the first Russian-built element of the station already has passed a 30-year fatigue test, which began more than three years ago. The newer U.S.-built elements are going through a life-extension analysis. "We do all kinds of scenarios, test all kinds of liabilities to make sure the parts can handle the loads and thermal cycles for years into the future," he said.

Beyond the question of whether the station's structure and systems can outlive original expectations—Mulqueen and Bryant are confident they can—other challenges need to be solved. There are logistical questions to be answered about getting personnel and supplies to the station in the long term. Bryant said plans also need to be made for increasing maintenance requirements as the station ages.

"You're talking about a spacecraft housing six people continuously that's also the size of a football field," Bryant said. "It's not each individual system that makes it complex, it's the combination of all those systems up there in the harshest environment imaginable."

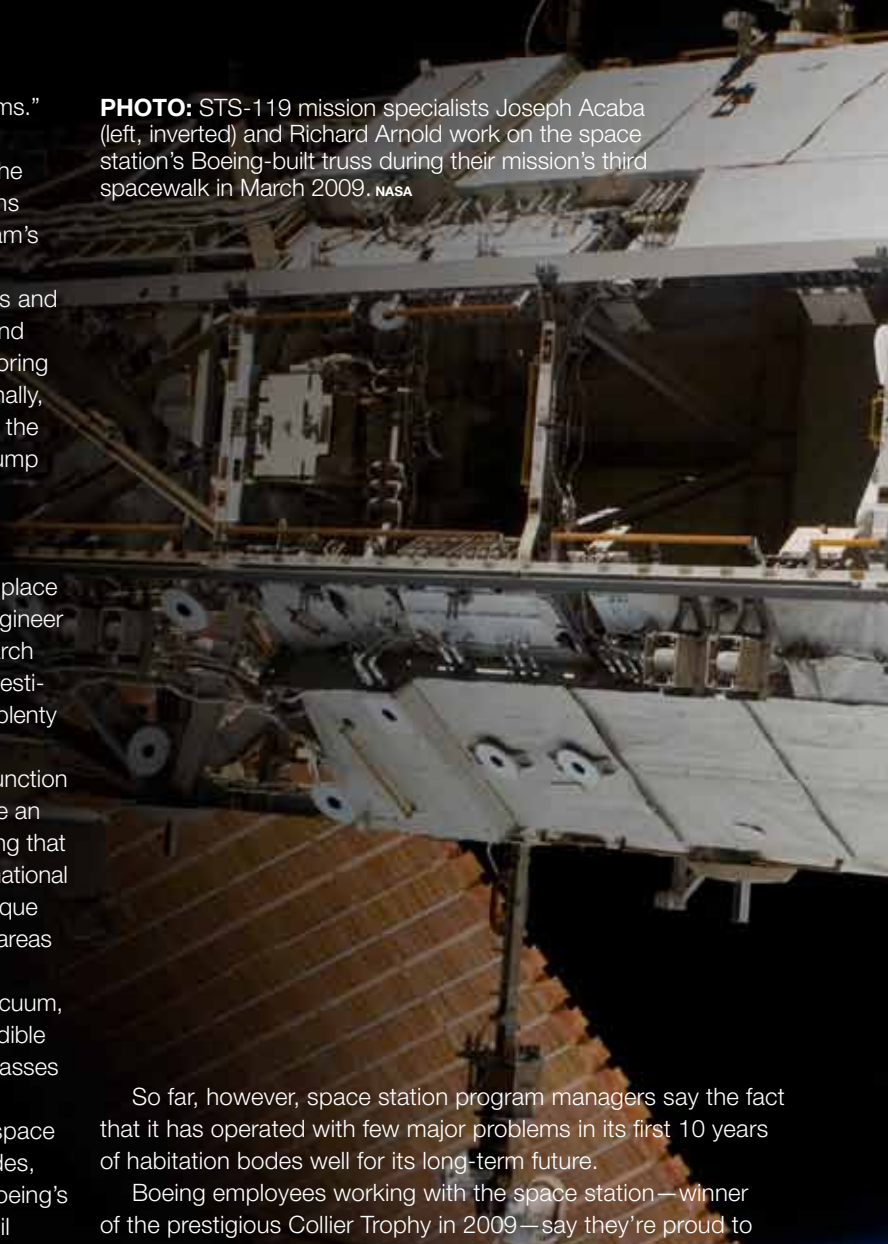

PHOTO: STS-119 mission specialists Joseph Acaba (left, inverted) and Richard Arnold work on the space station's Boeing-built truss during their mission's third spacewalk in March 2009. NASA

So far, however, space station program managers say the fact that it has operated with few major problems in its first 10 years of habitation bodes well for its long-term future.

Boeing employees working with the space station—winner of the prestigious Collier Trophy in 2009—say they're proud to be part of the historic program. Bob Levy, an electrical power systems engineer in Houston, said he's watched the station pass across the sky above Texas many times and even talked recently to an astronaut on board.

"What I like is the fact that when I come up with ideas and present them to NASA, very often they get implemented and new hardware is flown up," Levy said. "I'm very proud of how well it's performed, of the work I and the rest of the team have done."

The value of the scientific experiments performed on board the station, along with the unique opportunity to study how long stays in space affect human beings, can't be emphasized enough, agreed Rice and Bryant. The lessons learned in sustaining life in the zero-gravity of low Earth orbit could one day be used on long journeys to other planets.

"Not only is it a true engineering marvel—what we went into engineering for—but it's also human spaceflight," Bryant said. "With the capabilities the ISS has, I firmly believe that a discovery on the station one day will change how we view life, or how we live it." ■

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"[ISS] can now do what was intended—provide an 'out-of-this-world-class' research laboratory."

– Amanda Rice, ISS Payloads engineer, Huntsville, Ala.

PHOTO: MICHAEL MCCORMICK/BOEING

"I'm very proud of how well it's performed, of the work I and the rest of the team have done."

– Bob Levy, electrical power systems engineer, Houston

PHOTO: ELIZABETH MORRELL/BOEING


U.S. AIR FORCE
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Flights of **hope**

Boeing rotorcraft, military transports and commercial jetliners answer the call for help when global disasters strike

It might be a lone U.S. Air Force C-17 dropping replacement engine parts to a British fishing boat adrift in pack ice near Antarctica, or a fleet of the huge cargo lifters, operated by various nations and NATO, ferrying supplies to Haiti after a devastating earthquake there.

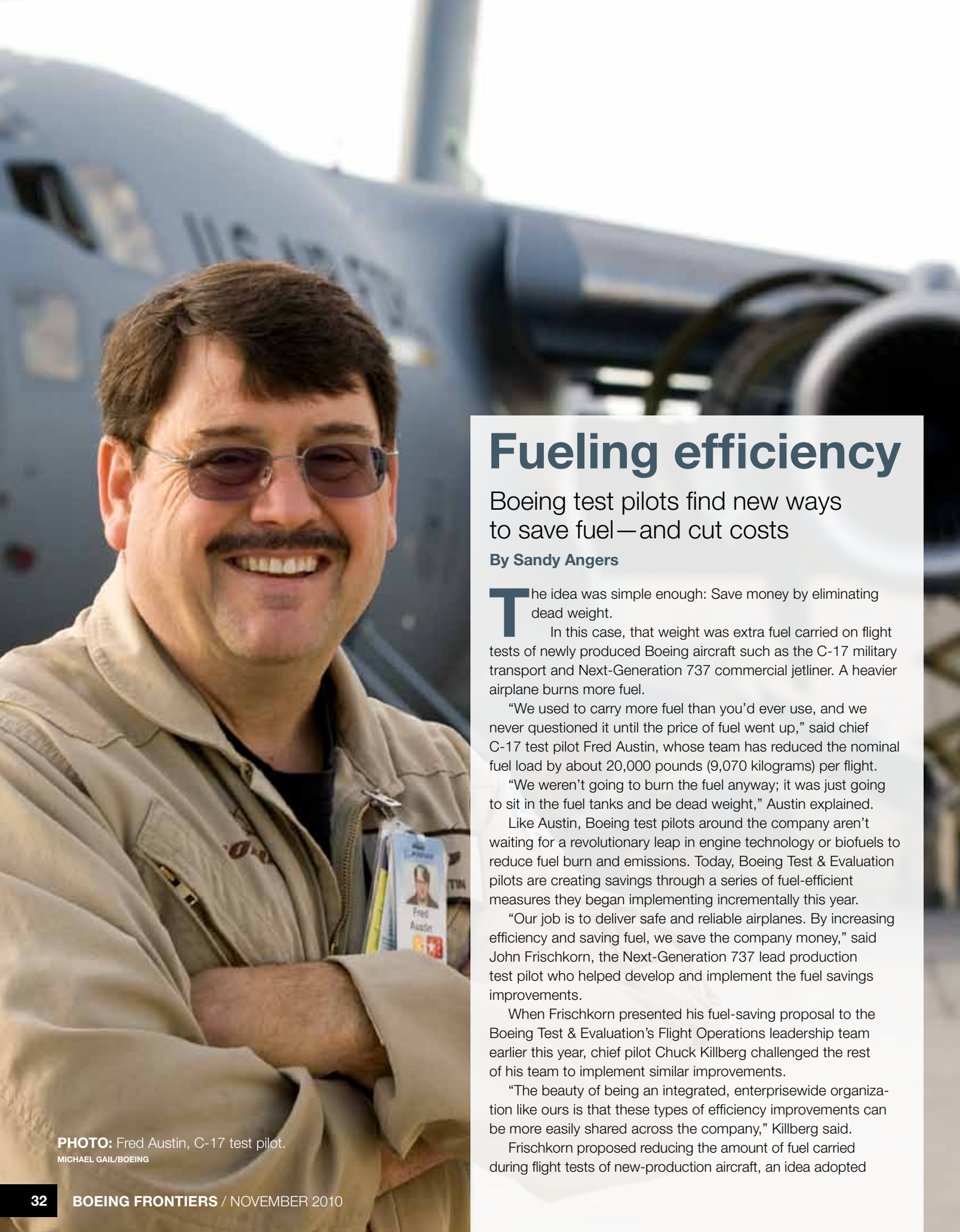
Perhaps it's a Boeing commercial jetliner loaded with food, medicine and other aid for victims of an earthquake in China, or Chinook helicopters evacuating displaced people from flood-ravaged Pakistan, or a V-22 Osprey utilizing its unique vertical landing

