



Frontiers

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SEPTEMBER 2010 / Volume IX, Issue V

Cyber secure

Protecting vital information networks
is a fast-growing market for Boeing

Frontiers

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Boeing employees in Utah have earned a reputation for taking on a variety of work and performing well, whether it's building parts of the company's commercial jetliners or supporting defense programs. Salt Lake City also is the only Boeing site in the United States that sends no waste to landfills—what doesn't become an airplane part is either turned into energy or recycled.

PHOTO: BOB FERGUSON/BOEING



SAIL into the future

Shuttle orbital vehicle 95 at the Johnson Space Center in Houston has never flown into space, but it has made possible all other space shuttle missions. Known as the Shuttle Avionics Integration Laboratory, or SAIL, it is a comprehensive mock-up for testing all phases of a shuttle mission—safely on the ground.

PHOTO: ELIZABETH MORRELL/BOEING



Energy stars

One of Boeing's key initiatives for reducing the size of its environmental footprint is energy efficiency. And a growing number of Boeing sites are finding innovative solutions for cutting energy consumption and driving down costs. In Portland, Ore., for example, employees have saved an estimated \$600,000 a year by modifying a furnace used in the heat treatment of jetliner spare parts.

PHOTO: JIM ANDERSON/BOEING



Changing lives

Boeing volunteers from around the world, along with family and friends, took time out on July 17 to change lives by helping build homes, work with young people in schools, serve meals in homeless shelters and perform many other community services. It was all part of Boeing's first Global Day of Service, which was timed to commemorate the company's founding in mid-July 1916. PHOTO: JESSICA OYANAGI/BOEING



World view

What started 16 years ago as a grass-roots effort by a small group of computer-minded employees has evolved into the Boeing Geospatial Intelligence Repository, an ever-expanding collection of detailed data and images of every place on the planet. Its use within Boeing is growing, giving the company a competitive advantage.

GRAPHIC: BOEING GEOSPATIAL INTELLIGENCE REPOSITORY

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07 Leadership Message

Boeing Defense, Space & Security has a bold vision for future growth as it works to expand its core business and reposition in a time of constrained defense budgets. There are many challenges ahead, according to Dennis Muilenburg, president and chief executive officer, but with continued focus on five strategic objectives the business will stay headed in the right direction.

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Locked on target

Boeing Defense, Space & Security positions itself for future growth

Dennis Muilenburg

*President and chief executive officer
Boeing Defense, Space & Security*

PHOTO: PETER GEORGE/BOEING



Airbus' illegal subsidies come with a price tag:

American jobs.

Yesterday, the World Trade Organization ruled that billions of dollars in European launch aid subsidies given to EADS/Airbus over the years are illegal and must end. To date, the U.S. aerospace industry has lost tens of thousands of jobs and billions of dollars in exports. On behalf of 159,000 Boeing employees and our suppliers in 50 states, we thank the Office of the U.S. Trade Representative for its determination to ensure fair competition and a level playing field. Now, let's finish the job and end launch aid subsidies before more U.S. workers pay the price.



For more information visit boeing.com/WTO

Our business continues to change before our very eyes. For proof, look no further than plans for the sleek, unmanned Phantom Ray to hitch a cross-country ride atop a modified Boeing 747 that carries NASA space shuttles.

Amid many significant and simultaneous changes we face in our industry—from growing demand for unmanned systems and cybersecurity to revamping the U.S. space program and expanding global opportunities—“One Boeing” clearly stands strong. But we cannot stand still.

That's the driver behind “Accelerating Change” at Boeing Defense, Space & Security. Accelerating Change builds on momentum from the past several years and embodies five strategic objectives (see box). With continued focus on these, we'll round the corner toward 2011 in better competitive standing.

Successes throughout 2010 tell us we're on the right track. But ongoing challenges—constrained budgets, rapid technology evolution, shifting geopolitics and multiple international conflicts, for example—compel us to up the pace to ensure our products and services are not only the highest quality but the most affordable.

To that end, we're working with the U.S. Defense Department and other industry leaders to help transform the Pentagon's acquisition process. The goal is to reduce associated overhead costs by \$100 billion over five years. The savings will fund modernization programs and strengthen warfighter readiness. For us, that means an even greater focus on trimming unnecessary costs, leaning out processes, efficiently structuring our business, and achieving market-based affordability. Some of that calls for tough decisions today—actions such as consolidating facilities where it makes sense and selectively adjusting employment levels to match current work. But ultimately, this helps customers and positions us for competitiveness—and growth.

We have a bold vision for future growth. That growth promises to go deep, as we expand our core business, and broad, as we

reposition ourselves in key adjacencies. Recent satellite orders and successful international campaigns—for example, orders for three 702HPs for Inmarsat and P-8I multi-mission maritime patrol aircraft for India—illustrate the power of our core. And our acquisitions of Argon ST and Narus strengthen our presence in the emerging C4ISR [Command, Control, Communications, Computers, Intelligence, Surveillance & Reconnaissance], cyber and intelligence markets. (See story on Page 20.)

Effective leadership underlies all of this; for BDS that means “People first, customer always.” Engaging our employees, investing in talent, building an open and inclusive work environment, and treating everyone with fairness and respect have never been more important. And satisfying our customers—with quality and affordability—remains the best way to win contracts and keep people on the job.

It's clear to me that our team—fully aware of the challenges we face—remains dedicated to the missions and welfare of our customers. The importance of their missions motivates and inspires us; I see that in the eyes of the employees I meet with every day across Boeing.

No doubt, our business will keep changing, but our strategy and unwavering commitment to our customers focus everything we do for success. We're locked on target. We're ready. ■

BDS STRATEGIC OBJECTIVES

- Lead effectively: People first, customer always.
- Accelerate productivity and reduce cost structure for competitiveness.
- Grow aggressively into adjacencies and expand internationally.
- Execute flawlessly to satisfy customers and extend core business.
- Selectively vertically integrate and expand competencies.



Teaching employees about intellectual property helps safeguard technologies

By Cindy Naucler Glickert and photo by Ron Bookout



GROWLERS ON THE PROWL

Two Boeing-built EA-18G Growlers operated by the U.S. Navy are shown flying in formation. The Growler, an electronic attack variant of the F/A-18F Super Hornet, is built on the same St. Louis assembly line as the Super Hornet. Boeing's Growler and Super Hornet teams in St. Louis are continuing to drive costs out of the program with Lean+ practices as Boeing works to achieve a third multiyear production contract with the U.S. Navy for the aircraft. The Growler replaces the Navy's EA-6B Prowler aircraft. TED CARLSON/BOEING

As a St. Louis-based instructor with the Intellectual Property Management organization, Roxanne Deggendorf develops and conducts training forums that help Boeing employees learn how to identify and protect the company's intellectual property. In this *Frontiers* series that profiles employees talking about their jobs and the way their work fits into Boeing's goals, Deggendorf discusses why she believes it's important for employees to get educated on this topic.

