



Frontiers

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Soaring, Down Under

Employees in Australia—Boeing’s biggest footprint outside the U.S.— are helping build a better future for the entire enterprise.





BOEING AND THE LEGACY OF LUTON.

Some partnerships can lead to revolutionary developments. Take Boeing and GKN Aerospace.

Working as one, the team has created a state-of-the-art wing de-icing system for the new 787 that allows the aircraft to monitor and remove ice from the wings throughout the flight. A legacy we can all be proud of.

 **BOEING**

boeing.co.uk

This is the twelfth in a series of ads created to build awareness of Boeing and its many partnerships in the United Kingdom. Boeing, the largest overseas customer of the UK aerospace industry, currently partners with more than 300 businesses and universities around the country. The advertising campaign has appeared in The Sunday Times, The Economist, Spectator Magazine and other UK publications, and complements current Boeing business and communications activities in that nation.



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TARGETING THE FUTURE

Boeing employees in Australia, including those who support the ScanEagle autonomous unmanned aerial vehicle (above), are working to create a brighter tomorrow for the entire enterprise. Here's a comprehensive look at Boeing's activities in Australia. **HEIDI SNOWDON**

ON THE COVER

The Sydney Opera House. Shutterstock.com photo

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PITCHING IN

All around Boeing—including in St. Louis (right)—you'll find employees taking the initiative to support the company's environmental activities at work—and to take part in green projects in their communities. To build environmental engagement, Boeing offers new tools such as blogs, training and "green team" toolkits to make that enthusiasm as effective and widespread as possible.





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In Albuquerque, N.M., Jeff Waitkus and Matt Edwards review coarse- and fine-tracker footage of a model plane and tethered rocket that were used to test the tracking algorithms of the Dual Line of Sight system. This technology helps extend the reach of Boeing's laser systems. BOB FERGUSON/BOEING

32 Support for all
What's the goal of Boeing's Support & Services domain? It's to take a companywide approach in developing technologies that best meet its customers' support and services needs—while creating a sustainable competitive advantage that increases Boeing's growth and productivity.

35 I can help you with that
At Boeing manufacturing sites across the United States, you'll find computing people providing workstation support for the factory floor and field operations. They've taken the initiative to solve common problems—and have introduced a number of cost- and time-saving desktop technologies and procedures.

36 Not just a hobby
If you see Boeing employees in Albuquerque, N.M., flying a radio-controlled airplane, rest assured that they're really at work. They're testing the hardware and algorithms used in the Dual Line of Sight tracking system, which extends the reach of Boeing's laser systems while maintaining their precision.

38 Get ready for a big test
The Boeing-led Ground-based Midcourse Defense program and its teammates are preparing for their most complex test, set for late this year.

39 Nice to meet you
Two U.S. Air Force F-22 Raptor pilots, including the first woman to fly an operational F-22, recently visited Seattle for their first engineering cross-talk with Boeing employees on this program. The discussion educated the F-22's developers and end-users.

40 A high-altitude office
For every new model or modified production airplane, Commercial Airplanes flight test engineers monitor myriad tests to make sure that the airplane performs as designed and meets customer requirements.

42 On the right wavelength
Did you know that Boeing's access to radio frequency spectrum is estimated to be worth billions of dollars? Here's an explanation of what RF spectrum is, why it's important and who at Boeing is working to ensure the company has access to it.

44 A secure link in the chain
U.S. Customs and Border Protection recently revalidated Boeing's top ranking in a global supply chain security program. This rating acknowledges Boeing's rigorous standards of supply chain security—and supports the company's production strategies.

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The leaders of the four companywide growth and productivity initiatives: From left, Jon Emery, Internal Services Productivity; Bill Schnettgoecke, Lean+; John Pricco, Development Process Excellence; and Ron Shelley, Global Sourcing. CAL ROMANESCHI/BOEING

Why there's growing urgency to incorporate 4 initiatives

It's been nearly three years since Boeing launched its four initiatives to boost the company's growth and productivity. Since January 2006, teams across Boeing have been learning to incorporate the initiatives into their daily work. We have established good groundwork, but now—given the combination of an external economic climate that's growing more uncertain, high expectations from customers, a set of internal challenges, and a competitive situation in which new competitors are arising while existing ones are becoming more productive—we need to take it to the next level.

Our customers have high and unpredictable operating costs, largely due to oil prices, and they count on us to provide products and services that help them operate more efficiently. Boeing and our supplier-partners can do that—and stay ahead of our fierce competition—only when we, ourselves, operate in the most efficient and effective manner. When we do this, we free up resources that Boeing can put into innovative product breakthroughs.

The initiatives—Lean+, Internal Services Productivity, Development Process Excellence and Global Sourcing—give us the common tools to reach first-time quality, cut waste and costs, and improve processes. The initiatives help provide us with a common, integrated approach—in tools, processes and language—that expedites the productivity that's so critical to our competitive success—and to our growth. The initiatives help us to execute a one-Boeing strategy of continuous improvement that increases competitiveness, drives innovation and better meets customers' needs.

The initiatives aren't about creating more work. To the contrary, the initiatives will save you an enormous amount of time, energy and costs. Why "reinvent the wheel"? Why waste time trying to overcome a roadblock on a project when someone may already have solved that problem in a similar situation? It's not about rework; it's about expanding your available resources and network of subject-matter experts. (To learn more about the initiatives, visit <http://bmm.web.boeing.com/init.html> on the Boeing intranet.)

Every Boeing employee is responsible for working across or-

ganizational and business-unit lines—as appropriate—to share expertise, use common tools and processes and increase productivity. And there are many great stories of how employees have implemented the initiatives. Recent successes range from P-8A team members from Integrated Defense Systems and Commercial Airplanes establishing cross-training in strain gages—which lets them create and share new time-efficient tools and processes—to Boeing contracting AT&T to become the company's primary telecommunications provider. Having one primary provider will save millions of dollars and enable numerous process improvements.

There are many stories like this across Boeing. It's very important that we share and document our experiences, project accomplishments and initiatives-driven results. That way, we can help each other reach goals, while accurately measuring our productivity, growth and financial results.

One important tool to help you is the Initiatives Database (<https://initiatedb.web.boeing.com> on the Boeing intranet), which supports collaboration and sharing best practices. It's a way not only to communicate lessons learned across Boeing but also to avoid repeating work previously accomplished. Since the IDB's launch in late 2006, engaged employees have been populating it with valuable information. As of July this year, 2,923 projects from various business organizations were documented in the IDB; 356 projects were replicated from other projects. Companywide projects in the database as of July generated a projected total net savings over five years of more than \$10 billion.

The Lean+ Roadmap (<http://leo.web.boeing.com/Roadmap> on the Boeing intranet) also can help with your goals. It's an interactive guide that connects and consolidates the many improvement tools and methods into one place, so it's easier for you to learn about—and then achieve—continuous improvement.

Looking ahead, we have teams working to bring you new tools and technologies that will help drive a more collaborative environment across Boeing. But it is critical we maintain our focus on the initiatives to continue to drive productivity and growth—and help us fund innovation. This will make Boeing (and our customers) more competitive while generating career opportunities and job stability that will benefit us all. ■

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LETTERS /

“The Payload Studio concept is a significant step forward in emphasizing and providing for the needs of the passenger.”

—Harvey Bjornlie, Pacific Palisades, Calif.

WHAT A CONCEPT!

Regarding your article on the Payload Studio Concept Center, in your November 2007 issue: The Payload Studio concept is a significant step forward in emphasizing and providing for the needs of the passenger.

It was also of interest to me that the “integrated passenger seat” concept is being revived, 50 years after it was first developed and put into production by Douglas Aircraft.

In the 1950s, I worked in the Interiors Design Group of Douglas Aircraft in Santa Monica, Calif. The group consisted of engineers, industrial designers, architects and human-factors specialists under the direction of Jack Graves. In the late 1950s, I was fortunate to work on interior design concepts for the DC-8, the first jet-powered Douglas commercial airplane. Our first customers included United Airlines, Eastern Airlines and Pan American World Airways. One of the prime interests of these customers was seat spacing flexibility. This required the ability to easily change the seat and class partition locations to accommodate a change in size of each class of seating, with the minimum of down time.

In previous aircraft, all of the passenger utilities were placed in fixed positions on the underside of the overhead baggage rack, directly above each seat. Since the seat positions were now to be easily moved, the passenger utilities must also be easily moved to match the seat position.