PHOTOS: (Above) A U.S. Air Force C-17 Globemaster III airdrops pallets of water and food to the town of Mirebalais, Haiti, following a 7.0-magnitude earthquake that struck the country in January. U.S. AIR FORCE **(Insets, from left)** Master Sgt. Douglas Brook and Tech. Sgt. Nicholas Wentworth of the U.S. Air Force Special Operations Command, who also are certified emergency medical technicians, perform on-scene medical care in Haiti after the quake. U.S. AIR FORCE Passengers on board a Canadian Forces C-17 are readied for takeoff for an evacuation flight from hard-hit Port au Prince, Haiti. CANADA'S AIR FORCE U.S. Army Sgt. Kristopher Perkins, a CH-47 Chinook crew chief, comforts a child whose family is being flown to higher ground following flooding in Pakistan's Swat Valley in August. U.S. ARMY

and high-speed cruise capabilities to quickly get help where roads and runways don't exist or have been damaged.

Whether it's a small emergency in the ocean or a disaster that affects tens of thousands on land, when the call for help and assistance goes out, Boeing aircraft operated by customers and countries from around the globe become "flights of hope" as they perform vital relief and humanitarian missions. ■

PHOTOS: (Left) U.S. marines and sailors head for a pickup by a Bell Boeing V-22 Osprey. They assessed living conditions, water sources and medical needs in Grand Saline, Haiti, soon after January's 7.0-magnitude earthquake hit. **U.S. MARINE CORPS**
(Insets, from left) Relief supplies carried by this U.S. Army Chinook helicopter are quickly unloaded following severe flooding in Pakistan's Swat Valley in August. **U.S. ARMY** A shipment of relief supplies is loaded into a just-delivered Emirates 777-300ER (Extended Range) in Everett, Wash., in August, en route to flood victims in Pakistan. **GAIL HANUSA/BOEING** A convertible model of Boeing's 737-based business jet, designed to easily change from passenger to cargo missions, is loaded with relief supplies for a flight to Santiago, Chile, following an earthquake there in February. **NIC GROENEVELD-MEIJER/BOEING**



Fueling efficiency

Boeing test pilots find new ways to save fuel—and cut costs

By Sandy Angers

The idea was simple enough: Save money by eliminating dead weight.

In this case, that weight was extra fuel carried on flight tests of newly produced Boeing aircraft such as the C-17 military transport and Next-Generation 737 commercial jetliner. A heavier airplane burns more fuel.

"We used to carry more fuel than you'd ever use, and we never questioned it until the price of fuel went up," said chief C-17 test pilot Fred Austin, whose team has reduced the nominal fuel load by about 20,000 pounds (9,070 kilograms) per flight.

"We weren't going to burn the fuel anyway; it was just going to sit in the fuel tanks and be dead weight," Austin explained.

Like Austin, Boeing test pilots around the company aren't waiting for a revolutionary leap in engine technology or biofuels to reduce fuel burn and emissions. Today, Boeing Test & Evaluation pilots are creating savings through a series of fuel-efficient measures they began implementing incrementally this year.

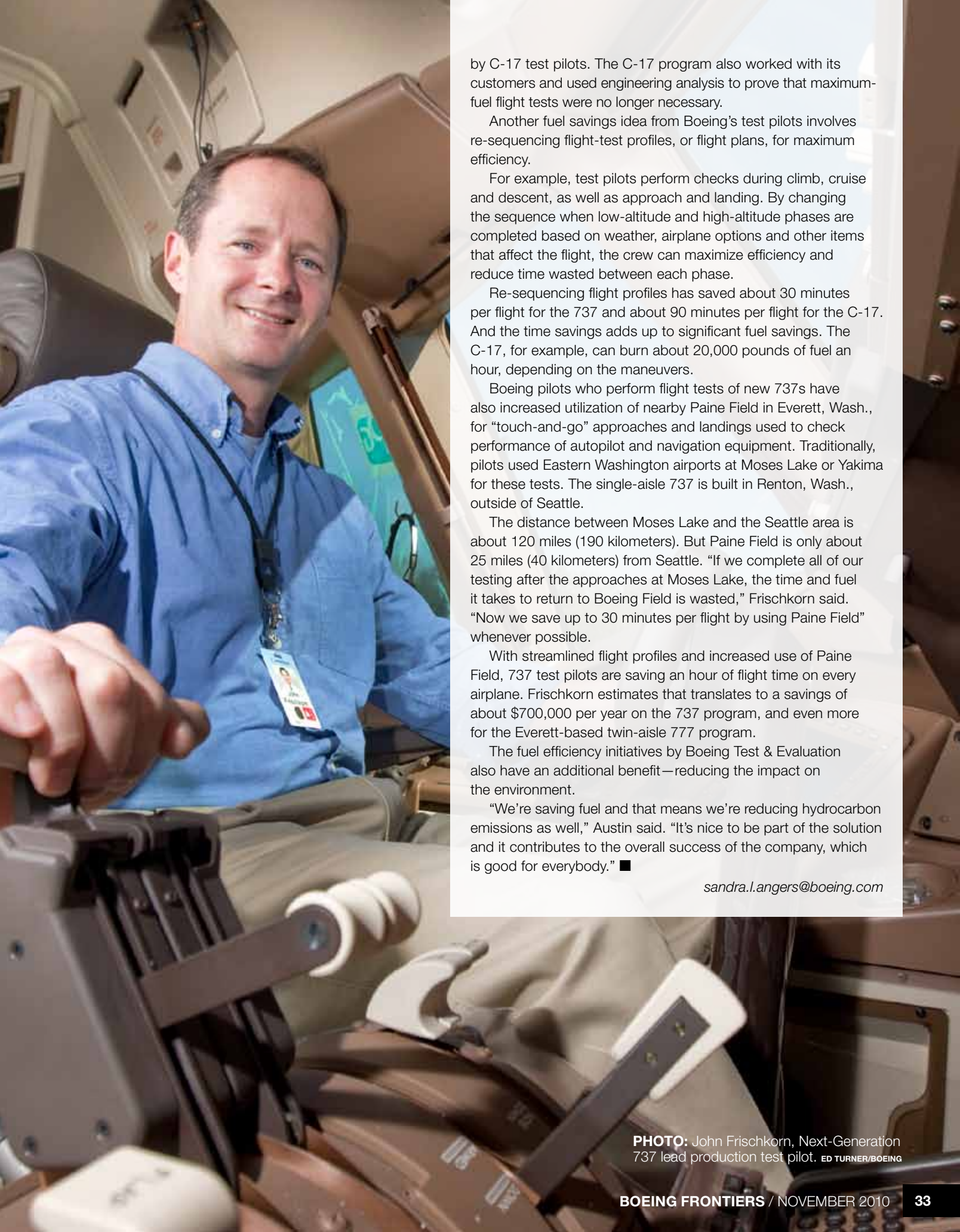
"Our job is to deliver safe and reliable airplanes. By increasing efficiency and saving fuel, we save the company money," said John Frischkorn, the Next-Generation 737 lead production test pilot who helped develop and implement the fuel savings improvements.