Quotables

You're never too smart to learn something new, or too entrenched in your work routine to be inspired. That's true for teachers, too.

I know, because I teach Boeing employees how to identify and protect intellectual property. That's intangible products of the mind or intellect that have potential economic value to the company—basically patents, trade secrets, trademarks and copyrights.

It's a challenging job. Picture a classroom full of smart students with complex questions. I'm always improving the materials and my teaching techniques to keep current with changes to the law and trends in teaching methodologies. When arms go up or debates break out or people busily scribble notes, I know they're engaged and learning.

The training forums support Intellectual Property Management's strategy to increase employee understanding of intellectual property and how to protect and leverage it. Our attendees' jobs range from contract administrators to systems analysts to technologists.

Some want to learn more about how to correctly mark sensitive information, or when it's OK to use a copyrighted cartoon. Others are learning how Boeing builds its patent portfolio, or have questions about why certain inventions are kept as trade secrets. Just imagine, every single product and service that Boeing offers began with an idea and those ideas are the very essence of intellectual property.

One of the things we do in class is describe workplace scenarios and then ask participants to identify potential issues related to safeguarding Boeing's intellectual property rights. For example, what if an engineer attending a technical conference shares proprietary technical information during casual conversation, and later finds that information posted on the Internet?

The answer is: Boeing may have lost valuable intellectual property rights in that information.

One of the most important lessons we teach: Employees should feel free to contact Intellectual Property Management whenever they have a question or need guidance. We're here to help.

This year, we've taken the series of classes to Philadelphia; St. Louis; Mesa, Ariz.; Seattle; Huntington Beach, Calif.; and Huntsville, Ala. Next year, we hope to visit Wichita, Kan., and Charleston, S.C., along with the larger sites we visit annually. Where we can't go, online training is available. If you can, take the training ... you can learn something and be inspired to look at your job in a more creative light. ■

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For more information about Intellectual Property Management, including links to intellectual property training, visit the organization's site at <http://ipb.web.boeing.com> on the Boeing intranet.

“The difference is like going from dial-up to broadband for your Internet.”

— Ken Torok, a vice president with Boeing's Space and Intelligence Systems, speaking to Bloomberg News on Aug. 23 about the leap in capacity for military communications provided by Boeing's Wideband Global Satcom satellite, which the U.S. Air Force, Navy and Army use for tactical military communications.

“I didn't drill any crooked holes and I was very proud of that.”

— Georgie Kunkel, now 90, one of the many “Rosie the Riveters” who worked at Boeing during World War II. She drilled holes in B-17 wing panels. Kunkel spoke July 25 at a “goodbye” ceremony at Seattle's Plant 2 factory buildings, which will soon be demolished. Boeing plans a habitat and restoration project along the nearby Duwamish Waterway.

The need for speed



Hughes Racer broke aviation records and its famous pilot left a legacy of aerospace achievement that lives on with Boeing

By Henry T. Brownlee Jr.

"I want to be remembered for only one thing—my contribution to aviation."

— Howard Hughes

He was eccentric and controversial, and wealthy almost beyond measure, a maverick businessman and Hollywood movie producer who in his later years became a recluse.

But Howard Hughes Jr. also was passionate about aviation, an aerospace pioneer and record-setting pilot who left a legacy of companies and accomplishments that shaped the future of Boeing, and of airplanes that advanced aircraft design and flight and are a part of aviation history.

This month marks the 75th anniversary of a record-breaking performance by one of those airplanes, the H-1 Racer. On Sept. 13, 1935, Hughes piloted the H-1 at 352 mph (566 kph) over a measured speed course near Santa Ana, Calif., shattering the existing international record of 314 mph (505 kph).

It was the H-1 that gave birth to Hughes Aircraft Co., which was established that same year.

Boeing's satellite business in El Segundo, Calif., and its helicopter business in Mesa, Ariz., have their roots in the aviation company Hughes founded. But the connection between Boeing and Howard Hughes goes back even further.

Hughes was born in Houston in 1905, the son of a wealthy oil industrialist.

By 1931, the young Hughes was already a well-known motion picture producer and an emerging pilot with a passion for speed and an eye for accuracy and detail. He admired Charles Lindbergh and had started to make a name for himself as an aviator with a Boeing airplane, the 100A. He bought the biplane soon after making *Hell's Angels*, an epic film about World War I pilots.

The 100A, a commercial version of the Boeing F4B-1, was extensively modified for Hughes by the Douglas Aircraft Co. and Lockheed to make it more aerodynamic and faster for racing. But having set his sights on breaking the speed record for airplanes over a measured course, Hughes soon realized that to break the record he would need to develop an aircraft from scratch—an airplane designed specifically to be the fastest in the world.

He assembled a team to engineer and build the airplane. With strict oversight from Hughes, the team developed the Hughes Racer in just 18 months.

The 27-foot-long (8-meter-long) airplane, with a 700-horsepower (522-kilowatt) Pratt & Whitney engine, incorporated pioneering designs such as a close-fitting, bell-shaped engine cowling to reduce airframe drag and improve engine cooling, and retractable landing gear to reduce drag and increase speed and range.

These and other innovative designs enabled the Hughes H-1 Racer to easily break the speed record held by French pilot Raymonde Delmotte.

In January 1937, Hughes broke the transcontinental speed record in the H-1 by flying from Los Angeles to the Newark Airport in New Jersey in 7 hours 28 minutes. For that flight, Hughes had longer wings made for the H-1 to boost its lift and range.

Over the next decades, Hughes' passion for airplanes continued. Among the many airplanes he owned was a Boeing 307 Stratoliner. Meanwhile, Hughes Aircraft expanded and eventually included Hughes Helicopters and Hughes Space & Communications, which launched the first geosynchronous communications satellite, Syncom, in 1963. The Hughes Space & Communications division was acquired by General Motors in 1985.

The year before, in January 1984, McDonnell Douglas, now part of Boeing, had acquired Hughes Helicopters. At the time, the business had started producing a new attack helicopter for the U.S. Army at a recently opened facility in Mesa. That helicopter is known today as the AH-64 Apache.