We considered a variety of options. Among them were movable utilities in the baggage rack; movable overhead baggage pods, with utilities, above each seat row; and a conventional overhead baggage rack with utilities located in the seats. The final decision was to develop a seat that

contained utilities: the cold air outlet, flight attendant call button, reading light, food tray light and emergency oxygen masks. The electrical cables and the cold air and oxygen lines were distributed throughout the airplane in a continuous sidewall duct, which also served as an armrest. Feeder lines ran from connectors on the underside of the duct to each seat row.

I was assigned the design responsibility for the seat and armrest. The development of the DC-8 interior architecture and seat took place in the factory mockup department, without the benefit of a design studio environment. The seat was called the “Palomar Unitized Seat.” It received the Industrial Designers Institute’s Ninth Annual Design Award in 1959.

—Harvey Bjornlie
Pacific Palisades, Calif.

Editor’s note: For more about the DC-8, see Page 8 of the June 2008 Boeing Frontiers. This article is available online at www.boeing.com/news/frontiers/archive/2008/june/i_history.pdf.

CORRECTIONS

Due to a production error, several words were omitted from a headline on Page 13 of the September 2008 edition. The headline at the bottom of the page should read “It all starts with GDP.” To read this article, visit www.boeing.com/news/frontiers/archive/2008/september/cover.pdf.

ABOUT THIS EDITION

In this edition, *Boeing Frontiers* introduces new design elements, including a new front cover banner and a new body-copy font. These changes help align the magazine with Boeing’s brand standards.

LETTER GUIDELINES

Boeing Frontiers provides its letters page for readers to state their opinions. The page is intended to encourage an exchange of ideas and information that stimulates dialogue on issues or events in the company or the aerospace industry.

The opinions may not necessarily reflect those of The Boeing Company. Letters must include name, organization and a telephone number for verification purposes. Letters may be edited for grammar, syntax and size.



SNAPSHOT /

Something to smile about

Seattle-based Alaska Airlines recently transitioned to an all-737 fleet. The Spirit of Seattle, shown here landing at Seattle's Boeing Field, is the carrier's newest 737-800 and sports a combined Boeing-Alaska Airlines livery. **JIM COLEY/BOEING**

QUOTABLES /

“This multiyear award will yield a cost savings of more than \$449 million for the U.S. Army and taxpayers.”

—Jack Dougherty, vice president, Boeing H-47 Programs, about a five-year, \$3.8 billion Army contract for 181 CH-47F Chinook helicopters and 10 more Chinooks under fiscal year 2008 supplemental funding, in the Aug. 27 *Defense Daily*

“Now we don't have to carry five different kinds of weapons. We can just carry one.”

—U.S. Air Force Lt. Col. David Lujan, about the first-ever combat use of the Laser Joint Direct Attack Munition (LJDAM) in Iraq, in the Sept. 3 *Defense Daily*. The LJDAM can hit both moving and stationary targets.

“[Next-Generation 737s] are good planes. WestJet loves them and we love them.”

—Tim Morgan, CEO of forthcoming new Canadian airline NewAir and a former executive at WestJet, in the Canadian newspaper *The Globe and Mail* on Aug. 26. WestJet operates an all-Boeing fleet.

IAM PROMOTIONS

No promotions listed for periods ending Aug. 29 and Sept. 5, 12 and 19.

ETHICS QUESTIONS?

You can reach the Office of Ethics & Business Conduct at 1-888-970-7171; Mail Code: 14-14; Fax: 1-888-970-5330; e-mail: ethicsline.ethics@boeing.com; Web site: <http://ethics.whq.boeing.com>

Good ideas heeded

How an open culture helped the DC-1 capture 90 percent of the world's airplane market

By Tim Sele

This year marks the 75th anniversary of the first flight of Douglas Aircraft Company's DC-1, and with it, a turning point in commercial passenger aerospace.

In 1930, the skies were dominated by the Boeing Model 80, the Ford Trimotor, the Fokker F10A Trimotor and the Curtiss Condor. In March 1931, a Fokker F10A accident took the life of famed U.S. college football coach Knute Rockne. That incident prompted the U.S. Bureau of Air Commerce to put harsh restrictions on wood-framed airplanes, essentially eliminating them from service.

In February 1933, Boeing's revolutionary all-metal Model 247 took to the skies, followed in July by the DC-1. By 1938, only five years after the first flight of the DC-1, its production version (the DC-2) and its first variant (the DC-3) carried 95 percent of all commercial airline traffic in the U.S. By 1939, the DC-2 and DC-3 carried 90 percent of airline traffic in the world.

That success raises the question: In a market crowded with talented competitors, how did a military aircraft company build a commercial transport that eclipsed all others?

One reason for the team's remarkable success was its culture of open communication. Douglas President Donald W. Douglas laid the foundation through his belief that "every step forward must be based on knowledge of what had been done before," and encouraging employees to collaborate and share information.

FROM THE BEGINNING

Let's go back to Aug. 5, 1932. Reviewing the morning correspondence, Douglas found a letter from Jack Frye, vice president of operations for Transcontinental and Western Air (TWA). In need of a new type of airplane and having been rebuffed by Boeing, Frye wrote to Douglas and others with his desired specifications.



Douglas was so captivated by the technical challenges that he didn't put the letter down until 2 a.m.

The next morning, Douglas gathered his team together to discuss the project. "Anytime any of you have suggestions, don't keep them on ice, or let them burn you up," he said. "Tell me about them in your own words. We'll need all the suggestions we can get."

Chief Engineer James "Dutch" Kindelberger was the first to jump in. Although TWA asked for three engines, he remarked they'd be "fools not to consider a twin-engine job." Arthur Raymond—who later would earn acclaim as the DC-3's designer—followed quickly: "Why not adopt some of the features of Jack Northrop's tapered wing? ... We can vary the sweepback to give us some latitude with the center of gravity."

At the time, John Knudsen "Jack" Northrop was president of Northrop Aircraft, a division of Douglas Aircraft. Northrop's fascination with elegant airframes was reflected in the DC-1—for example, in the stressed skin aluminum wing with longitudinal members and ribs that divided the structure into small, rigid structures called cells. This approach eliminated support spars through the passen-

This image from a 1959 reunion shows some of the key participants in the DC-1, -2 and -3 programs, a group of people who together changed the course of commercial aviation. From left are Arthur Raymond, Lee Atwood, George Stompl, Bailey Oswald, "Dutch" Kindelberger, Donald Douglas, Ed Burton, Frank Collbohm and J.O. Moxness.

BOEING ARCHIVES



A Douglas DC-1 is shown in 1933 against the backdrop of the Grand Central Air Terminal in Glendale, Calif., the primary airport in the Los Angeles area at the time. The DC-1 and DC-2 enabled airlines to fly both faster and more economically. BOEING ARCHIVES

“[If] you have suggestions, don’t keep them on ice.”

—Donald Douglas, Douglas Aircraft president

ger cabin and provided a remarkably efficient basic structure.

Ten days later, Raymond and Harry Wetzel hopped the train to New York to meet with TWA executives Frye and Charles Lindberg. After three weeks of negotiations, they had a contract. Lindberg and Frye shared that they initially had some trouble securing financing from the banks, which had “found it difficult to believe [Douglas] could meet the performance specifications.”

After the negotiations, Raymond took a Ford Trimotor flight home that would shape the team’s attitude on passenger comfort. He described vibrations so intense that they shook the eyeglasses off his nose, with noise levels and temperature drops that were nearly intolerable. As if to punctuate the experience, after the Trimotor landed on a wet runway, mud sucked in through vents was blown over the passengers. Back at the office, Raymond remarked to Douglas, “We’ve got to build comfort and put wings on it.”

To improve passenger comfort, Douglas brought in Stephen J. Zand, an acoustical expert, who helped lower passenger cabin noise from 98 to 72 decibels. Douglas later remarked to Zand, “If it hadn’t been for you, passengers would still be flying with cotton stuffed in their ears.”

The bulk of DC-1 test flying fell to Edmond “Eddie” Allen, then unmatched in combined engineering and piloting skill. Allen approached his role seriously: “If you’re looking for a swashbuckling movie hero test pilot, you’ve picked the wrong speaker. This business today is a science.” During testing on the DC-1, Allen’s thoughts would intersect with those of Bailey Oswald, a physicist and aerodynamicist from the California Institute of Technology.