When Frischkorn presented his fuel-saving proposal to the Boeing Test & Evaluation's Flight Operations leadership team earlier this year, chief pilot Chuck Killberg challenged the rest of his team to implement similar improvements.

"The beauty of being an integrated, enterprisewide organization like ours is that these types of efficiency improvements can be more easily shared across the company," Killberg said.

Frischkorn proposed reducing the amount of fuel carried during flight tests of new-production aircraft, an idea adopted

PHOTO: Fred Austin, C-17 test pilot.
MICHAEL GAIL/BOEING



by C-17 test pilots. The C-17 program also worked with its customers and used engineering analysis to prove that maximum-fuel flight tests were no longer necessary.

Another fuel savings idea from Boeing's test pilots involves re-sequencing flight-test profiles, or flight plans, for maximum efficiency.

For example, test pilots perform checks during climb, cruise and descent, as well as approach and landing. By changing the sequence when low-altitude and high-altitude phases are completed based on weather, airplane options and other items that affect the flight, the crew can maximize efficiency and reduce time wasted between each phase.

Re-sequencing flight profiles has saved about 30 minutes per flight for the 737 and about 90 minutes per flight for the C-17. And the time savings adds up to significant fuel savings. The C-17, for example, can burn about 20,000 pounds of fuel an hour, depending on the maneuvers.

Boeing pilots who perform flight tests of new 737s have also increased utilization of nearby Paine Field in Everett, Wash., for "touch-and-go" approaches and landings used to check performance of autopilot and navigation equipment. Traditionally, pilots used Eastern Washington airports at Moses Lake or Yakima for these tests. The single-aisle 737 is built in Renton, Wash., outside of Seattle.

The distance between Moses Lake and the Seattle area is about 120 miles (190 kilometers). But Paine Field is only about 25 miles (40 kilometers) from Seattle. "If we complete all of our testing after the approaches at Moses Lake, the time and fuel it takes to return to Boeing Field is wasted," Frischkorn said. "Now we save up to 30 minutes per flight by using Paine Field" whenever possible.

With streamlined flight profiles and increased use of Paine Field, 737 test pilots are saving an hour of flight time on every airplane. Frischkorn estimates that translates to a savings of about $700,000 per year on the 737 program, and even more for the Everett-based twin-aisle 777 program.

The fuel efficiency initiatives by Boeing Test & Evaluation also have an additional benefit—reducing the impact on the environment.

"We're saving fuel and that means we're reducing hydrocarbon emissions as well," Austin said. "It's nice to be part of the solution and it contributes to the overall success of the company, which is good for everybody." ■

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PHOTO: John Frischkorn, Next-Generation 737 lead production test pilot. **ED TURNER/BOEING**

Recipe for cle

Boeing scientists cook up a better way to perform environmental cleanup—using a touch of sugar and vinegar

By Blythe Jameson

Walking across the tarmac at the north end of Boeing Field in Seattle, Carl Bach prepares for a delivery of sugar. The mechanical engineer is not assisting with a catering order. Bach, project manager for Boeing's Environment, Health and Safety Remediation team, is one of more than 30 "remediators" working on environmental cleanup programs at sites affected by former operations.

Sugar and sugar syrups that can't be used at a bakery or soda company are being used to treat volatile organic compounds in groundwater, according to Bach.

"We couldn't believe how effective this is," Bach said. "Natural degradation is already occurring. We are basically providing an additional food source, feeding the bacteria and promoting the biodegradation process that already exists."

The sugar, which otherwise might have been sent to a waste treatment plant, provides an ideal food source for the bacteria. Identifying strategic injection points is key, as the sugar is used only where it will completely degrade and provide the greatest benefit.

Bach and the Remediation team work with regulatory agencies, leading scientists and experts, and community members to clean up former manufacturing facilities, as well as sites where Boeing or companies it has acquired shipped chemicals and other waste for treatment, storage or disposal.

The team also looks for opportunities to build sustainable, or what the U.S. Environmental Protection Agency calls "green remediation," practices into their projects. An EPA initiative, these unique applications are geared toward minimizing the environmental footprint of a cleanup.

Reducing air emissions, minimizing impacts to water quality, conserving natural resources and increasing operational efficiencies are some of the ways the team works to further enhance a remediation project. "Bioremediation," or using naturally occurring microorganisms to degrade hazardous substances into less toxic or nontoxic substances, is one way the team is seeing success at several remediation sites.

At Santa Susana, a former federal rocket engine testing site in Southern California, the Remediation team treated perchlorate-impacted soils on site. Perchlorate, a salt, is used as a component of solid rocket fuel and road flares. By using food products and other biodegradable materials to help naturally occurring microorganisms clean up the salt, the team eliminated the need to haul soil to a hazardous waste facility.

"Rather than shipping approximately 650 truckloads of contaminated soil to a landfill, we stockpiled the soil on site, added water and a food source, and left the bugs to break down the perchlorate," said Art Lenox, Remediation project manger for the Santa Susana site. "We saw concentrations reduced by orders of magnitude, meeting our cleanup goal, and we didn't have to send it off-site for disposal."

And in Rancho Cordova, Calif., a Remediation team used highly concentrated, pure vinegar to treat contaminated groundwater.

"We saw significant results," said Brian Anderson, Remediation project manager for Rancho Cordova. "By injecting concentrated food-grade vinegar into the groundwater zone, we eliminated 500 pounds (230 kilograms) of perchlorate in 18 months. This started as a pilot test, but it proved to be very effective and we intend to continue operating this system." ■

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PHOTO: Carl Bach, Remediation project manager, examines a sample of sugar solution that will be injected into the groundwater at Boeing Field in Seattle. MARIAN LOCKHART/BOEING

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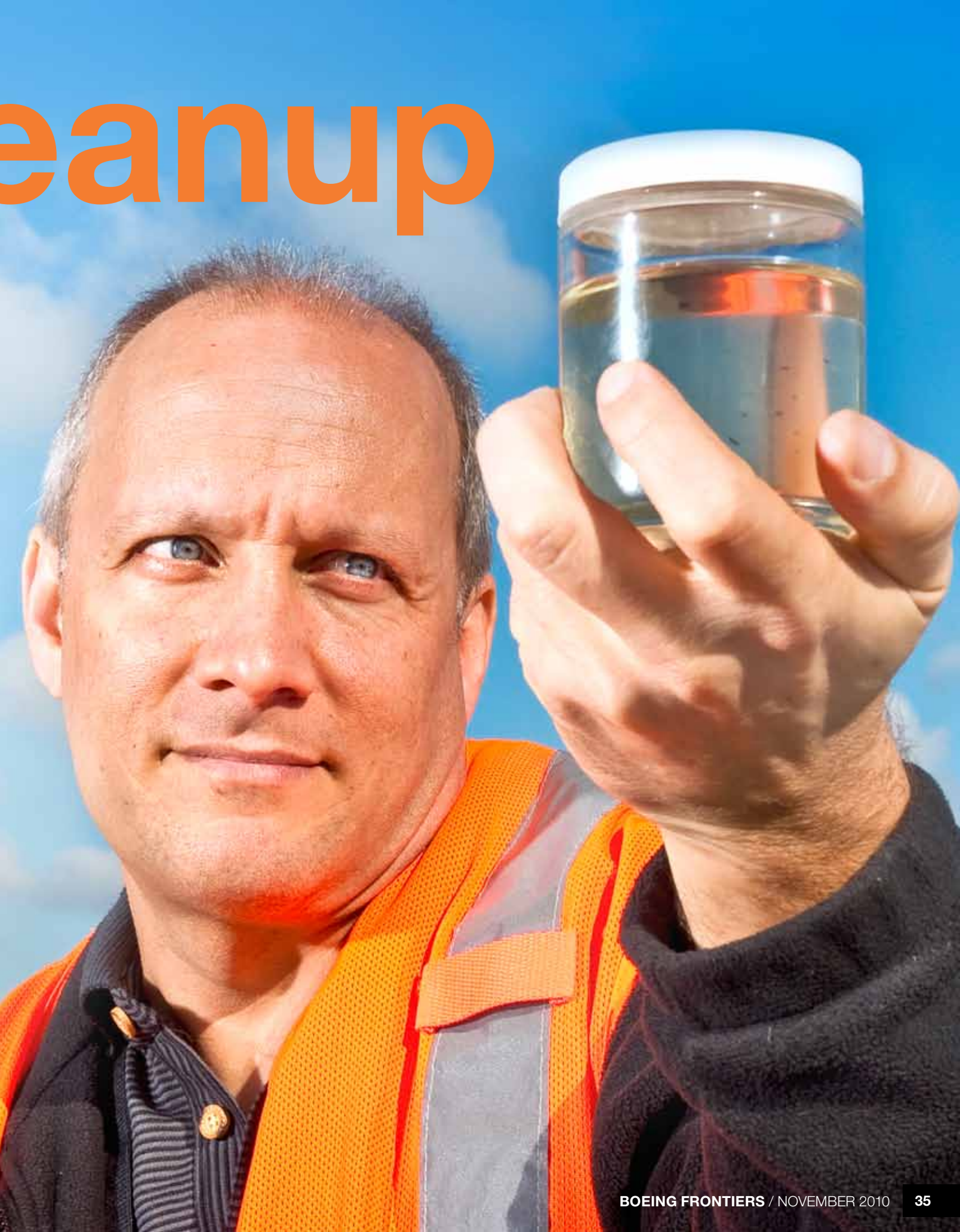