In 2000, Boeing acquired Hughes Space & Communications from General Motors.

Hughes died in 1976. His Racer, which led to the formation of Hughes Aircraft, never flew again after setting the transcontinental speed record. It is on display today in the National Air and Space Museum in Washington, D.C. ■

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PHOTOS: (Left) Howard Hughes Jr. with the H-1 Racer. UNIVERSITY OF NEVADA, LAS VEGAS, LIBRARIES
(Inset) Hughes with his Boeing 100A, which was streamlined for more speed. BOEING ARCHIVES

A healthy understanding

Prevention is key to minimizing health risks and curbing rising health care costs

By Jill Gulbrandsen

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

Individuals and employers have felt the impact of rising health care costs over the past decade. At Boeing, health care costs are projected to continue to increase by 7 to 8 percent annually, almost twice the rate of inflation, according to Rick Stephens, senior vice president, Human Resources and Administration.

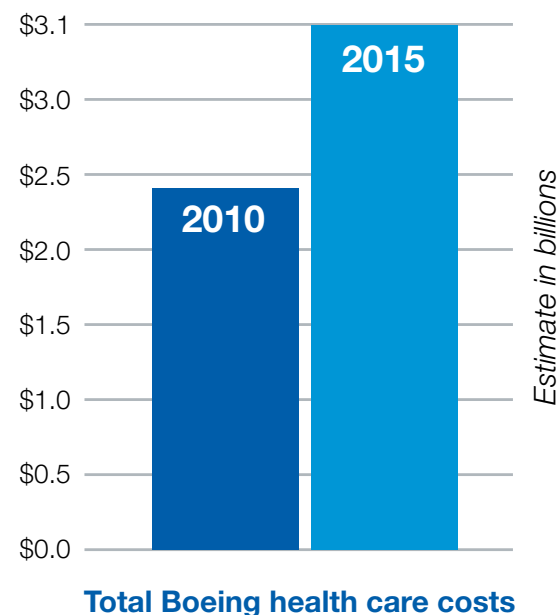
Boeing will spend an estimated \$2.4 billion on health care in 2010. At the current growth rate, this could rise to \$3.1 billion by 2015, consuming resources that could be used for product development and technology advances to keep Boeing competitive in the marketplace.

The recently passed health care law will be phased in over many years and is expected to change the U.S. health care system. While some aspects of the new legislation—broadening access to care, eliminating exclusions for pre-existing conditions, removing caps, and, in 2014, offering access to health care pools to early retirees who might not have employer-based coverage—are positive, the changes will result in additional cost pressures on the company.

In particular, a 40 percent excise tax will apply to the value of employee and early retiree health plans that exceed certain thresholds set by the government. This new tax, which takes effect in 2018, could represent a significant new liability. The company's objective will be to manage the cost of plans so that this tax does not apply to Boeing plans.

To address the health care cost challenge, Boeing will need to increase some of the costs that employees pay. "There will be differences in how some groups of employees share in the increases, based on pressures in some business segments or timing; as we work through our collective bargaining obligations, our plan is to be as fair and consistent as possible," Stephens said. "We also intend to introduce changes over time to make it easier for you and your family to plan and manage your benefits."

The good news is that health care expenses are not completely out of the company's—or employees'—control. Since 2006, Boeing has saved an estimated \$593 million



through more efficient supplier management, employee wellness programs and other initiatives.

Employees can also take significant steps to manage their health, benefits and health-related expenses. As much as 40 percent of Boeing's health care costs—almost \$1 billion each year—are linked to preventable health risks, including inactivity, stress, nicotine addiction and poor nutrition.

Fortunately, the company's Well Being initiative offers employees an array of programs, tools and resources designed to reduce or eliminate health risks that can lead to more serious illnesses. Examples are the Boeing on the Move physical activity challenge, free tobacco cessation assistance, chronic condition management, flu shots and more.

"As a company, we believe that helping employees live healthier lives is the right thing to do," Stephens said. "The company benefits as well, because a healthy work force translates into improved productivity, both on and off the job." ■

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An ounce of prevention

Boeing provides a variety of opportunities for employees to identify health risks and take steps to improve their health and well-being—ultimately helping to reduce health care costs for both employees and the company.

In addition to benefits for preventive care, Boeing offers:

- On-site health screenings at most U.S. locations and the online Health Assessment, on www.BoeingWellness.com through Nov. 30; those who complete the Health Assessment will receive a \$50 gift card (www.boeing.com/healthassessment)
- Flu shots each fall, free for employees at work sites across the United States; an annual flu vaccine is the best way to reduce the chances that you will get the flu

- Free and confidential tobacco cessation program featuring professional Quit Coaches®, free nicotine replacement therapy and help managing weight while quitting (<https://www.quitnow.net/boeing>)
- Wellness services available over the phone via Boeing TotalAccess, including Health Coaching (with access to a six-week Healthy Weight Program), a 24-hour NurseLine and a Condition Management Program to support those with chronic health conditions

PHOTO: SHUTTERSTOCK.COM

Playing by the rules

Landmark ruling that Airbus subsidies are illegal will help level the playing field for Boeing

By Tim Neale

It was a long time coming, but the decision the World Trade Organization handed down earlier this summer regarding the financial support European governments give to Airbus was a resounding victory for the United States.

"It's a landmark decision because it rules every instance of European launch aid an illegal subsidy that has harmed U.S. aerospace interests," said Ted Austell, Boeing vice president, Executive, Legislative and Regulatory Affairs.

What is launch aid?

"It's a clever practice where governments loan Airbus billions of dollars for new aircraft development on terms a commercial lender would never provide," Austell said.

Launch aid interest rates are pegged to the government borrowing rate, below what commercial lenders would charge, and repayments are pegged to airplane deliveries rather than to a fixed schedule. Also, repayment begins only after Airbus reaches a certain threshold of deliveries, and if it doesn't sell as many units as projected, remaining loan amounts are forgiven.

Austell said launch aid has given Airbus a huge competitive advantage.

"With European taxpayers shouldering a significant portion of both the risk and cost of airplane development," Austell said, "Airbus has been able to bring new products to market faster than it could have otherwise, and sell its products at prices that often are difficult to match when you're developing airplanes the old-fashioned way—with your own money, or money borrowed on commercial terms."

In its ruling, the WTO made it clear that the subsidies helped Airbus become the world's largest commercial airplane company.