Allen was convinced that better performance could be achieved by increasing engine revolutions per minute at altitude—which was opposite the prevailing opinion. Simultaneously, Oswald developed charts to capture and communicate how to fly the airplane to achieve maximum performance. Once flight test was complete, not only were the DC-1 and DC-2 ready for service, but they also came with an unprecedented set of performance charts that enabled the airlines to fly both faster and more economically.

FDR RECOGNIZES TEAM

The DC-1 broke five world records between May 16 and 19, 1935, and set two additional records in new categories. The DC-1 team was recognized with the Collier Trophy, presented to Douglas by U.S. President Franklin D. Roosevelt on July 1, 1936, the three-year anniversary of the first flight.

The DC-1 team, talented as they were, achieved this remarkable success through a culture of open communication. The key was how Donald Douglas had “created an atmosphere” where ideas could be shared and allowed to grow normally.

Later, Boeing seized the market lead with the Dash-80, which led to the 707 and family of 7-series jetliners. Douglas was slow to react, due in large part to its success. Although the DC-8 outsold the 707 for a time, Douglas trailed after that, eventually exiting a business where it once held 90 percent market share. ■

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High-school students from Springfield, Va., explore real-life applications of the U.S. Constitution in the Boeing Learning Center at the National Archives Experience in Washington, D.C. Boeing supports a range of Archives activities. ANDI KLING, COURTESY OF FNA

Primary source

Boeing helps the National Archives expand outreach, education efforts

By Maribeth Bruno

The U.S. National Archives preserves and protects 10 billion historical records that tell the story of the United States from its creation. The Foundation for the National Archives' (FNA) relationship with Boeing began much more recently, but the partnership report it provided to the company this summer shows how Boeing's support has allowed the FNA to make these archived materials more understandable and exciting to thousands more people in the United States and around the world.

"Boeing has become a great partner at all levels," said FNA Executive Director Thora Colot. "The company's generosity enabled us to create the Boeing Learning Center and launch national outreach initiatives like traveling exhibitions and a new, award-winning Web site. We also have been able to have a direct impact on schoolchildren, teachers and families in the District of Columbia and in diverse communities nationwide."

Boeing's donations support a range of Archives activities. For instance, a multiyear Boeing gift of \$5 million funds the National Archives Experience, the Archives' educational outreach program that provides offerings such as these:

- **The Boeing Learning Center:** Since April 2007, the Washington, D.C., headquarters of the Archives' educational programs has received more than 10,000 visitors from nearly 60 countries; it has also conducted more than 200 workshops and educational field trips serving nearly 6,000 teachers and students. Its ReSource Room offers games and more information on Archives exhibits. In the Learning Lab, school groups search through document facsimiles to find historical examples of the Constitution in action.

- **Traveling exhibitions:** "Eyewitness: American Originals From the National Archives" has attracted hundreds of thousands of visitors across the United States. Another exhibit, "School House to White House," began a multicity, multiyear tour this past spring. The upcoming "Discovering the Civil War" will be the Archives' largest traveling exhibition yet. "1783: Subject or Citizen?" opens this month in Washington and is the Archives' first international exhibition.

- **The Digital Vaults:** The new National Archives Experience Web site launched earlier this year includes an award-winning interactive exhibit of 1,200 visual records. "Digital Vaults" at www.digitalvaults.org allows visitors to create their own collections, games, posters and movies based on the Archives' primary sources. More than 1,000 people visit the site each day.

In addition, Boeing supports the FNA's annual gala, at which the organization presents its Records of Achievement Award to honor an individual who's had a significant impact on the public's understanding of U.S. history. Past winners include broadcaster Tom Brokaw; the C-SPAN cable television service and its founder, Brian Lamb; and historian John Hope Franklin.

"Boeing's support of FNA partners us with one of this country's greatest public assets on a major focus area for us—increasing public understanding of and engagement in the processes and issues that affect our communities," said Anne Roosevelt, Boeing Global Corporate Citizenship vice president and FNA board member. "We're looking forward to helping them bring their inspiring civics programs to an even wider audience." ■

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From St. Louis to the space shuttle

STS-125 astronaut Mike Massimino has roots with McDonnell Douglas

By Ed Memi

Astronaut Mike Massimino is linked to Boeing in two ways. He's part of the crew that will repair and upgrade the Hubble Space Telescope on the Space Shuttle *Atlantis* STS-125 mission scheduled for this month. He's also a former employee of McDonnell Douglas, a Boeing predecessor company.

During STS-125, Massimino and his fellow crew members will rendezvous, grapple and then berth the bus-sized telescope to a special work platform in the space shuttle payload bay. They'll make repairs and upgrade components during five different spacewalks over five consecutive days.

The STS-125 mission is the shuttle's last visit to the Hubble Space Telescope before the shuttle fleet retires in 2010. The repairs and upgrades *Atlantis'* crew perform will leave the telescope ready for another five years or more of research. Boeing is a major subcontractor to United Space Alliance, the space shuttle operations contractor.

Since Space Shuttle *Discovery* launched Hubble in 1990 and released it into an orbit 304 nautical miles above Earth, the telescope has circled Earth more than 97,000 times and provided more than 4,000 astronomers access to the stars not possible from inside Earth's atmosphere. Hubble has helped answer some of science's key questions and provided images that have awed and inspired the world.

Massimino worked for McDonnell Douglas as a research engineer from 1992 to 1995. During that time, he developed laptop computer displays to assist operators of the shuttle's robotic arm. He left McDonnell Douglas to take a faculty job at the Georgia In-



Astronaut Mike Massimino, STS-125 mission specialist, practices repairing Hubble Space Telescope hardware during a training session at NASA's Johnson Space Center in Houston.

PATRICK L. ARMSTRONG/BOEING

stitute of Technology; he was later accepted into the NASA astronaut corps.

While at McDonnell Douglas, Massimino worked for former astronaut Bob Overmyer. "While Mike was working at McDonnell Douglas, the astronauts had a chance to look him over," said retired Boeing engineering manager Clay Fulcher. "A lot of folks who've been selected to be part of the astronaut crew have previously interacted with astronauts as either contractors or NASA employees." ■

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747: 40 years, by the numbers

On Sept. 30, 1968, the first 747 rolled out of the Everett, Wash., factory. In the 40 years since, more than 1,400 747s followed suit, and production began in August on the newest addition to the 747 line, the 747-8 Freighter. Here's a look at what the 747 family has accomplished.

17 million

Number of 747 flights logged to date

89 million

Flight hours logged to date. This period is equal to more than 10,000 years

42 billion

Number of nautical miles flown (77.8 billion kilometers)

6 million

Approximate number of parts in a 747

1,523

Total orders, through August

PHOTO: The first 747 rolled out of the Everett, Wash., factory 40 years ago.
BOEING HISTORICAL ARCHIVES

'The future is ours to decide'

Australia is the home of key customers and partners in both the commercial and defense markets. Here's a comprehensive look at Boeing's activity 'Down Under'

The Sydney Opera House and Harbour Bridge are among the more notable landmarks in Australia, a market where Boeing has its greatest footprint outside the United States. SHUTTERSTOCK.COM

Inside

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Hawker de Havilland: Meet Australia's major aerostructures company. [Page 16](#)

Phantom Works: Why Boeing's advanced R&D arm is embedded in Australia. [Page 17](#)

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ScanEagle: This unmanned aerial vehicle serves the Australian Army. [Page 19](#)

Profiles: Meet some of the many people working for Boeing in Australia. [Page 20](#)

In the community: A look at some of the many ways Boeing gives back to Australia. [Page 23](#)

By Sarah Hall

Australia—it's renowned for its outback, kangaroos, koalas, Vegemite, the Sydney Opera House and ... Boeing? That's right, Boeing. The company may not immediately spring to mind as a national icon, but for more than 80 years Boeing has played a significant role in Australia's aviation and aerospace industries. That presence extends from being the home of key customers in the commercial and defense markets to serving as important contributors in both of these business segments. Indeed, Australia has the biggest number of Boeing employees outside of the United States.

To get an in-depth view of Boeing's activities "Down Under," *Boeing Frontiers* spoke to Craig Saddler, president of Boeing Australia and South Pacific.

Q: Why is Australia important to Boeing, and vice versa?

A: Boeing's presence "Down Under" is actually its largest footprint outside the United States. This is due to the size of Australia's market for both commercial and defense products.

Many people don't realize the diversity and scale of our programs here in Australia. We have nearly 4,000 employees across 28 locations, six different business thrusts and an overall investment of more than 800 million (Australian) dollars (U.S. \$667 million). As a result, Boeing has established and maintains a reputation as much more than an aerospace company. We make significant contributions not only in terms of Australia's aerospace industry and economy, but also in terms of both products and operations. All the while, we continue to successfully partner with the Australian government and the defense and commercial industries.