New frontiers

Boeing is making good progress on its entry for NASA's commercial spacecraft competition

By Ed Memi

For engineers such as Boeing's Eric Jensen, it's an exciting opportunity to design a new commercial spacecraft that will continue the legacy of the space shuttle and the Apollo vehicles that came before.

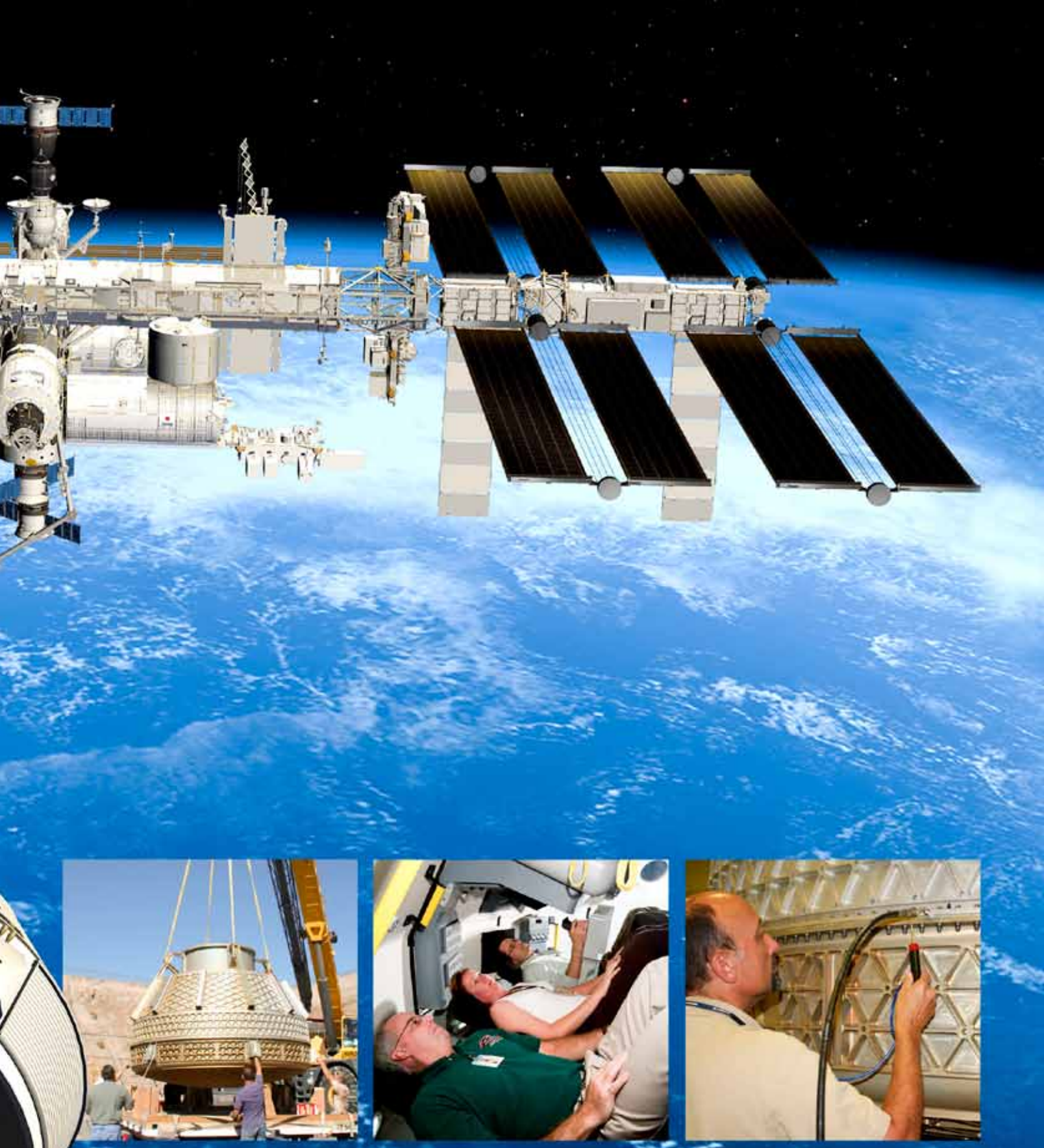
The Boeing Crew Space Transportation-100 capsule (CST-100) that Jensen is working on is the company's entry for NASA's Commercial Crew Development program, which aims to provide a commercial service for transporting a crew of up to seven to and from the International Space Station.

"I don't think there's a program at Boeing that could have provided the kind of opportunity I have at the onset of my career to interface with our NASA customer and to work on such a hands-on, fast-paced project," said Jensen, who has been with Boeing for only two years.

In addition to largely replacing the retiring shuttles on space station missions, Boeing's capsule could be used to support orbital habitats proposed by Bigelow Aerospace and other future destinations in low Earth orbit. And Boeing recently announced a preliminary agreement with Space Adventures to market unused seats on its crew capsule for private passengers.

Boeing has been making significant progress on its CST-100 spacecraft since it and four other companies were selected by the space agency earlier this year to develop critical technologies and capabilities for the Commercial Crew Development program.

With an $18 million Space Act Agreement with NASA, Boeing has about 100 engineers in Houston and Huntington Beach, Calif., working on 36 design or demonstration milestones. The Boeing Space Exploration team in Florida and employees in St. Louis, Philadelphia and Seattle have also provided



PHOTOS: (Top) An artist's concept shows the Boeing CST-100 spacecraft as it approaches the International Space Station. JOHN RANKIN/BOEING **(Insets, from left)** The pressurized structure of the Boeing crew capsule after completing an extensive series of pressure and leak tests at the Bigelow Aerospace facility in Las Vegas. BIGELOW AEROSPACE Boeing engineers (from left) Grant Cooper, Lynna Wood and Xavier Simon inside a full-scale mock-up of the Boeing CST-100 cockpit. ELIZABETH MORRELL/BOEING Sam Baker, a Boeing Test & Evaluation engineer at the Huntington Beach, Calif., site performs a helium leak test on the seals of the pressurized structure of the Boeing CST-100 spacecraft. BIGELOW AEROSPACE

support. Their accomplishments to date include:

- Design, build and testing of a flight-like crew module pressurized structure
- Creation of a mock-up of the interior of the spacecraft to ensure the crew can enter and exit the vehicle safely, as well as reach control switches and see easily through windows
- Demonstration of the base heat shield structure and thermal protection system, which would protect the crew during re-entry into Earth's atmosphere
- Development of an avionics systems integration facility to support rapid prototyping of avionics systems and full-scale avionics systems development
- Development of a rendezvous sensor that allows the vehicle to autonomously approach and dock with the space station and the Bigelow Orbital Space Complex
- Demonstration of airbag landing, water landing, uprighting and life-support systems

NASA is expected to announce new contract awards by the spring of 2011 for the next round of competition.

Keith Reiley, Boeing's Commercial Crew Development program manager, said Boeing's progress thus far will likely put the company in a good position to earn the follow-on agreement and, eventually, a chance to compete for a large design, development, test and evaluation contract.