"Had Airbus successfully entered the LCA [large commercial aircraft] industry without subsidies, it would be a much different, and we believe a much weaker, LCA manufacturer," the WTO said in its ruling.

Eliminating launch aid has been a Boeing priority not only to level the playing field with Airbus but also to establish important principles for new competitors, Austell said.

A \$3.6 trillion commercial airplane market is at stake, as well as markets for military aircraft based on commercial platforms such as the 767 NewGen Tanker. In the tanker competition, EADS, the parent of Airbus, is offering a plane based on the A330, which along with the A340 received more than \$5 billion of government money.

Jim Arkedis of the Progressive Policy Institute said the ruling is "welcome, not just for Boeing and American manufacturers but because it boosts the credibility of the rules-based global trading system, which lately has shown signs of fraying at the edges."

U.S. officials have long recognized the importance of the Airbus subsidy issue. There's been strong bipartisan, bicameral support in Congress and from multiple administrations for ending the subsidies to Airbus, and President Barack Obama recently showcased the WTO ruling against launch aid as an example of U.S. efforts to ensure a fair and level playing field. "That's why Boeing has been running ads [see Page 6] thanking the U.S. government for bringing this complex case to the WTO," said Tom Downey, Boeing senior vice president, Communications.

What's next? The European Union is appealing the ruling, but the appeals process is expected to conclude early next year, said B. Marc Allen, Boeing vice president, Global Law Affairs, and the company's lead attorney on the case. The organization's rulings seldom are reversed on appeal and the U.S. government remains confident that the core of its victory against Airbus subsidies will stand, he said.

The European Union has a counter-case against the United States for alleged subsidies to Boeing. A confidential preliminary ruling in that case is expected this month, with a final, public decision sometime next year. U.S. officials believe the European case, which does not allege subsidies with the market-distorting impact of launch aid, is weak, and so does Boeing, Allen said.

In any event, the cases are separate matters.

"Any rulings that might be made against U.S. practices will not negate the rulings just made against European practices," Allen said. "If, by chance, the WTO concludes there are some U.S. programs that have crossed the line, the U.S. government will undoubtedly move to remedy that, and we will move in tandem with our government. We fully expect Airbus/EADS and the EU to act in just the same way, making good on their end of the WTO bargain."

Once the appeal is settled in the U.S. case against European subsidies, if the initial panel's findings are affirmed, then European governments will face immediate compliance obligations under the ruling. Compliance will mean the withdrawal of illegal subsidies. In the context of illegal launch aid for the A380, that will translate into Airbus having either to pay back the still-outstanding loans or restructure them on commercial terms, Allen said.

It also means no further government-subsidized loans for airplanes such as the A350, which Airbus is developing to compete against the Boeing 787 and 777.

"In today's global market, it's essential that people play by the rules," Austell concluded. ■

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PHOTO: The Airbus A380, which is shown here parked behind Boeing's 787 Dreamliner at the Farnborough International Airshow in July, is one of the Airbus commercial jets that the World Trade Organization has ruled was developed using illegal government subsidies, or launch aid. The WTO decision is considered a major victory for the United States and will help level the competitive playing field for Boeing. The European Union has appealed the decision.

ED TURNER/BOEING





“We’re always ready to take on new work and reinvent the facility.”

— Bryan McCleary, senior engineer of the Boeing site in Salt Lake City

‘Can do’ crew

Whether supporting defense programs or making jetliner parts, Boeing teams in Utah have a long tradition of service

By Kathrine Beck and photos by Bob Ferguson

Boeing’s relationship with Utah began simply, with a plane stop.

In July 1927, when a Boeing Air Transport touched down in Salt Lake City, the state was one of the many stops along an air route between Chicago and San Francisco. But in the eight decades since, Utah has become much more to Boeing than a stopover on the way to someplace else. Today, facilities in the Beehive State provide specialized parts for Commercial Airplanes and important services for the company’s defense operations.

Boeing teams in Salt Lake City design and build the forward instrument panels

for all models of Boeing commercial airplanes. Overhead instrument panels and aisle stands—the console between pilot and co-pilot—for the 747, 777 and 787 all come from Salt Lake City.

And taking on varied work whenever a need arises around Boeing has both brought work to the state and earned Boeing employees there a nickname, the “can-do crew.”

“We’re really flexible,” said Bryan McCleary, senior engineer at the Boeing site in Salt Lake City, where 455 employees work. “We’re always ready to take on new work and reinvent the facility.”

The 18-acre (7-hectare) Salt Lake City site is a center of excellence for complex machined Commercial Airplanes parts. Since 1987, employees there have

built all kinds of parts and assemblies, including the entire MD-80 fuselage. Recently, they completed a package for the 747-8 trailing edge and now they’re at work on instrumentation for the 747-8 and 787-9.

“We’re very big on Lean+ manufacturing, and when we change the shop around, we do it in a way to accommodate the best Lean processes,” McCleary said.

One area where the can-do spirit is especially important is Spares Fabrication, which makes parts for out-of-production airplanes. Mechanic Mike Espinosa described the work as being “different all the time. Lots of times we don’t have tooling or shop aids for the parts, which is most of the fun.”

Salt Lake City also is the only

PHOTOS: (Clockwise, from far left) Bryan Woodward, Fabrication specialist, applies paint to a 787 console; Lynda Sutton, Fabrication specialist, attaches electrical jumpers on a 777 console; Fabrication specialists Phu Thai (left) and Mike Stice verify a part that came from a four-post press; Jesse Rocha assembles a 777 main instrument panel. All are at the Boeing Fabrication Salt Lake City facility.



“Everything that comes out of here that isn’t an airplane part either gets turned into energy or is recycled.”

— Todd Silva, Environment, Health and Safety manager of the Boeing site in Salt Lake City

Boeing site in the United States that sends no waste to a landfill.

“Everything that comes out of here that isn’t an airplane part either gets turned into energy or is recycled,” said Todd Silva, the site’s Environment, Health and Safety manager. Cardboard, plastic and other items are sorted and sold to recyclers, generating revenue for Boeing. Food waste and garbage is trucked to a nearby facility, where it is burned to produce energy.

Leave Salt Lake City, head north 40 miles (65 kilometers) and you’ll find another 370 Boeing employees at the Ogden site. They report to Strategic Missile Systems, part of Defense, Space & Security. Boeing has been supporting missile programs there since September

1960, when ground was broken on the U.S. Air Force Plant 77 for Boeing-built Minuteman Intercontinental Ballistic Missiles (ICBMs). The first one rolled off the line on April 12, 1962.