Q: What are some recent examples of Boeing's success in Australia?

A: From a Commercial Airplanes perspective, we've achieved fantastic results. Qantas is the largest airline customer for the 787 Dreamliner (65 on firm order), and Virgin Blue will launch its new international airline, V Australia, with the 777-300ER, the first 777s ever sold in Australia. This is also an example of how our Australian customers are seeking fuel-efficient fleets and how Boeing can meet this demand with superior products like the 787 and 777, despite pressure on the global aviation industry through rising fuel prices. As an aside, Boeing airplanes account for about 90 percent

of the South Pacific jet fleet above 100 seats.

At the IDS end, special mention must be made of the sale of four C-17 Globemaster III military transports for the Royal Australian Air Force (RAAF), as well as the 24 F/A-18F Super Hornets that will supplement RAAF frontline fighter squadrons from 2010.

The launch this year of a Phantom Works branch in Australia, only the second outside the U.S., nicely rounds off our in-country capability.

Q: What's the structure of Boeing in Australia?

A: Boeing has seven different businesses in Australia: Alteon Training Australia, Aviall, Boeing Australia, Hawker de Havilland, Jeppesen Optimisation, Jeppesen Marine and Jeppesen Australia. They are all subsidiaries of Boeing Australia Holdings Pty Ltd., a Sydney-based company established to consolidate and focus the company's Australian presence (see Page 18).



To get the most out of Boeing in Australia, "we need to make sure we are working together," said Craig Saddler, president of Boeing Australia and South Pacific. BELINDA MASON-LOVERING

Commercial Airplanes Sales is also based in Sydney and provides sales and marketing support of our products, customer engineering and quality control and procurement functions.

Q: As the chairman of Boeing Australia Holdings, what is your primary objective in securing new business moving forward?

A: If we're going to get the most out of Boeing in Australia, we need to make sure we're working together. I'm committed to making sure we implement a "One Boeing" approach in all present and future business relationships. With such extensive commercial and defense programs, success will result from working together rather than setting individual agendas. My aim is to find growth opportunities for all of Boeing's Australian subsidiaries by working together.

Boeing has more than 160,000 employees across the globe. Having so much expertise and knowledge at our fingertips is a key

(Continued on Page 15)

Sight while in flight

Why Wedgetail is a critical program to Boeing and to Australia

The Wedgetail Airborne Early Warning and Control aircraft has a heady mission. This aircraft will enhance Australia's intelligence, surveillance and reconnaissance capability and perform a range of tasks, including battle management, air defense, over-the-horizon targeting, search and rescue, and civil support operations. Not surprisingly, it's the largest commercial-to-military aircraft modification in Australia's history.

In December 2000, the Commonwealth of Australia contracted Boeing for the design, development and supply of six Next-Generation 737-700 aircraft modified into the Wedgetail AEW&C configuration. Similar aircraft were subsequently sold to Turkey and Korea.

The conversion involves the installation and integration of an advanced Multi-role Electronically Scanned Array antenna (basically a three-ton radar perched atop the 737), ventral fins and mission system equipment. The first two aircraft were modified in Seattle, with the final four at Boeing Australia's Amberley facility. In addition to this work, Boeing Australia is responsible for logistics support, as well as managing the production of the Operational Flight Trainers and AEW&C Support Centre at the Royal Australia Air Force's air base RAAF Williamtown.

The first two aircraft will be delivered in mid-2009. At that stage, they will support the initial training capability of the RAAF and be upgraded to include the certified electronic warfare system in early 2010. Aircraft No. 3, the first to be modified in Australia, entered the U.S. flight test program in January. Aircraft four, five and six will be delivered in 2010.

The Wedgetail program has faced stiff challenges during its development, mostly due to the slower-than-anticipated maturation of key subsystems and the complexity of integrating the mission system hardware and software. This has led to schedule delays and three charges against earnings since 2007 totaling approximately \$1 billion. Boeing is tackling the challenges by leveraging the company enterprise in every way to ensure ultimate success. It also engaged its suppliers and customers in building a program plan that addresses simultaneous development and production.

—Sarah Hall

In this 2005 image, a Wedgetail Airborne Early Warning and Control Aircraft flies over Sydney Harbour Bridge.

AUSTRALIAN DEPARTMENT OF DEFENCE

strength that sets us apart from other aerospace companies. This is a message I want to reinforce to our employees and customers: Despite Australia's location, we are still able to stay close and connected with Boeing across the globe.

Q: What are the challenges of operating in Australia?

A: Despite having a common language, there are significant cultural differences between Australia and the United States. A process or system that works well in America may not achieve the same result here, and I've seen this happen a few times. It's a matter of applying foresight to interpret if a plan will or won't work, and adapting it accordingly.

Q: What are the key capabilities of Boeing in Australia?

A: Too many to mention in a few sentences! All of Boeing's Australian operations are market leaders in the products and services offered. One example is Boeing Australia, which does a fantastic job maintaining defense aircraft and providing modifications and upgrades. This military support is not only a special capability, it's a vital one within the Australian market and has the potential to reach across all of Boeing through IDS Global Services & Support (formerly Support Systems).

Another great example is the amazing work Hawker de Havilland is doing with composite technology. Using advanced technology resin infusion moulding, Hawker de Havilland is building the movable trailing edge of the 787. Winning the 787 work is testament to the skills and expertise of Hawker de Havilland, as it is the

largest Australian aerospace project in history, worth more than 4 billion (Australian) dollars (U.S. \$3.3 billion) revenue over the next 20 years. That's big business!

Q: Are issues in the global aviation and aerospace industries affecting Boeing's Australian operations?

A: We aren't seeing that at present. Customers want the most fuel-efficient planes, and they want them now! Virgin Blue currently operates just over 50 Boeing Next-Generation 737s, which are very fuel-efficient. Similarly, Qantas' selection and orders for up to 115 787 Dreamliners is another example. The 787 will burn 20 percent less fuel than today's similarly sized airplanes while flying greater distances and carrying more people point to point. This reinforces how Boeing is able to maintain and meet the needs of its Australian customers in times of global economic uncertainty.

Q: What are the most exciting projects across Boeing's operations in Australia?

A: Alteon Training Australia has developed a specialized course for a Multi-Pilot License (MPL) training program, which is currently underway as a beta test with six Chinese cadets. The MPL program has the full support of the Australian Civil Aviation Safety Authority (CASA), which encouraged the development of the program to produce airline qualified pilots more efficiently and effectively. The test will be used as a learning experience, with Alteon and CASA working together with industry on implementation of the MPL in Australia.

(Continued on Page 17)

Australia at a glance

Official Name: Commonwealth of Australia

Location: A continent between the Indian and the South Pacific oceans

Area: 7.7 million square kilometers (3 million square miles), slightly smaller than the 48 contiguous states of the United States