That Boeing, already a pioneer in commercial aviation, could help lead the way in developing a commercial space transportation system is exciting for engineers on the program such as Jensen. "I get to see my small part—helping to design the pressurized structure—go from concept all the way to fabrication and assembly of something that I think is a great venture for Boeing." ■

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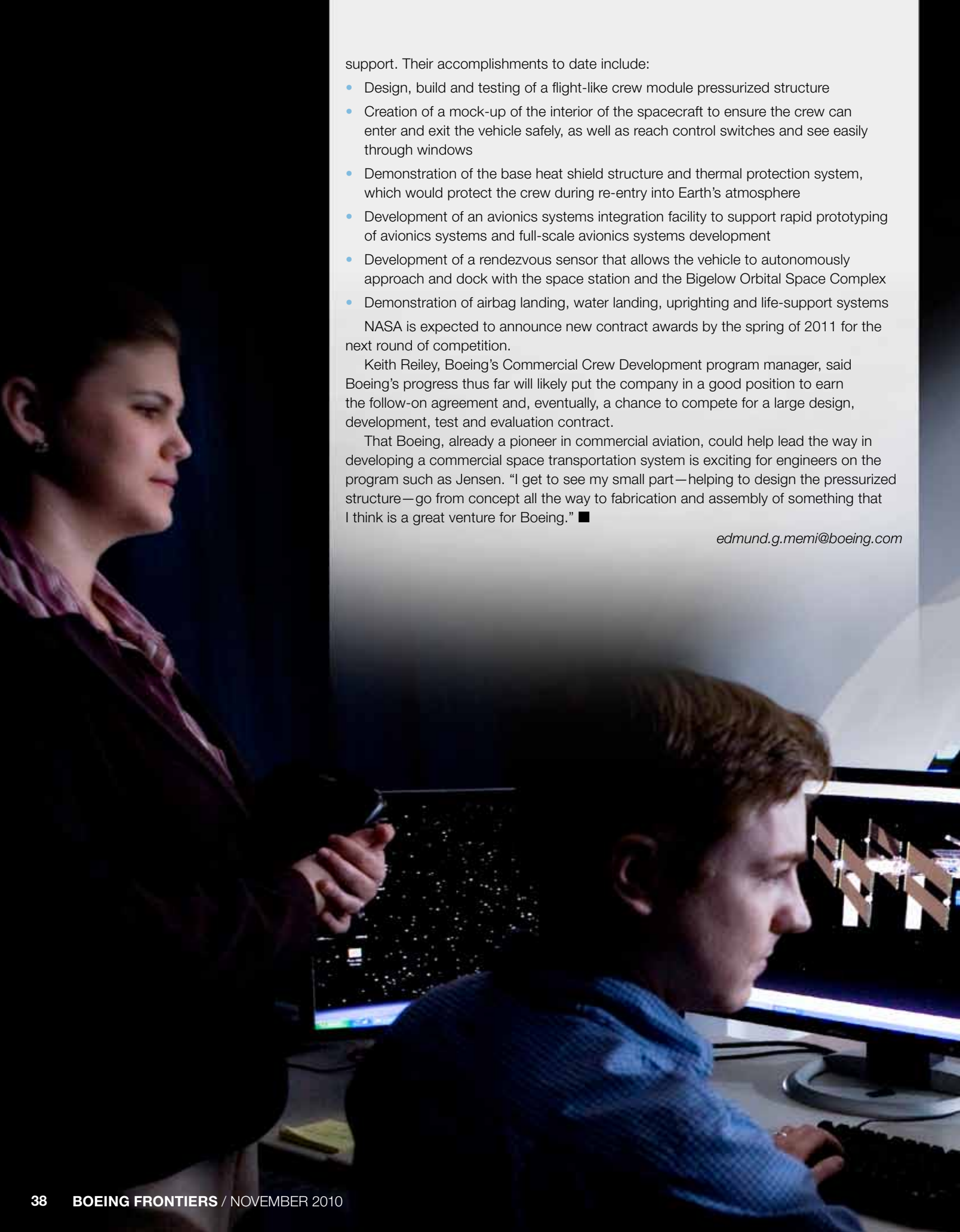

PHOTOS: (Below) Leslie Robertson, Boeing Software Engineering, and John Wissinger, Boeing Satellite Operations & Ground Systems, run a simulation in the Avionics Systems Integration Facility in Houston to support rapid prototyping of avionics systems and full-scale avionics systems development for the Boeing CST-100 spacecraft. ELIZABETH MORRELL/BOEING **(Insets, from left)** Bill Overton, Boeing technology support subcontractor, Mike Fraietta, Boeing Satellite Operations & Ground Systems, and John Gasvoda, Boeing Software Engineering, participate in a simulation run in the Avionics Systems Integration Facility. ELIZABETH MORRELL/BOEING A test of the CST-100 airbags, which are used to upright the vehicle in case it inverts after an emergency water landing. BIGELOW AEROSPACE Bigelow Aerospace program manager Tom Londrigan performs tests in the full-scale CST-100 mock-up. BIGELOW AEROSPACE

Shore thing!

Boeing to use its rotorcraft production expertise in bid to supply U.S. Navy with an advanced hovercraft

By Marc Sklar

The U.S. Navy's next 'air'craft may not take off with the head-snapping speed of an F/A-18 Super Hornet leaving the deck of a carrier. But it will still turn heads.

Flying on a cushion of air just feet above the water and land, this hovercraft, or air cushion vehicle, will transport troops, equipment, supplies and weapons from ships to landing zones. The Ship to Shore Connector is the Navy's proposed replacement for its Landing Craft Air Cushion hovercraft that has been operational for more than two decades.

Boeing—with its large-scale systems integration expertise, rotorcraft production and product life-cycle support—has teamed with shipbuilder Marinette Marine Corp. to bid for the project.

"The Marines and Army forces that will depend on the new craft are incorporating heavier vehicles into their operating units," said Richard McCreary, chief executive of the shipbuilding firm. "They need higher speeds for increased operational tempos, and the ability to perform in even more hostile environments."

Carried in the belly of amphibious assault ships, the Ship to Shore Connector will be able to operate independent of tides, water depth, underwater obstacles, ice, mud or beach gradient. Its ability to move over water and land gives it flexibility to be used for everything from beach assaults to humanitarian efforts. The Navy's current hovercraft were deployed to the Arabian Gulf in Operation Desert Storm and have been used in Haiti earthquake relief missions.

The Boeing and Marinette team also includes Oceaneering International Inc., which will provide craft support and design and has experience with current ship-to-shore connector maintenance for the Navy, and Griffon Hoverwork, a U.K. hovercraft designer and builder for more than 40 years.

"It's a powerful combination," McCreary said of the team, which must build a vehicle to meet requirements that substantially exceed what the Navy's current hovercraft can do.

Greg Peterson, program manager for the Ship to Shore Connector, is confident the proposal from Boeing and Marinette will meet the Navy's needs. "From the drive system to the lift system to the pilot station to training and everything in between," he said, "our systems individually and as a whole deliver more for the customer." ■