Today, Boeing provides sustaining engineering, modifications and upgrades for the ICBM fleet. Rick Schankel, Ogden site executive and ICBM program director, said the system is continuously upgraded to improve safety, security and capability, as well as to receive technical updates.

“I like this project because we’re able to utilize new technology,” said Lance Garner, project engineer for the ICBM Security Modernization Remote Visual Assessment Program. “We’re continually upgrading because it’s a reliable weapons system.

The Air Force has announced the ICBM system will be in place until at least 2030.

“Keeping this system operating is a huge responsibility,” said Bill Burtt, deployment lead for replacing the environmental control system for the Minuteman III program. “We are trying to seamlessly work with the Air Force as we upgrade a missile system that no one wants to use, but it has to be on alert 24/7. This system is a critical part of the U.S. nuclear defense triad and we don’t forget that.”

The Ogden site population includes employees located in and around Hill Air Force Base and its annex, Little Mountain, as well as employees who support the ICBM program at remote missile silo locations.

Forty Boeing employees operate and

maintain the Air Force-owned Little Mountain Test Facility. The site contains linear accelerators, shock and vibration equipment and a one-of-a-kind triaxial shaker and centrifuge. The bulk of the testing there supports the ICBM program, but the facility also provides an opportunity for Boeing—under an agreement with the Air Force—to generate additional revenue for the company by performing testing for other customers.

It turns out that a lab built to test the effects of a nuclear explosion also is a great place to test truck parts that need to withstand a lot of shaking.

Boeing employees support another Ogden-area Air Force facility, the Strategic Missile Integration Center. Boeing provides engineering support to the Air Force

personnel who test all ICBM modifications before they are deployed. Ogden Boeing employees also support the Ground-based Midcourse Defense system, as well as the A-10 Thunderbolt II, F-22, C-17 and C-130 aircraft.

Despite hazards such as ordnance, radiation sources, mobile cranes and high-voltage work, the Ogden site has racked up more than 4.5 million work hours without a day lost due to job-related injury or illness, a Boeing record that dates back to 2001. ■

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PHOTOS: (Clockwise, from top left) The view of Little Mountain Test Facilities from Promontory Point, at the northern tip of the Great Salt Lake; Ken Vordos, product acceptance specialist, completes a final inspection on a 787 main instrument panel; VaLynn Preece, Materials manager, displays a Lichtenberg figure, created by electrical discharges occurring between an electrode and an insulator (acrylic here), which form patterns resembling frozen lightning (application of electrical energy is a focus at the site); Gene Knot (left), Electromagnetic Effects lab technician, and John Law, Electromagnetic Effects physicist, simulate effects of electromagnetic interference environments on associated Air Force Weapon Systems support equipment; a test fixture is lowered for Shock and Vibration experts (clockwise, from top left) Chuck Simpson, Aaron Evans and Jerry Harper to assess the impact of simultaneous pitch, yaw and roll effects.



SAILing

through space

The mission of this space shuttle is to remain on the ground so others can fly

By Kelly Melone

Inside a shuttle mock-up called orbital vehicle 95 at the Johnson Space Center in Houston, engineer Doug Huntsman and his Boeing teammates are testing space shuttle mission software for something called a “transoceanic abort landing.”

On this day, they will run different scenarios consisting of various ascent, entries and aborts.

No space shuttle has ever had to make an aborted landing after launch, but OV-95 is the place to practice one.

Since the shuttle’s flight software is checked and verified for its final time in OV-95, there is no other place to catch errors or deficiencies before launch. “We’re the shuttle’s last line of defense,” Huntsman said.

Unlike NASA’s other shuttles, such as *Endeavour* (OV-105), *Atlantis* (OV-104) and *Discovery* (OV-103), OV-95 can’t leave the ground. But it has made all those other shuttle missions possible.

Known as the Shuttle Avionics Integration Laboratory, or SAIL, OV-95 is essentially a shuttle in a lab. It doesn’t have wings or a tail. There is no landing gear. What it does have is a state-of-the-art glass cockpit, middeck and payload bay without the clamshell doors of an actual shuttle.

It is configured, and wired, nearly identically as a shuttle that carries astronauts into space.

The lab is a comprehensive test bed in which the software, hardware, flight procedures, ground support—and the people—are brought together.

“We test before we fly and test like we fly,” explained Don Magnusson, the SAIL test operations and maintenance manager for United Space Alliance, the joint venture by Boeing and Lockheed Martin and the lab’s operator. “And then we fly like we test.”

A typical shuttle mission costs more than \$1 billion. So the software better work.

Chad Smith is one of the newest members of Boeing’s SAIL team and works in Entry Guidance, Navigation and Control.

“We start with the black and white. We look at the actual code that’s being added into the software,” Smith said. The Boeing team puts the updated software through its paces “reconfiguring switches, providing crew keyboard inputs, monitoring changes and making sure things happen in the right sequence.” Then, after every test, they conduct a full analysis and submit their reports—wrapping up 63 days before a shuttle flight.

The shuttle program is nearing the end, and that fact is not lost on Smith, Huntsman and the other team members. But as long as there are shuttle missions, they have work to do. ■

PHOTO: Boeing SAIL team members Doug Huntsman (left) and Ariel Rodriguez check switch configurations on the OV-95 flight deck. ELIZABETH MORRELL/BOEING

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Power performers

Employee ingenuity and dedication are generating big energy savings for Boeing

By Bill Seil

In the late 1970s, Boeing introduced Frugal MacDougall, the energy conservation squirrel who made appearances in *Boeing News* cartoons and in costume at employee events. The campaign encouraged employees to take basic conservation measures, such as turning off lights when not needed.

Today, the company's energy efficiency programs are far more sophisticated and widespread. Energy efficiency is one of five targeted areas for reducing the company's environmental footprint by 2012.

Boeing employees have reduced energy consumption on a revenue-adjusted basis by 32 percent since 2002, and the company is on its way to achieving its 2012 target of reducing energy consumption by 25 percent over a five-year period.

Jeff Nunn, Conservation program manager in Shared Services Group, said energy conservation supports the company's goal of continuous productivity improvement by reducing operating costs, and has the added environmental benefit of reducing greenhouse gas emissions.

"Environmental thinking is incorporated in Lean+ programs throughout the company," Nunn said. "Conservation is a growing part of our culture. Ultimately, we want it to be less of an initiative and more embedded in sustaining operations and processes—just part of the way we do business."