Population: Nearly 21 million

Official language: English

Government: Federal parliamentary democracy

Capital: Canberra

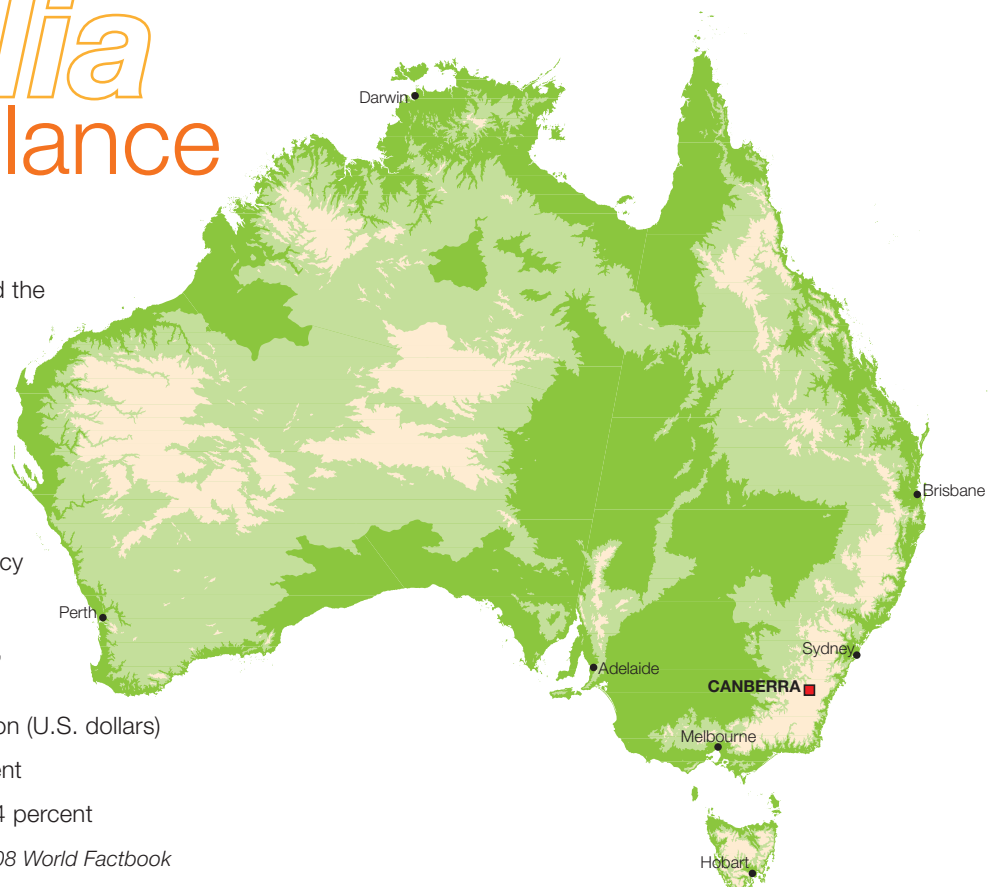
Other key cities: Adelaide, Brisbane, Darwin, Hobart, Melbourne, Perth and Sydney

Gross domestic product, 2007: \$760.8 billion (U.S. dollars)

Estimate GDP growth rate, 2007: 3.9 percent

Military spending as part of GDP, 2006: 2.4 percent

Source: Central Intelligence Agency (CIA) — The 2008 World Factbook



Trailing edges help lead the way

Meet Hawker de Havilland, a Tier One supplier for the 787 Dreamliner

As a Tier One supplier for Boeing's 787 Dreamliner program, Australia's Hawker de Havilland is contributing to aerospace history through its innovative and advanced composites manufacturing capabilities.

Operating since 1927, Hawker de Havilland (HdH) is Australia's major aerostructures company and a leader in the design, manufacture, testing and repair of airframe structural components. The company was acquired by Boeing in 2000 and announced as a structural partner for the Boeing 787 in 2003.

HdH was selected to develop and deliver the 787 Moveable Trailing Edge (MTE) package thanks to the company's technology, design and manufacturing capabilities, and extensive experience in composites. The MTE package is the largest commercial aerospace project in Australia.

HdH is at the forefront of the liquid-moulding fabrication techniques that are being used to manufacture the 787 MTE. Known as Resin Infusion, the end product is created by injecting resin into dry carbon-fiber fabric and curing the parts in a conventional oven. This is more energy efficient and economical than traditional "prepreg" composite manufacturing—a more labor-intensive process requiring resin-saturated carbon cloth to be carefully placed in molds and cured in high-pressure autoclaves.

Once the composite parts are produced they go through trim, drill and nondestructive inspection processes before being transferred to a state-of-the-art multistage assembly line. With more than 4,500 fasteners needed per flap, HdH introduced commercial grade automotive-industry robots outfitted with proprietary technology. This allows them to drill and countersink to aerospace tolerances. Efforts are under way to qualify a new fastener the robots are capable of installing, which would provide additional productivity and capacity improvements.

In addition to high-tech robots and composites manufacturing, HdH's 787 program is entirely virtual. With tools setup, parts checks, schedules and quality systems monitored entirely on computers, not a scrap of paper is used for the 787 program. The paperless aspect of HdH's 787 work, a solid example of a successful Lean+ initiative, also complies with ISO 14001, an international environmental management system standard. HdH is on plan to achieve ISO 14001 accreditation by late 2008.

Since production began in January 2007, HdH has completed 18 shipsets of MTE hardware.

—Sarah Hall

Carolyn Tan monitors the Moveable Trailing Edge automated assembly production line. Eighty years of technological progress has led to cutting-edge automated manufacturing at Hawker de Havilland's Melbourne site. JOHN INMAN

Boeing Australia's work on the Airborne Early Warning and Control (AEW&C) aircraft, Project Wedgetail, is worth noting as it is the largest and most complex aircraft conversion program ever in Australia. Other major projects at Boeing Australia include Vigilare and the High Frequency Modernisation Program (HFMOD). While both projects have experienced substantial delays, Vigilare will be the most sophisticated ground-based air defence system in the world, while HFMOD will be a leader in high frequency communications and systems integration.

As I mentioned earlier, Boeing is incredibly proud of Hawker de

Havilland's 787 work, and hopefully our role will continue to grow through the further development of our composite technology capabilities. Phantom Works is heavily researching this area, too.

Q: What does the future hold for Boeing in Australia?

A: The future is ours to decide. While 80 years in Australia has made Boeing part of the fabric of this country, and vice versa, there are no entitlements and we are dedicated to maintaining our commitment to Australian customers, employees and communities by delivering on all fronts. ■

sarah.e.hall@boeing.com



Research, robots and resin

It's all in a day's work for Phantom Works Australia

There are many reasons why Australia is among the locations worldwide supported by Phantom Works, Boeing's advanced research and development arm.

Australian researchers have been at the forefront of pioneering aviation and aerospace technologies, including hypersonic flight and the world's first flight data recorders. The nation is huge, with lots of airspace. Australia has a progressive regulatory environment across both commercial and defense industries. And Australians are focused on environment and sustainability, and lead in the application of satellites to monitor climate change.

These factors make Australia an ideal place for Phantom Works to work on advanced R&D technology projects. When the Australian aerospace industry faces a technical challenge, Phantom Works Australia strives to respond with solutions where the technical risks already have been identified, understood and addressed. Phantom Works Australia and Boeing Research & Technology Europe in Madrid, Spain, are Phantom Works' largest research operations outside of the United States.

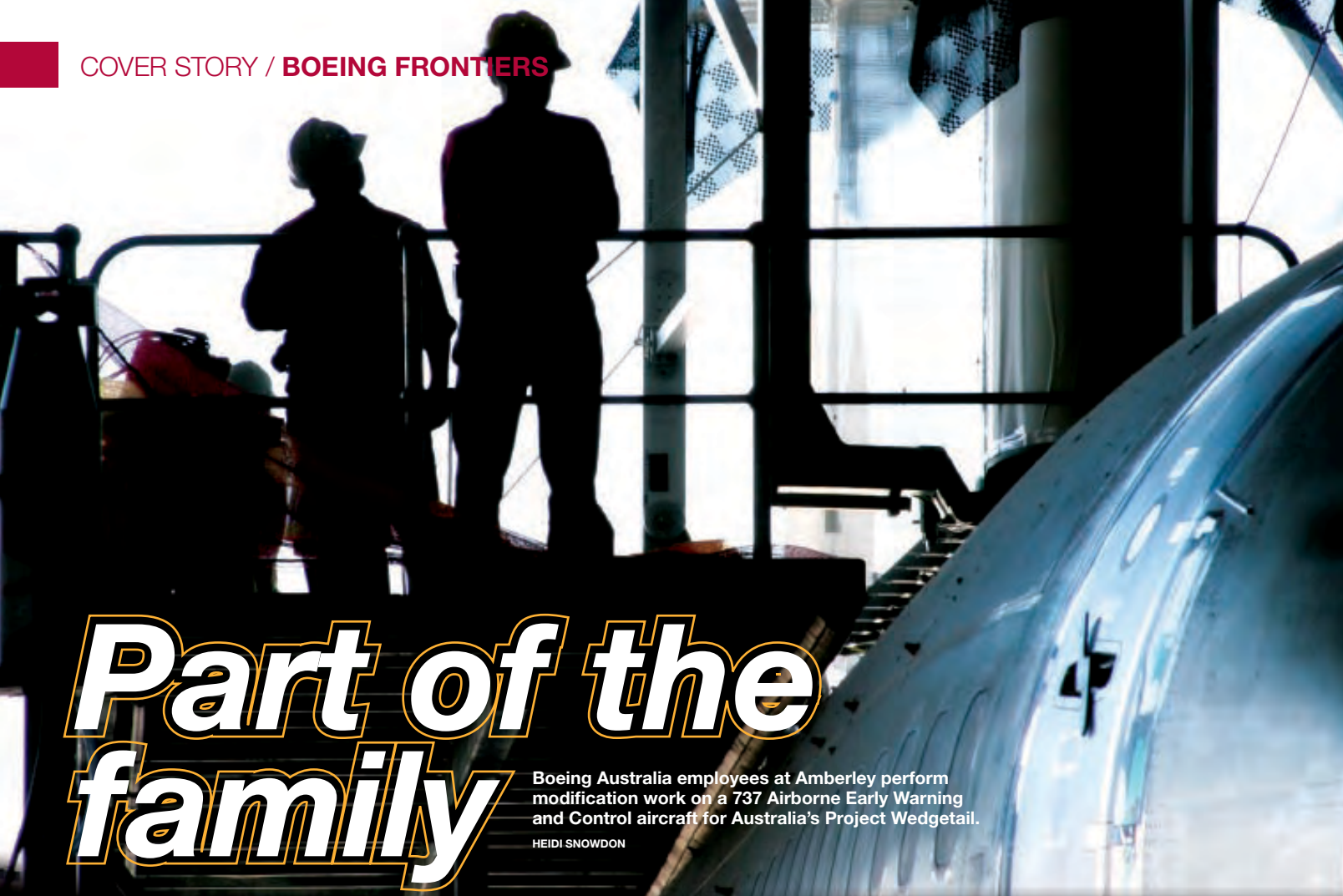
Embedded within Boeing Australia in Brisbane and Hawker de Havilland in Melbourne, Phantom Works Australia supports both Commercial Airplanes and Integrated Defense Systems. The 30 teammates, employed across science, mathematics and engineer-