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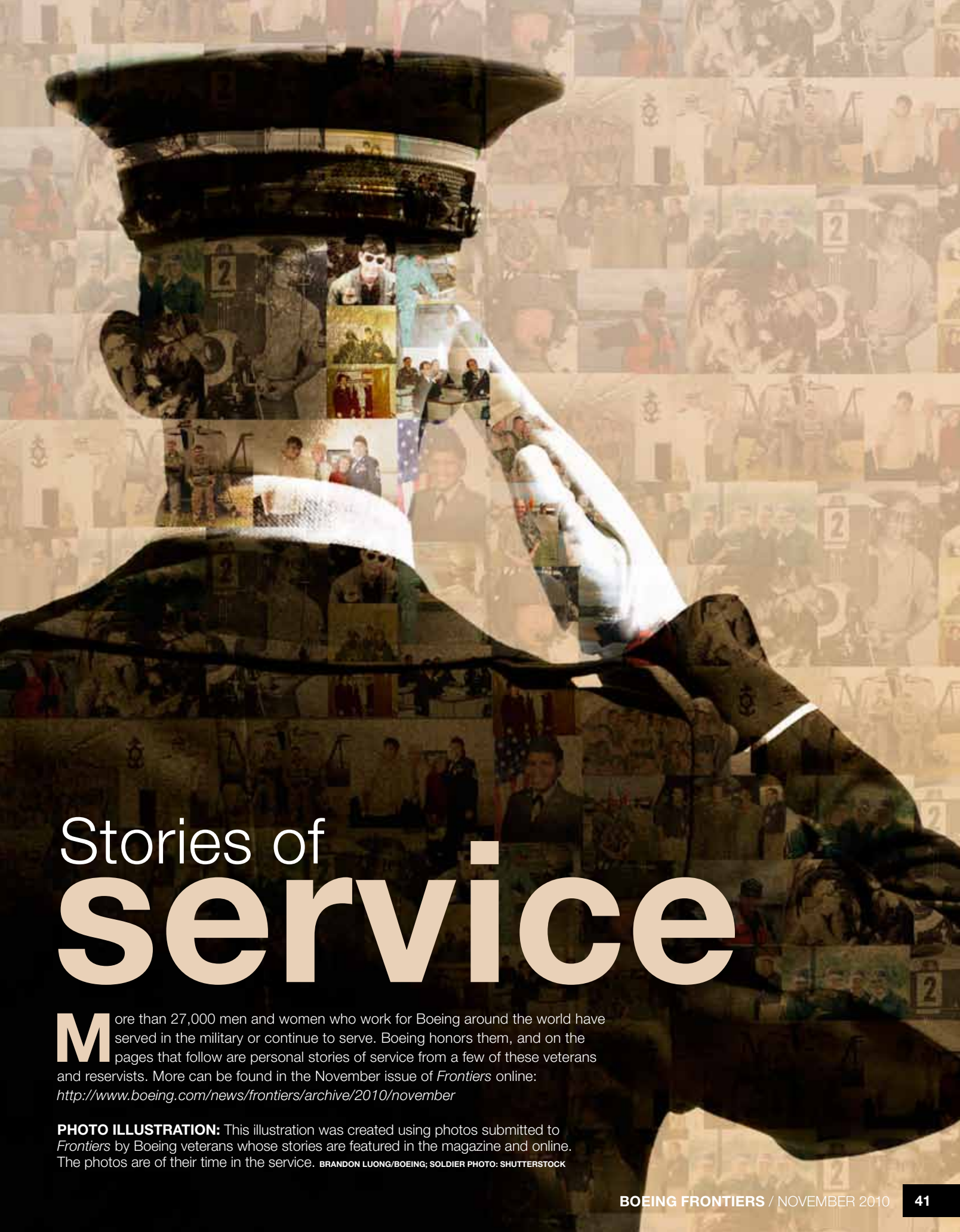
PHOTO ILLUSTRATION: The proposed Ship to Shore Connector air cushion vehicle will transport troops, equipment, supplies and weapons systems to landing zones for the U.S. Navy.
BOEING AND MARINETTE MARINE CORP.



Stories of service

More than 27,000 men and women who work for Boeing around the world have served in the military or continue to serve. Boeing honors them, and on the pages that follow are personal stories of service from a few of these veterans and reservists. More can be found in the November issue of *Frontiers* online: *http://www.boeing.com/news/frontiers/archive/2010/november*

PHOTO ILLUSTRATION: This illustration was created using photos submitted to *Frontiers* by Boeing veterans whose stories are featured in the magazine and online. The photos are of their time in the service. **BRANDON LUONG/BOEING; SOLDIER PHOTO: SHUTTERSTOCK**

Nicole Lepage

Engineer, F-15 Forward Fuselage Mechanical and Structural Engineering

Structure & Payload Design, Boeing Defense, Space & Security, St. Louis

U.S. Air National Guard, 2004–present

I anxiously joined the Missouri Air National Guard in May 2004, graduated basic training with honors and was assigned duties in Aircraft Armament Systems with the 131st Fighter Wing in St. Louis. There I got the opportunity to work on F-15C/Ds. I was disappointed in June 2009 when I learned the Fighter Wing would be moved to a new mission as the 131st Bomb Wing at Whiteman Air Force Base, Mo. I now perform my Air National Guard duty there. I still work as a weapons loader, but on a new airframe, the Northrop B-2 bomber, which Boeing helped develop. The 131st is an amazing unit. We provide a federal mission of support during times of war, but we also have a state mission of providing assistance during national emergencies. The dual role is extremely fulfilling. The military has given me much pride and I can only hope to give back to the service what it has given me. ■

PHOTO: BOB FERGUSON/BOEING

John Camara

Technical Fellow, Electrical Engineering Power Systems engineer, Sea-Based X-Band Radar Vessel Engineering Team, Ground-Based Mid-Course Defense Program

Network & Space Systems, Boeing Defense, Space & Security, Huntsville, Ala.

U.S. Navy, 1974–2000 (active duty and reserve)

According to most, history is a course required for graduation, something somebody did in the past that must be memorized. I served for 24 years in the Submarine Service both as a nuclear-trained technician and later as an officer during the height of the Cold War. History was something we did, together, every day. It was our job, our sacrifice, our service on that historical "front line" that helped people continue to live free. Knowing we were there, unseen and always ready ensured opponents were kept at bay. The most important historical aspect, now that the Cold War is over: The guns remained silent. I'm proud to have served. Proud. ■

PHOTO: BOB FERGUSON/BOEING

Katrina Grooms

Equal Employment Opportunity investigator

Boeing Global Diversity and Employee Rights, Houston

U.S. Army, 1990–1998 (active duty and reserve)

I enjoyed every waking moment of my military service in the U.S. Army. I learned self-discipline and it showed me I had the potential to do anything I set my mind to do. I also learned to finish any task I started. The Army taught me the value of working with diverse groups of people from all walks of life and cultures, and it gave me the opportunity to attend college, where I obtained associate's, bachelor's and master's degrees. The Army's core values are loyalty, duty, respect, selfless service, honor, integrity and personal courage. I am successful in my career because of my service to my country, and because I work for a company that invests in me. Hoorah! ■

PHOTO: ELIZABETH MORRELL/BOEING

John Beer

Flight Crew Operations Manuals/Flight Crew Training
Airborne Early Warning & Control Projects

Boeing Defence Australia, Boeing Defense, Space & Security, Brisbane, Australia

Royal Australian Air Force, 1967–1987

After initial trade training, I started maintaining de Havilland Caribou airplanes in Sydney and New Guinea. After moving on to Macchi jet training aircraft in Perth, I was eventually moved to Adelaide, to the Lockheed P-3, and stayed for my remaining 17 years of Royal Australian Air Force service.

After working on and watching these large airplanes come and go over the initial few years, I decided to apply for flight engineer training, graduating in mid-1977.

I totally enjoyed the flying, even though the work and commitment remained very high as I became involved in simulator and flight-deck training activities. Upon retiring from the air force in 1987, I capitalized on my military training and experience and began a 15-year civil flying career, flying Boeing 727 and 747 airplanes with airlines all over the world. Now, I'm working on flight-crew operations and training projects for the Wedgetail and other Airborne Early Warning & Control aircraft variants. ■

PHOTO: HEIDI SNOWDON/BOEING

Scott Dittberner

Senior Business Operations specialist,
Engineering Business Operations

Boeing Commercial Airplanes, Everett, Wash.

U.S. Navy, 1975–1980; U.S. Coast Guard Auxiliary, 2002–present

I have always prided myself on being a patriot because I truly love my country and all that it stands for. I served six years in the U.S. Navy, at the tail end of the Vietnam War and during the Cold War period of the late 1970s. They were tough times for those in uniform, who were treated poorly and not looked upon kindly by the public. I left the Navy in 1980 and started a career in aerospace. However, after the Sept. 11, 2001, terrorist attacks, I felt compelled to get back into uniform and help defend my country. I joined the U.S. Coast Guard Auxiliary, which augments the Coast Guard, where I am qualified as a vessel examiner and as boat crew. It's good and comforting to see that Americans now value and appreciate men and women in uniform and treat them with respect. It is a positive sign that we are all patriots in our own way, and that will help keep the country strong and safe in the years to come. ■

PHOTO: MARIAN LOCKHART/BOEING

Linda Herrera

Orbiter Avionics engineer, Network & Space Systems
Boeing Defense, Space & Security, Kennedy Space Center, Fla.

U.S. Air Force, 1977–1983

Graduating from high school in 1977, I had dreams of engineering and travel. I enlisted in the Air Force, accepting a career in avionics, inertial and radar navigation. While in the service I was able to see many places and experience challenges that now sound like the stuff of movies. My most memorable trip was an operation to air-refuel cargo planes dropping supplies at the South Pole. Although the maintenance crew planned to spend a relaxing day touring New Zealand while the mission was flown, an intermittent problem in one of the tankers caused us all to be part of the mission—a cold adventure indeed. My training served me well after the Air Force. I worked for 10 years on Tomahawk Cruise Missile guidance computers, and today I am part of the Boeing Space Shuttle Guidance, Navigation and Flight Controls team at Kennedy Space Center. ■

PHOTO: BOB FERGUSON/BOEING

Anna Belle Farrington

Senior manager, Cell 10 Quality

Boeing Commercial Airplanes, North Charleston, S.C.