Boeing has strengthened its energy efficiency focus through its affiliation with the ENERGY STAR program, which is administrated by the U.S. Environmental Protection Agency. Boeing's Corporate Offices building in Chicago recently became the third Boeing site to earn the label. It joins Houston's Bay Area Boulevard building and the Douglas Center's Building 800 in Long Beach, Calif., which earned labels in 2008 and 2009, respectively.

Harry Williams, senior manager, Chicago Site Services, said the certification was achieved by

PHOTO: To save energy and cut costs, St. Louis Facilities engineers Kevin Arcynski (left) and Steve Ahrens helped reprogram software used to operate an aging heating, ventilation and air-conditioning system. BOB FERGUSON/BOEING



working with the building's management organization to implement cost-saving and energy-efficiency improvements throughout the 36-floor structure. Boeing occupies 12 floors and leases the remaining floors to tenants.

"Our ENERGY STAR label is the result of a team effort by both management and employees," Williams said.

Improvements focused on lighting, energy management systems, heating, ventilation and air-conditioning systems (HVAC), and automated controls. There was also a campaign to promote energy conservation in employees' day-to-day activities.

"Improving the energy efficiency of commercial buildings is critical to protecting our environment, said Richard Nagle, acting deputy director of the EPA Region 5 Air and Radiation Division, who attended a July event celebrating Chicago's ENERGY STAR achievement. "Organizations like Boeing are leading the way."

Boeing recognizes conservation improvements taking place throughout the enterprise with its annual Conservation Awards. Twenty-seven awards were presented this year, several recognizing innovative energy-efficiency projects.

One such project occurred at the St. Louis site, where facilities engineers Steve Ahrens and Kevin Arcynski rewrote software to get an older HVAC system, using constant airflow, to function more like a modern, energy-efficient, variable airflow system. This change will result in annual savings of more than 13 billion British Thermal Units (BTUs) of energy and an annual cost savings of approximately \$100,000. A BTU is approximately the amount of energy needed to heat 1 pound (0.45 kilograms) of water 1 degree Fahrenheit (0.56 degrees Celsius).

Bryan Kury, a St. Louis Site Services manager, said the improvement can be replicated across the enterprise on existing equipment.

"It's a very creative solution that immediately began to save both energy and money," Kury said.

Another award-winning project took place at Boeing Portland. It involved a furnace that uses gas to heat-treat spare flap tracks for older model 747 jetliners. Bob Faulkenberry, an equipment engineer at the facility, said the furnace had an old carbon dioxide analyzer control that made it very difficult to restart the unit after it was shut down.

"The furnace is a critical piece of equipment, because it's one of a kind," Faulkenberry said. "But today, it's only needed for spares, so we needed a way to operate it on a limited basis."

After researching the problem, they found a modern analyzer control with a digital output that was reliable and available. It took some effort and ingenuity to get the surrounding equipment to recognize the digital signals, but the change was ultimately a success. It has resulted in estimated

PHOTO: Ryan Tapp (left) of Boeing supplier Energy Industries works with Site Services electrical engineer Tom Esbrook to install energy-efficient fluorescent lamps at the F-22 Composite Fabrication and Assembly Center in Seattle. MARIAN LOCKHART/BOEING

PHOTO: Tamara Linton (left) of Boeing Site Services and Paul Libbey of CB Richard Ellis discuss the energy and cost saved by a new equipment monitoring system at the Boeing site in Chicago. BOB FERGUSON/BOEING

annual cost savings of \$600,000 and energy savings of more than 37 billion BTUs.

A lighting project at the Boeing Developmental Center near Seattle involved installing energy-efficient fluorescent lamps and replacing ballasts (which ensure the correct voltage and current for starting and operating the bulb) based on the results of a recent Lean Energy Assessment. Tore Sleveland, a Site Services conservation specialist, said the project provided an example of people leveraging their supplier relationships and experience with the assessment data to secure 2009 Seattle City Light rebate funding. The project, which was financed by the utility, will produce an annual energy savings of 808,000 kilowatt hours—enough energy to heat 73 average-size homes a year in the United States—for an annual cost savings of about \$50,000.

“In addition to having the work completed at no cost, we have lowered our energy expenses and are saving on maintenance costs,” Sleveland said.

Upon completion by year-end of similar projects at other Boeing sites in the Seattle area, teams will have replaced 15,000 fixtures at an annual energy savings of roughly \$250,000.

Diverse energy projects such as these, developed and championed by employees throughout the company, are at the heart of Boeing’s energy conservation success. ■

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A good fit

A Boeing team has made sure that space station elements fit seamlessly during assembly

By Tabatha Thompson

Imagine the frustration of buying a large appliance such as a refrigerator, lugging it home and removing the old one, only to discover that the new one doesn’t fit, or the plug doesn’t work with the electrical outlet.

What if that refrigerator were for the International Space Station orbiting 220 miles (350 kilometers) above Earth? The only way to return it for one that’s the right size and fit would be to wait for the next space shuttle launch.

Thanks to a Boeing team, this kind of bad-fit scenario has never happened during 15 years of station assembly.

The Boeing Verification and Assembly Analysis team in Houston provides all the checks to make sure hardware headed for the space station fits seamlessly.

“Our skills can be applied to just about any project, but the obvious difference with space station is that assembly takes place on orbit; so, there’s very little margin for error or chance for a redo,” said John Cook, Boeing Assembly Analysis lead.

Boeing is NASA’s prime contractor for the design, development and integration of all the U.S.-built elements of the space station.

Hardware integration has been one of Boeing’s biggest challenges, requiring

meticulous planning and coordination, explained Mark Mulqueen, vehicle director for Boeing’s International Space Station program.

“Given the cost and effort that goes into launching a piece of hardware into space, there’s simply no room for error,” Mulqueen said.

With more than a dozen international partners collaborating on space station construction, the team has learned to navigate differences in language, culture and technical approach.

“This team is the last check and balance to ensure that when elements are put together in space, they fit and function with one another perfectly, said NASA’s Cal Brogdon, who analyzes robotics for the space station at the Johnson Space Center in Houston.

To make that happen, team members travel everywhere—from the Kennedy Space Center to Japan to Russia. They measure and inspect hardware headed for the station and enter the data into a computer modeling program that verifies all parts will fit together. Finally, the team performs a simulated on-orbit assembly.