ing fields, work together as innovators and integrators on several key R&D focus areas. These include:

- Developing advanced composite manufacturing solutions for high-performance and cost-efficient aerostructures. An example is the design and manufacture of advanced composite structures using liquid molding processes, such as Resin Transfer Molding and Resin Infusion, which is being used on the 787 Dreamliner.
- Exploring ways to incorporate the use of commercial-grade industry robots and automation in the manufacturing of high-volume composite parts, as well as for use in aircraft maintenance.
- Creating software tools and flexible systems to develop network-centric solutions for military and commercial platforms.

These capabilities and activities have resulted in strong working relationships with leading Australian universities as well as government-backed R&D entities such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Defence Science Technology Organisation, Australia's lead science and technology agency for the Department of Defence. The relationship with CSIRO is now in its 20th year and has resulted in a number of international patents and performance breakthroughs in the application of aerospace-quality coatings.

—Sarah Hall



Part of the family

Boeing Australia employees at Amberley perform modification work on a 737 Airborne Early Warning and Control aircraft for Australia's Project Wedgetail.

HEIDI SNOWDON

Meet the entities of Boeing within Australia

Here's a look at the entities within Boeing Australia Holdings Pty Ltd, the company created to consolidate Boeing's presence in Australia. These subsidiaries work together in a "One Boeing" approach, adding value to the company and its customers—as well as to Australians and the communities where they live, work and play.

Alteon Training Australia

Locations: Brisbane, Sydney, Melbourne

Employees: 75

Alteon, a wholly owned Boeing subsidiary that operates in Commercial Airplanes' Commercial Aviation Services organization, offers training on six flight simulators in Brisbane, three in Melbourne and one in Sydney. In Brisbane, Alteon provides training for Boeing 717, Next-Generation 737 and Airbus A320 airplanes. The Melbourne center offers training on Classic and Next-Generation 737s and A320 training. In Sydney, Alteon supports 777 training.

Did you know: In the last 1.5 years, Alteon training centers in Australia have supported 16 different airlines representing nine different countries. And currently, Alteon is conducting a Multi-Pilot Licence (MPL) training program trial with six cadets from China.

Aviall

Locations: Melbourne, Brisbane, Cairns, Perth, Sydney

Employees: 45

Aviall is a leading provider of aftermarket supply-chain management services for the aerospace, defense and marine industries.

Aviall's Australian business, which features six locations and serves about 550 customers, was established in 1968; Boeing acquired Aviall in 2006.

Did you know: Major customers include the Royal Australian Air Force, Qantas, Aero Inventory and Standard Aero.

Boeing Australia

Locations: Brisbane (headquarters), Adelaide, Amberley, Canberra, Darwin, Exmouth, Geraldton, Melbourne, Nowra, Oakey, Perth, Riverina, Shoal Bay, Tindal, Townsville, Williamstown

Employees: 2,300

Boeing Australia is Australia's leading defense aerospace enterprise and an integral part of Integrated Defense Systems. Its core competencies include maintenance and modification; engineering and upgrade; sustainment; command, control and communications (C3); and simulation, operations analysis and experimentation. Phantom Works Australia and Boeing Australia Component Repairs work within Boeing Australia.

Boeing Australia was known as Rockwell Australia until Boeing's 1996 acquisition of Rockwell International's aerospace and defense businesses.

Did you know: There are more than 15 major projects currently under way at Boeing Australia, including the F-111 Program, the F/A-18 Hornet Program, the Wedgetail Airborne Early Warning and Control aircraft and the High Frequency Modernisation Project.

Hawker de Havilland**Locations:** Melbourne, Sydney**Employees:** 1,400

Hawker de Havilland is Australia's major aerostructures company. Highly regarded for its work in advanced carbon fiber technology, Hawker de Havilland is responsible for designing and building the movable trailing edges (MTE) on the Boeing 787 Dreamliner. MTE is Australia's largest aerospace program. Other major projects for Boeing include the manufacture of the rudder, empennage and elevators for the 777; movable leading edges for the 747; ailerons for the 737; and trailing edge flaps for the F/A-18 C/D.

Did you know: The Hawker de Havilland of today is made up of Rockwell International's aerostructures businesses, which Boeing acquired in 1996, and Boeing's 2000 purchase of Hawker de Havilland. Boeing combined these entities under the Hawker de Havilland name.

Jeppesen Australia Pty Ltd**Locations:** Brisbane, Melbourne, Canberra, Sydney**Employees:** About 160

Boeing subsidiary Jeppesen delivers solutions that integrate people, processes and technology to provide safety, efficiency and economy to air, sea and rail operators around the world. Jeppesen Australia supplies a broad range of charting and navigation services, from worldwide flight information to aviation weather to maritime navigation products. In Australia, Jeppesen's operations are divided into three businesses: Rail, Logistics and Terminals; Commercial and Military Aviation/Business and General Aviation; and Jeppesen Marine Australia (JMA), responsible for the sale of digital cartography within the Australasian region.

Did you know: JMA's customers include both the Australian and New Zealand Departments of Defence.

—Sarah Hall

ScanEagle: Eye on the horizon



A ScanEagle unmanned aerial vehicle is launched. Australia has used ScanEagle for more than 14,000 hours of operations. HEIDI SNOWDON

Since December 2006, Australian troops in Iraq and Afghanistan have been supported by Boeing Australia's reconnaissance and surveillance services using the ScanEagle autonomous unmanned aerial vehicle. It's the same vehicle serving U.S. armed forces in Iraq.

In helping to protect the lives of Australian soldiers, Boeing Australia delivers the following capabilities through the ScanEagle:

- Maintenance, launch, recovery and flight operations.
- Mission rehearsal to maximize operational performance.
- Fully integrated supply chain and logistics services to ensure delivery of 24-hour operations.
- ScanEagle UAV operator training for on-location Australian Army personnel.

Working closely with Boeing Field Services Representatives, the

Australian Army has now amassed more than 14,000 combat hours with the ScanEagle, built by Boeing subsidiary Insitu. Additionally, Boeing Australia has delivered valuable UAV operational experience that is assisting the introduction of more complex UAV platforms into the Australian Defence Force.

Boeing also is home to Australia's first qualified ScanEagle flight instructors. In 2007, the Commonwealth of Australia approached Boeing Australia to deliver in-country Aerial Vehicle Operator (AVO) training as an alternative to Army personnel undertaking eight weeks training in the United States before being operationally deployed. Together with Insitu, Boeing developed an AVO training solution within Australia that reduces the time soldiers spend away from their units and families. This program also broadens ScanEagle capabilities available to the Australian Defence Force and other potential regional partners.

—Sarah Hall

G'day, mates!

Meet some of the many people working for Boeing in Australia

Dion Grayson

Apprentice manager / Boeing Australia / Amberley, Queensland

Years with Boeing: 1.5

What are your roles and responsibilities?