U.S. Air Force, 1986–2007

I served in the U.S. Air Force for more than 21 years, retiring as a senior master sergeant in May 2007. My specialty was aircraft maintenance, both in bombers (the Boeing B-1B) and transports (the Boeing C-17). The time I spent in the military was awesome. The culture and training you bring from your military experience allows you to be successful in any endeavor you undertake. Indeed, the love I have for aircraft continues now that I'm working for Boeing. And I'm no longer maintaining aircraft. Now I'm building them from the ground up! ■

PHOTO: BOB FERGUSON/BOEING

Al Matthews

Videographer, Creative Services

Shared Services Group, Tukwila, Wash.

U.S. Navy, 1969–1985

I spent 15 years on active duty. My first duty station was Kirtland Air Force Base in Albuquerque, N.M. I found it strange that I was serving in the Navy at an air force base in the middle of the desert. I spent most of my days in the back seat of McDonnell Douglas F-4s and Douglas TA-4s shooting high-speed film of weapons releases. After that, I worked in Intelligence, Combat Camera Group and Public Affairs. Everything I have done in the military has made me a better videographer, and everything I learned there I am able to use at Boeing. I am glad to be part of the best aerospace company in the world. ■

PHOTO: MARIAN LOCKHART/BOEING

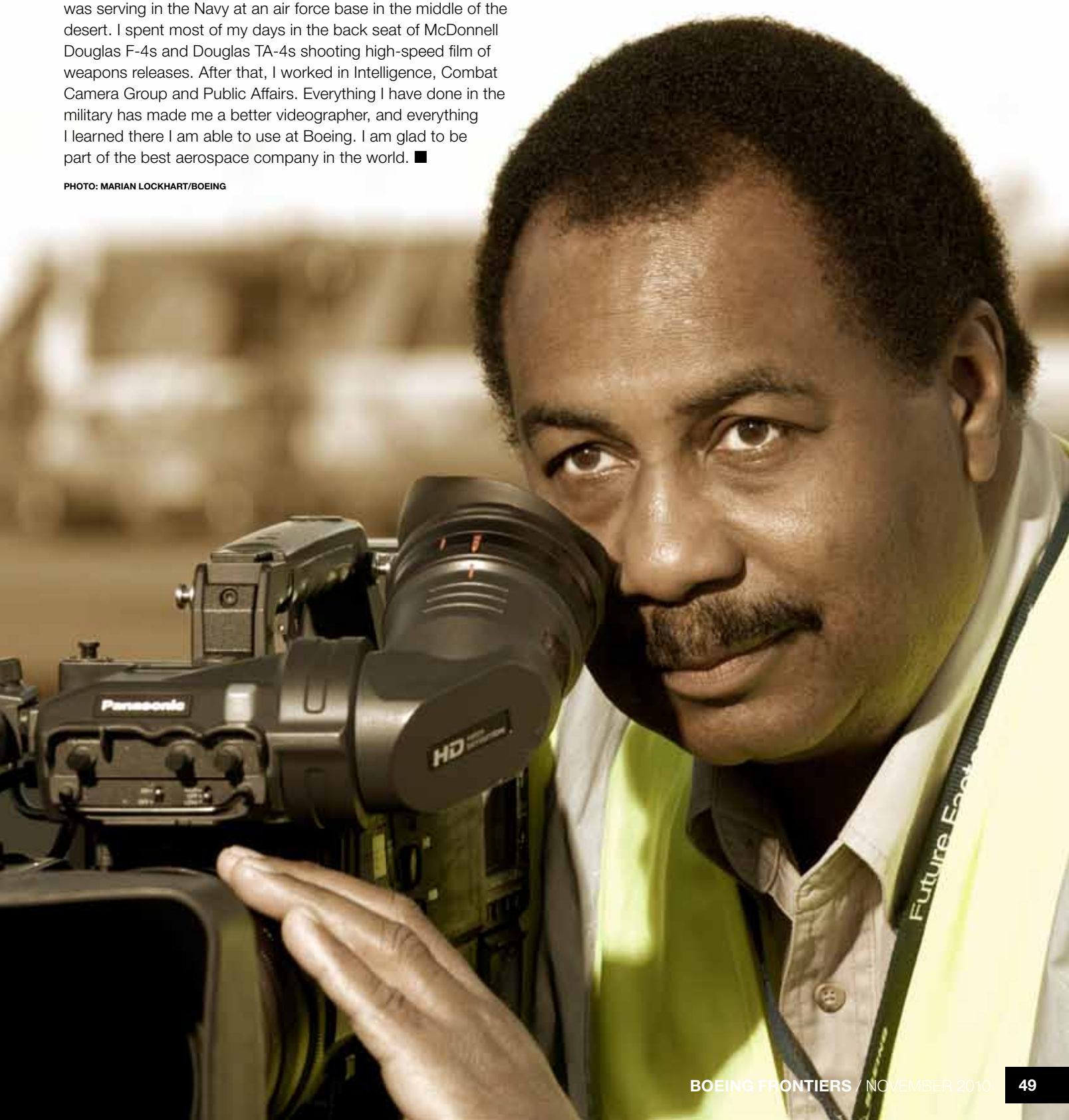


PHOTO: Alfred Girard, a maintenance mechanic on the 737 program, pumps wastewater containing oil into a tank for trucking to the Renton, Wash., plant's treatment facility. **GAIL HANUSA/BOEING**

Oil **change**

Engaged employees drive environmental gains

By Bill Seil

This is the first in a series of articles that focus on how Boeing employees across the enterprise are making a difference in Boeing's wide-ranging commitment to environmental stewardship.

Reducing oil waste at Boeing's jet-making plant in Renton, Wash., was accomplished with a "twist."

In 2007, environmental leaders at the site began looking into ways to recycle the approximately 171,500 pounds (77,800 kilograms) of liquid hazardous waste generated each year by machines and vehicles around the plant.

Since that time, the site has successfully reduced hazardous waste oil disposal by 97 percent. It is on track to recycle more than 100,000 pounds (45,360 kilograms) of oil and oily water during the calendar year; during the first half of 2010, the site had to dispose of only 2,270 pounds (1,030 kilograms) of liquid hazardous waste oil. Oily water is produced, in part, when oil is diluted to use as a coolant for machining operations. Highly diluted oily water can be treated at the plant's on-site wastewater treatment facility, which has accounted for a large part of the reduction in hazardous liquid waste.

Renton's liquid waste recycling program contributes to Boeing's five-year target of reducing hazardous waste disposal by 25 percent, on a revenue-adjusted basis, by 2012.

The effort was led by a team at the plant known as TWIST (The Waste Information Sharing Team), but its success was a group effort involving personnel from throughout the facility. Those involved used Lean+ tools and methodologies to analyze disposal processes and find ways to isolate recyclable oil in a safe, efficient manner.

Steven Webb, environmental control technician in Renton Hazardous Materials Management, said employees were open to the idea of changing their processes to support the recycling effort.

"We had the idea, but it took the cooperation of the folks in the shops to actually make it happen," he said.

In the past, some workshops put waste solvents into disposal containers with waste oil. The mixture was then put into the plant's large hazardous waste container, which was regularly emptied by an outside waste disposal vendor. The waste was then properly destroyed by incineration.

Blake Boling, an Environment, Health and Safety environmental scientist supporting the 737 airplane program, said the shops are now separating specific types of liquid waste into individual containers. They are then collected by Oregon-based Oil Re-Refining Co. The site has even been able to remove its central hazardous waste tank, as it's no longer needed.

In some cases, the Oregon company reimburses Boeing for the waste oil. This takes place when the liquid waste meets the regulatory definition of "used oil." It must be at least 75 percent oil and cannot be contaminated by other materials, such as solvents.

"Developing an oil recycling program required developing a solid understanding of how the guys on the shop floor operate," Boling said. "We took the time to interview different groups during different shifts. The concept of recycling oil is not new, but when you have a complex manufacturing operation, it takes a lot of planning and effort to change the way things are done."