“We simulate the on-orbit configuration for each of the elements and perform a fit-check with the cable and fluid lines that

link these elements,” said Janice Hawkins, with the Cable and Fluid Assembly team. “The astronauts who will be on orbit participate in the test and run the same sequence they would at the station.”

In 2009, an on-the-ground test uncovered a problem with a connection on the Italian-built observation deck, Cupola. The fluid lines were too large to allow the Cupola to connect to its permanent home on a U.S.-built node of the space station.

Engineers corrected the problem, and astronauts successfully installed the Cupola in February of this year.

The Boeing team continues its work on the space station, but has expanded its focus to include commercial cargo carrier systems now in development.

“Basically, we can apply our expertise to any integration out there,” said Craig Stanton, the lead for Digital Pre-Assembly and Cable and Fluid Assembly teams. “Doesn’t matter if it’s a space application, a commercial airplane or just about anything else.” ■

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PHOTO: Boeing Space Exploration engineers Craig Stanton (left) and Clay Stangle examine a connector for a space station component. ELIZABETH MORRELL/BOEING

Virtual performance

Boeing employees create high-tech library of data and images for every place on Earth

By Chris Haddox

For Robert Kramer of Phantom Works, and the growing list of other Boeing users, BGIR (pronounced bigger) is definitely the better way to find exactly what they need.

"Earth is our playground and we are expanding our sandbox," Kramer said. "And that's good news for those who need what we have."

What he has is highly accurate digital information, and the "sandbox" is the Boeing Geospatial Intelligence Repository, or BGIR—an ever-growing collection of data such as images and detailed 3-D renderings of any point or place on Earth.

"We are interested in any kind of data that defines or describes Earth," said Kramer, who brands himself and others who collect and maintain the data as high-tech librarians.

The repository began 16 years ago as a grass-roots effort by a small band of computer modelers known as the Synthetic Natural Environment Working Group. Its members, from various programs across

Boeing, did digital visualization work. They shared ideas and data such as digital images and maps of military bases or terrain. That collaboration reduced and prevented redundant work.

In 2007, at the group's biannual meeting at the Boeing Leadership Center, St. Louis, the members knew they were on to something and pondered how to make geospatial collaboration even bigger and better.

"I left the meeting and began putting together the idea of an online repository, but no one really had the time to do it," recalled Kramer. He made the time and began collecting data from the National Geospatial Intelligence Agency and commercial satellite providers for the Virtual Warfare Center, where he is the BGIR lead engineer for Advanced Experimentation & Visualization in Phantom Works.

As Kramer's collection grew, he noticed others had their own private geospatial data "stashes" and thought, Why not combine those and put them into a single place and make it official? The repository was born.



Rick Gaylor was one of the first to realize its potential. Gaylor is a visual engineer at the Integrated Technology Development Lab in Seattle. He builds visual systems and visual databases for trainers and Boeing Business Development, and the repository gave him access to data and information he never had before.

"For the first time, we are able to build data sets for areas of interest for the entire planet," Gaylor said. "That's incredibly powerful when creating a true representative visual database for our users. We could never do that before."

Gaylor convinced his management by putting the system to the test and prototyping a high-resolution digital model of Elmendorf Air Force Base in Alaska over a weekend—not the 18 months an outside vendor proposed.

"I was able to download the content, prepare it in about an hour and in one day re-create Elmendorf with more detail than ever before, which is the beauty of the BGIR," Gaylor said.

The Boeing Geospatial Intelligence Repository became official in September 2009. So far this year, it has saved the

company more than \$2 million—and thousands of labor hours. "We've realized the cost savings is an order of magnitude bigger than the cost it takes to gather and keep the information within BGIR," Kramer said.

Almost every large Boeing program has used the repository, including Commercial Airplanes. Customers have used it, too.

"We provided SBInet [Boeing's border security program] a very accurate digital terrain model for developmental use and that has now become one of the gold standards in how to do terrain mapping," Kramer said.

Nearly 20 requests for information come to the repository each month.

Since that first meeting at the Boeing Leadership Center in 2007, the amount of data the repository contains has grown from three terabytes to nearly 50 terabytes. It will soon double. The next goal, according to Kramer, is a petabyte, which is a quadrillion bytes, an amount equivalent to 100 times the data contained in the print collection of the U.S. Library of Congress.

The repository is on its way to becoming the official data source for Boeing, Kramer

and Gaylor say, which will bring additional resources to provide more data. It also will become more accessible and easier to use, and customers will be able to request data online and download the information themselves over the Boeing network.

Bill McLean, manager of the Geospatial Intelligence Program—West in Seattle, said the repository is a perfect example of how the resourcefulness and creativity of a few can benefit the entire Boeing enterprise.

"The success of this effort shows how Boeing employees can empower themselves to proactively chart a larger course," McLean said. "We've only begun to identify the value this effort brings to the Boeing team."

Added Gaylor: "We want to be able to give them the world." With BGIR, Boeing can. ■

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PHOTO: From left, Rob Klein, geospatial engineer, Rick Gaylor, visual engineer, and Robert Kramer, Boeing Geospatial Intelligence Repository lead engineer, look over a synthetically generated Seattle skyline.

GRAPHIC: BOEING GEOSPATIAL INTELLIGENCE REPOSITORY
PHOTO: RICHARD RAU/BOEING

"Earth is our playground and we are expanding our sandbox."

— Robert Kramer, lead engineer, Boeing Geospatial Intelligence Repository



One fine day

How Boeing volunteers around the world helped communities and changed lives

By Geoff Potter

It was a "One Boeing" kind of day.

In communities on three continents, more than 1,600 Boeing employees, their families and friends volunteered their personal time and skills to touch lives at schools, workplaces, homes and even homeless shelters during the company's first Global Day of Service on July 17.

"Employees from across the enterprise came together on the same day for a common purpose, and they touched the lives of people around the world," said Patrice Mingo, Boeing director of strategic employee programs. The success of the global event exceeded expectations, she said.

Timed to commemorate the founding of The Boeing Company on July 15, 1916, the new, signature event put an exclamation point on Boeing's evolving volunteer program, which was launched by the Employee Volunteer Council and Global Corporate Citizenship

earlier this year. The purpose is to connect employee volunteers worldwide and maximize their positive impact in communities.

Beyond the six pilot Global Day of Services sites, other Boeing employees also participated. In Kansas, for example, volunteers gathered at the Wichita Art Museum to educate the public about the arts. They helped operate an art studio for kids and hosted an ice cream social that drew 1,200 attendees.