My role is to ensure Boeing Australia continues to develop a highly skilled work force for the future by providing the support needed for our people throughout their apprenticeships. As an employer of apprentices, it's not just about investing in the success of our people through training, it's about contributing to the success of our business by ensuring Boeing Australia remains competitive in the global market with a skilled work force.

What's your career highlight so far?

Being the runner-up in the Australian government's Ministers Awards for Excellence in the Employers of Australian Apprentices category was a fantastic achievement. The awards epitomize excellence, commitment and best practice in training apprentices throughout the country. For Boeing Australia to be recognized for making a significant and worthwhile investment in the skills and needs of our future work force was great.



JASON WEEDING

HEIDI SNOWDON



Robyn Dangelmayer

F/A-18 technical writer / Boeing Australia / Brisbane, Queensland

Years with Boeing: 3

What are your roles and responsibilities?

I prepare F/A-18 technical publications using customer source data and Xyvision XML Professional Publisher, a publishing tool. Publication amendments also involve creating and/or updating graphics using CorelDraw. All publication amendments are done in accordance with current standards and contractual requirements, including cost, delivery and quality objectives.

What's your career highlight so far?

My milestones to date include contributing to the creation of the first in-country flight manual checklist, and leading my own six-month contract task to produce new Forward Looking Infrared system publications.

This year I also won the Boeing Young Leader Award, which was a huge surprise! My prize was a 10-day trip aboard the tall ship *Young Endeavour*. Along with 23 youth crew from around Australia and seven staff, we sailed along the Queensland coastline working together to foster our personal and leadership skills. It was an absolutely amazing experience, and I'm so grateful to Boeing for giving me the opportunity through the Young Leaders Award.

Virginia Whewey

Advanced mathematics technologist
Phantom Works Australia / Williamstown, New South Wales

Years with Boeing: 5

What are your roles and responsibilities?

Any time numbers present themselves, people tend to call me! I help researchers at Phantom Works Australia solve tricky mathematical and statistical problems. I also consult with the Australian business units to help them get the most out of their data and have more reliable information for decision making. I recommend the best way to collect data, how to plot and analyze it, and what conclusions can be made.

What's your career highlight so far?

There is no shortage of unique and challenging problems to be solved. Another great thing about working for Boeing is the possibility of expanding both personal and career boundaries through international assignments.



HEIDI SNOWDON

Corey Wilson

ScanEagle flight instructor / Boeing Australia / Brisbane, Queensland

Years with Boeing: 4

What are your roles and responsibilities?

My job is to instruct students from Boeing and the Australian Defence Force on the ScanEagle Unmanned Air System. During my time in Iraq I was a Field Service Representative and provided overwatch and reconnaissance capability under direction from the Australian Army. This included launching, recovering, flight and basic maintenance of the aircraft.

What's your career highlight so far?

My most valuable experiences have been doing two three-month tours of Iraq with the Australian Army for ScanEagle. Both stints overseas have served me well in my current position.



COURTESY OF COREY WILSON

Emma Hodsdon

Business analyst / Boeing Australia Holdings / Sydney, New South Wales

Years with Boeing: 5

What are your roles and responsibilities?

Currently I am supporting Craig Saddler, president Boeing Australia and South Pacific, in a rotational position as business analyst. I'm responsible for coordinating Boeing's environmental strategy in Australia, and working with Craig on the development of the country strategy. I normally work for International Corporate Communications supporting all parts of the Boeing enterprise in Australia and Asia.

What's your career highlight so far?

Not long after I started the 787 was launched. I've really enjoyed watching the progress of the program and can't wait for the first flight! I've also been involved in the organization and execution of some fantastic events including the 777-200LR Worldliner global tour, Wedgetail delivery, Avalon Airshow, and the Phantom Works Australia launch.



Christopher *Howe*

Materials and Process engineer / Phantom Works Australia, embedded within Hawker de Havilland / Melbourne, Victoria

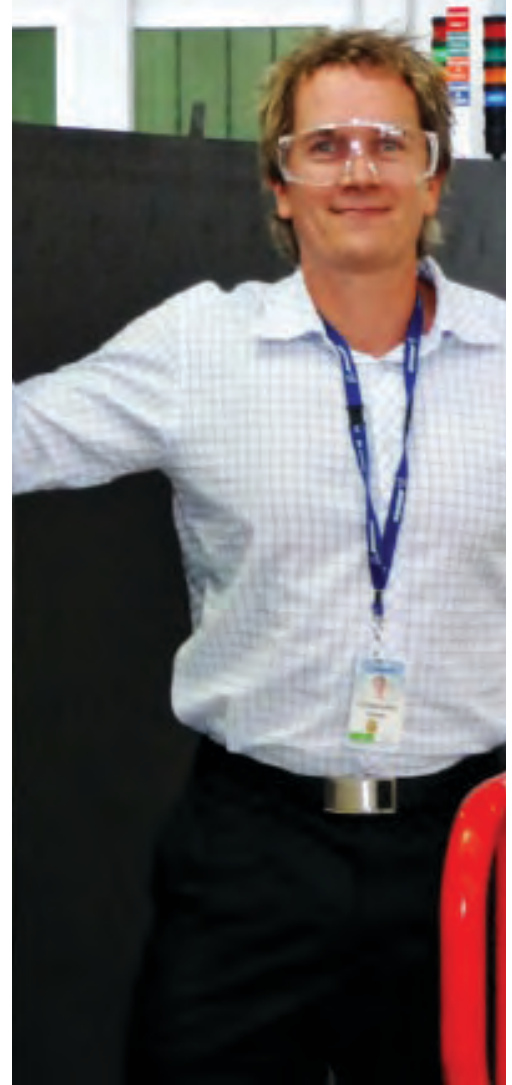
Years with Boeing: 9

What are your roles and responsibilities?

To research, develop and implement technologies for the manufacture of advanced composite structures, with the responsibility of owning the process from discovery to production readiness.

What's your career highlight so far?

Working with a team of people who are passionate and committed to contributing to developing and qualifying new technologies. It means I'm always around talented people who love to smile, who enjoy putting in the necessary effort to achieve success, and can overcome challenges by working together in harmony.



Carolyn *Tan*

Mechatronics engineer / Hawker de Havilland / Melbourne, Victoria

Years with Boeing: 3

What are your roles and responsibilities?

I support the 787 Moveable Trailing Edge (MTE) automated assembly production line. My day-to-day tasks include refining processes, training operators, debugging errors, responding to quality concerns, managing consumables, and preventative maintenance. I'm also accountable for the quality of parts produced in the robot cell and the overall cycle time.

What's your career highlight so far?

The joy of witnessing the first shipset of the 787 MTE parts complete their journey through the assembly robot cell was a major highlight. It was a grueling schedule of around-the-clock production and support. The team enjoyed a lot of fun times with heaps of positive energy, but naturally it included setbacks, too. All in all though, we reached the goals we set out to achieve and received recognition for a job well done.

Part of the community

In August, Boeing Australia employees, including Nick Mair (left) and Jamie Paterson, volunteered their time to sell merchandise for Cancer Council Australia's "Daffodil Day." Proceeds funded essential services, education and research programs.

HEIDI SNOWDON

Good corporate citizenship is a core value of Boeing and integral to the way it conducts business worldwide—including in Australia. Here's a look at some of the ways Boeing gives back to communities in this nation:

Philanthropy: In 2008, Boeing will donate U.S. \$400,000 through corporate giving to benefit Australian communities. At the highest levels of its community involvement, Boeing is a member of Philanthropy Australia, an organization of Australian entities and individuals that serves the philanthropic goals of its members. Boeing takes a holistic approach to community involvement in Australia by providing support through sponsorships, charity work, community work and ensuring the well-being of its employees, who also choose to work on a range of voluntary projects where help is needed by their local communities.

Education: Boeing knows the future of a cutting-edge aerospace industry is rooted in the smart, talented and enthusiastic youth of today. In Australia, the company is passionate about engaging and encouraging young people through education to inspire their interest in science—particularly aerospace and aviation-related projects.

For example, Boeing Australia Limited supports the Aerospace Project, a partnership between the Queensland Government and industry to develop pathways between high schools in this Australian state and the aviation industry. Currently, 17 schools across the state are involved in the project and offer aerospace studies to more than 800 students.

Scholarships and awards: Boeing has established a number of scholarships and awards at universities around Australia. Two years ago, Boeing Hawker de Havilland and RMIT University established a travel bursary, or scholarship. This travel bursary offers the best research students in aerospace engineering a chance to undertake a study tour to the United States and see companies building passenger airplanes, military fighter aircraft, helicopters and satellites.