Oil recycling is a good option for other sites, according to Boling, but planners must keep in mind that hazardous waste recycling regulations vary from state to state. The availability of recycling vendors also varies from region to region. But it is well worth the effort, Boling noted, and supports the company and employees' commitment to a quality environment for everyone. ■

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‘I want to be

Boeing employees share their stories about why

By Susan Birkholtz

People want to be healthy, to feel their best and enjoy the people and things that life has to offer. But sometimes getting there can require assistance. Boeing provides a number of Well Being programs, tools and resources to help employees and their families get healthy, stay healthy and manage chronic health conditions. One such tool is the online Health Assessment, which allows eligible employees and their spouses or same-gender domestic partners to identify health risks they may have. Accessible via www.boeingwellness.com, the Health Assessment is available through Nov. 30, 2010.

As part of the Health Assessment “What’s your reason” campaign, Boeing employees were invited to share their reasons for wanting to take the Health Assessment and be healthy. Here are three of the stories they shared.

SECOND CHANCE

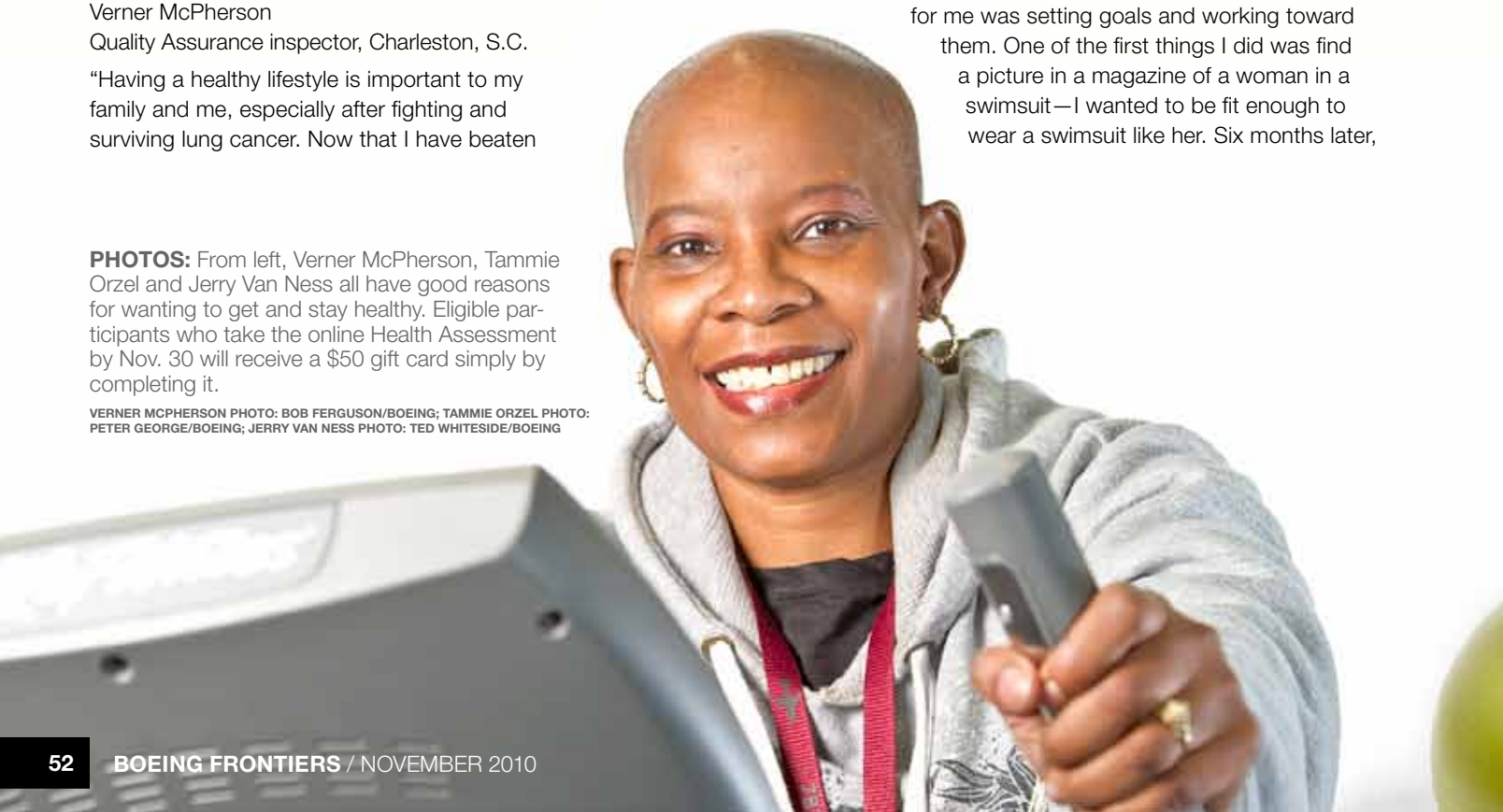
Verner McPherson
Quality Assurance inspector, Charleston, S.C.

“Having a healthy lifestyle is important to my family and me, especially after fighting and surviving lung cancer. Now that I have beaten the disease and am in recovery, it’s very important that I keep myself healthy and in good shape. I want to be healthy for my husband, who has been there for me throughout my illness, and for my 10-year-old daughter. I want to see her graduate from college and, hopefully, still be around to see my grandchildren. I want to take them to the park and have the energy to chase them around.”

MODEL BEHAVIOR

Tammie Orzel
Industrial Security specialist, St. Louis

“I decided it was time to get into better shape the day my doctor told me that I was ‘severely de-conditioned.’ I went to see him because I was feeling short of breath when I walked from my car into work each day. I started adopting a healthier lifestyle on Jan. 1, exercising and eating right. The key for me was setting goals and working toward them. One of the first things I did was find a picture in a magazine of a woman in a swimsuit—I wanted to be fit enough to wear a swimsuit like her. Six months later,



PHOTOS: From left, Verner McPherson, Tammie Orzel and Jerry Van Ness all have good reasons for wanting to get and stay healthy. Eligible participants who take the online Health Assessment by Nov. 30 will receive a $50 gift card simply by completing it.

VERNER MCPHERSON PHOTO: BOB FERGUSON/BOEING; TAMMIE ORZEL PHOTO: PETER GEORGE/BOEING; JERRY VAN NESS PHOTO: TED WHITESIDE/BOEING

healthy for...'

staying healthy matters

I was in that swimsuit. The hard work is paying off, and I feel so much better. I've always wanted to be a model, so late last fall, I submitted some photos to a modeling agency—and was accepted. I have done runway modeling in six fashion shows, and at 50, I have been the oldest model there. This is all incentive for me to keep doing what I am doing, not only for the health benefits but also for the confidence it has given me to go out and achieve my goals."

SCARED STRAIGHT

Jerry Van Ness
Quality Assurance specialist, Wichita, Kan.

"My reason for wanting to get and stay healthy stems from fear—fear of not seeing my children grow up and start families; fear of not being with my wife for many more years; and fear that I may not be healthy enough to take care of myself when I'm finally able to retire. In the past six years, I've had to deal with stage 2 melanoma skin cancer and, most recently, diabetes. I had been borderline diabetic for some time, so I didn't worry. That changed with my last doctor's visit—my blood sugar levels were so elevated that my doctor said I needed to be concerned about the possible ramifications—hearing loss, vision loss and limb loss. That woke me up. Diet? What should I eat? Exercise? Absolutely. Now I'm using my treadmill and it's losing its dusty appearance. I may even join a gym. I've come a long way." ■

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For more information about Well Being programs, tools and resources, visit the Boeing intranet at http://wellbeing.boeing.com or Boeing's wellness website at www.boeingwellness.com

MAKING A SPLASH

The 747-8 Freighter kicks up spray as it powers through standing water to determine whether the water is ingested into the engines. The water spray test is just one of the many requirements on the road to certification. To accomplish this test, Boeing built a shallow, temporary pool in the middle of a runway and then filled it with water. Pilots maneuvered the big airplane down the runway and through the water several times, starting at 35 mph (56 kph) and then at higher speeds. Parts of the airplane, such as the engine cowling and leading edge of the wing, were painted with a pink dye, which comes off when sprayed with water. This tells engineers where the water is hitting the airplane as it passes through the trough. The water spray test took place at a remote airfield near Glasgow, Mont. PHOTO: BOEING


COURAGE IS THE THREAD THAT HOLDS US ALL TOGETHER.
This Veterans Day, the people of Boeing salute all who served and all who serve. You are the tie that binds us and makes our freedom possible. Thank you.
BOEING