Here's a brief look at what was accomplished at those six sites:

IN ST. LOUIS, more than 200 Boeing volunteers worked with nonprofit Rebuilding Together to

repair houses. The teams poured concrete, replaced porch columns, painted, redid siding, cleaned up yards and much more to help poor,



PHOTOS: (Below and top left inset) In Puget Sound, volunteers help build new Habitat for Humanity houses. JESSICA OYANAGI/BOEING

(Insets, top middle and right) With Rebuilding Together, volunteers repair the houses of poor, disabled and elderly homeowners in St. Louis. RICHARD RAU/BOEING

(Above) In Seoul, Korea, volunteers serve meals, and wash up afterward, at the Rise Again homeless center. KEVIN KELLY/BOEING





PHOTOS: (Below) Volunteers head out to start working on California wetlands restoration. BOB SCHNEIDER/BOEING (Insets, from left) In Australia, volunteers weed and plant a high school's new Boeing Garden. KAREN CLARKE/BOEING Together with students and staff, volunteers help decorate a Tokyo school for its 25th anniversary fundraiser. MITSUKO TAKAHASHI/BOEING

disabled and elderly homeowners continue to live independently.

"This was my first leap into volunteer work of any kind, and it was a little overwhelming at times, but it was worth every moment," said Shanán Smith, a Lean+ facilitator who helped lead 74 Engineering, Operations & Technology employees that day.

"Watching people come together and bring their knowledge and abilities to lift the burdens of homeowners in need was an experience beyond words," Smith added.

IN KOREA, 15 volunteers, including Boeing Defense, Space & Security leaders, employees and their families, prepared and served meals to nearly

170 people at the Rise Again Center, a homeless shelter in Seoul.

IN JAPAN, employees chose to work at Tokyo Shure, which is celebrating 25 years of providing alternative schooling for children and young people. The volunteers helped students and staff decorate the school with handmade signs and origami for a fundraiser marking the anniversary.

IN WASHINGTON STATE, nearly 800 volunteers, many from Boeing Commercial Airplanes, partnered with Habitat for Humanity to build 12 homes at six construction sites across three counties. Other teams helped paint and clean up Puget

Sound schools and child care centers.

IN SOUTHERN CALIFORNIA, more than 450 Boeing volunteers removed invasive vegetation and trash to help maintain the natural habitat of local wetlands areas.

The teams included members of the Clean & Green Crew, part of the LA Conservation Corps' Young Adult Corps. These are at-risk students who gain job skills training, education and experience working on conservation and service projects.

Together, the volunteers repaired 4,800 square feet (450 square meters) of decomposed granite trail path

and removed 5 acres (2 hectares) of invasive species that included a 700-pound (320-kilogram) palm tree. They also got rid of nearly 12 tons (11 metric tons) of trash.

IN AUSTRALIA, employees joined with members of the Brisbane, Queensland, community to help improve the grounds for Balmoral State High School.

"The neighbors around the school all came out to see what was going on and were pleased to see Boeing's involvement," said James Baker, who led the Australian event. "They even suggested we might like to do their gardens." ■

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Thanks, MATES!

This Boeing team makes sure tools are calibrated and ready

By Jennifer Hawton

Chris Winslow tests fiber optic networks on U.S. Navy F/A-18s—a critical system that links the Boeing jet's avionics.

To ensure the customer gets the quality product it expects, Winslow, an Associate Technical Fellow in Boeing Defense, Space & Security, relies on a proprietary fiber optic test module known as the Automated Fiber Optic Test Set. This tool saves him a lot of time because it tests all of the aircraft's 100-plus fiber optic connections at once, rather than having to check each connection with a hand-held tester.

The development and maintenance of this tool—and the upkeep of about 400,000 other critical tools—falls under the purview of the Metrology and Test Equipment Services (MATES) team at Boeing Test & Evaluation. (Metrology is the science of measurement, and the team ensures the company's instruments are accurate

enough to build reliable products.) The team keeps these important tools calibrated and in use in Boeing factories and labs—all the while looking to find ways to do this calibration task more efficiently.

For example, the team has found ways to determine the best interval between tool calibrations: By implementing a common information system, the team has been able to gather and examine companywide reliability data since 2008. Proprietary software analyzes this data and “predicts how increasing calibration intervals will impact tool reliability according to an internationally accepted recommended practice,” said Vicki Dunlop, MATES leader for Boeing Test & Evaluation.

Because of this improvement and the wealth of reliability data available, the team has been able to increase calibration intervals an average of 27 days since the formation last December of the Boeing Test & Evaluation organization, according to Dunlop. Multiplying that period by the 400,000 calibrated tools across Boeing means that calibrated equipment is available for use for an additional 11 million days.

“We continue to drive improvements and save money since becoming a part of Boeing Test & Evaluation,” Dunlop said. “Being an enterprisewide service group allows us to continue our work without any departmental barriers.”

Richard J. Moldovan Jr., a manufacturing test engineer with Defense, Space & Security, also counts on the team's services. With more than 100 fiber optic segments in each F/A-18, the fiber optic test tool “allows us to reduce days of labor to a few hours by automating tests of the fiber optics in these aircraft,” Moldovan said.

Added Philip Ciecalone, calibration technician in the St. Louis Electrical Metrology Laboratory: “It's really about keeping the tools up and running that people need to do their jobs. Just as our customers want to keep their airplanes in the air, we want to keep our important tools in the field, doing their jobs.” ■

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PHOTO: Philip Ciecalone, calibration technician in Boeing's St. Louis Electrical Metrology Laboratory, calibrates an Automated Fiber Optic Test Set. **PETER GEORGE/BOEING**



DREAM SIMULATOR

The first 787 Dreamliner full-flight simulator, built by Thales, was unveiled last month and will be used by Boeing Training & Flight Services in Seattle to train pilots to fly the Dreamliner. Using the simulator as part of flight training, pilots can transition to the 787 in five to 20 days; Boeing 777 pilots can qualify to fly the Dreamliner in as little as five days. The 787 flight deck features significantly larger display screens than in previous commercial jets. The five screens offer 546 square inches (3,500 square centimeters) of display area—twice that of the 777. There are currently eight 787 training suites installed at five Boeing Training & Flight Services locations around the world.

PHOTO: GAIL HANUSA/BOEING



LIFE IS A JOURNEY BEST TAKEN TOGETHER.

And that may be the one true link that brings us all together,
regardless of race, creed or color. That's why we support
those courageous enough to make discrimination, history.

 **BOEING**