Scholarships and awards aren't only for students. Australian high school teachers also have been given the opportunity to participate in the annual Boeing Space Camp program, a once-in-a-lifetime educational camp to stimulate the teaching of math and science.

—Sarah Hall

Getting **eco**-engaged



PHOTOS:

Top left: Boeing employees from Mesa, Ariz., volunteered to help the U.S. Forest Service and the Arizona Trails Association maintain a portion of the 800-mile-long Arizona Trail. BILL POOLE

Bottom left: Frank Migaiolo (left), an Environmental Affairs manager in Everett, Wash., and Ross R. Bogue, vice president and general manager, 747 program and Everett site, review an environmental project plan while standing next to engineered wetlands on the north part of the Everett site. This area acts as a natural biofilter for stormwater runoff from the facility. GAIL HANUSA/BOEING

Right: Boeing employees picked up rubbish along the Florida waterfront after Tropical Storm Fay deposited debris on the beaches. Chris Rose, operations manager, Space Station processing, Kennedy Space Center, displays some of the trash he picked up at Shepard Park in Cocoa Beach, Fla. DAVID BRINKO/INDYNE

Employees across the enterprise are driving environmental action

By Bill Seil

Boeing employees in Everett, Wash., sign up to volunteer their time for environmental efforts around the community. People in St. Louis organize personal electronic equipment recycling events and clean-ups of area roadsides. Huntsville, Ala. teammates help the site earn recognition from the city for their energy-conservation and recycling efforts. Meanwhile, employees throughout Boeing are using an intranet site to share tips and information on how to be more environmentally conscious, both at work and away from it.

These instances are some of the many examples of how employee enthusiasm for environmental action is helping support Boeing's aggressive environmental strategy. The company is building new tools such as blogs, training, wikis and "green team" toolkits to make that enthusiasm as effective and widespread as possible.

The company's environmental engagement program, launched in April, was developed by the Environment, Health and Safety (EHS) organization, working in concert with a newly created Employee Environmental Advisory Council. It focuses on a package of environmental "enablers"—tools employees can access to find answers, share ideas and get involved.

"The employee campaign is a chance for Boeing people around the enterprise to get environmentally involved at work, at home, on the road and in their communities," said Mark Arvizu, enterprise environmental programs manager at EHS. "Employees are already doing great work across the enterprise, and we want to ensure initiative and ingenuity can be replicated from site to site."

The broad-based program will pay special attention to the com-



New 777 fueling stands at the company's Everett, Wash., plant are used to prepare airplanes to take on fuel for the first time. One benefit of the stands is reducing the amount of waste fuel generated during the initial fueling and testing. In this May 2008 image, John Donohue (left) and Jake Kaltbrunner—members of an employee involvement team that designed the stands—conduct a non-functional demonstration of this system. WILL WANTZ/BOEING

Boeing Frontiers and Page 20 of the March 2008 *Boeing Frontiers*).

"Here in Everett, I know of no other single subject that rallies us all together—irrespective of our role in the company—than our environmental stewardship," said Ross R. Bogue, vice president and general manager, 747 program and Everett site. "We are very conscious of our collective need to be a great neighbor in the community where we work, live and play."

“Opportunities appear every day for employees to be involved and engaged in reducing our consumption of natural resources, improving our recycling practices and reducing hazardous materials.”

—Ross R. Bogue, 747 program, vice president and general manager

pany's five-year targets for energy efficiency, recycling solid waste, and reducing hazardous waste and greenhouse gasses. Environmental engagement at work can range from recycling office paper to developing ways to remove hazardous materials from manufacturing processes.

ENGAGEMENT IN EVERETT

Environmental engagement has long been an important part of the culture at the Boeing Everett plant in Washington state, where widebody jetliners are manufactured. Everett was one of the first Boeing sites to earn ISO 14001 certification; this globally recognized certification signifies that Everett has an effective environmental management system to monitor and continually improve its environmental performance (see Page 25 of the February 2007

Bogue said Everett employees reacted enthusiastically to this year's EHS Fair. The event featured many outside not-for-profit agencies that channel volunteer support to community needs. Boeing continues to be a major source of volunteer help for environmental projects.

Employee inclusion is an important part of Everett's overall environmental strategy for the design and manufacture of its products, Bogue said. It's part of the total value stream that ends with Boeing products reaching its customers. Customers, too, are part of this process.

"Opportunities appear every day for employees to be involved and engaged in reducing our consumption of natural resources, and improving our recycling practices and reducing hazardous materials," Bogue said. "Awareness is important, but it's also



The EnviroWiki on the Boeing intranet is helping encourage employees to collaborate in developing environmental ideas online.

“We know that in 12 to 18 months there will be new, very innovative and exciting enablers emerging from this environmental engagement program.”

—Mark Arvizu, Environmental, Health and Safety, enterprise environmental programs manager

directly tied to improvements in our production system.”

Terry Mutter, director, Enterprise Strategy for EHS, noted that while Boeing employees have a long history of environmental involvement, the employee program led by EHS is a strategic approach to embedding environmental stewardship into Boeing’s corporate culture. It has the full support of corporate leadership and uses multiple approaches to encourage participation and collaboration. Mutter sees it as a large-scale systems integration challenge—something Boeing is particularly skilled at handling.

Much is already being done by the company’s business units to develop environmentally progressive products, services and manufacturing processes. Most notably, in this time of high fuel costs, work is being done to improve the fuel efficiency of commercial airplanes which directly reduces greenhouse-gas emissions and improves their carbon footprint. Mutter said environmental efforts will grow as the company introduces new standards, processes and design tools that support its environmental strategy.

Opening doors for employees to participate is a priority. An online Environment Information Center on the Boeing internal Web (<http://ehs.web.boeing.com/enviro>) guides employees to a number of opportunities for environmental involvement, including enablers to help them get started. Compilations of frequently asked questions are growing, thanks to employee inquiries and the support of subject matter experts.

Alongside the environmental news and links, two key features of the information center are “EnviroTips” and the “EnviroBlog.” The tips help employees take action at home, at work and in the

community to protect the earth and its natural resources. The blog allows employees with an important environmental message to share it with colleagues across the enterprise and get their replies. Environmental leaders from across the company have already authored blogs.

Blogs are a growing online tool that are part of the new “social media” that also includes the wiki. Wikis feature written statements that can be modified by readers. They are collaborative tools that allow multiple participants to develop an idea.

Arvizu said an EnviroWiki (<https://wiki.web.boeing.com/confluence/display/envprog> on the Boeing intranet) recently was developed and already is seeing a growing community emerge that encourages employees to collaborate in developing environmental ideas online. The fact-based tool allows side discussions that can be restricted to individual teams or work sites.

“We quickly discovered that the enablers would have to be complementary,” Arvizu said. “They have to link to each other and support each other. That’s important to advancing the sociability and replication we’re hoping to achieve in the program.”

HANDS-ON ACTIVITIES

While virtual online collaboration is important, there’s much to

be said for meeting face-to-face and working toward a goal.

Boeing Employees for Environmental Protection (BEEP) (see <http://beep.stl.mo.boeing.com> on the Boeing intranet) was formed in 2004 to promote recycling awareness at Boeing facilities in St. Louis. Sponsored by Boeing Recreational Services, the club has organized ongoing recycling programs and committed volunteers to other environmental activities.

Tony Ham, a former director at the St. Louis site, recently became Mesa, Ariz., site director. His executive sponsorship of the BEEP program at St. Louis has made him a believer in employee environmental groups. He is eager to begin a similar program at Mesa.

Ham said he became involved with BEEP a couple of years ago when he was trying to get recycling bins moved inside buildings. With bins located outdoors, the recycling program was not as effective as it could have been. BEEP members had also been concerned about this problem, but they weren’t in a position to change policy. When Ham signed on as their executive sponsor, arrangements were made to bring the bins inside.

“I think it’s important for us as a company to demonstrate that we care about the environment and are willing to help clean it up,” Ham said. “We want future generations to enjoy this beautiful planet.”

Since it was created, BEEP has gone beyond recycling to take on many other environmental projects, including Earth Day and highway cleanup activities.

“Environmental issues have become very important to our customers, stakeholders and employees, and their calls for more aggressive programs have come at the same time.”

—Aileen Yankowski, EHS director of Compliance and Services

BEEP and similar organizations have set a standard for Site Green Teams—groups supported by the environmental engagement program to advance environmental efforts selected by the employees.

“A site green team can begin with something as simple as a town hall-type meeting where several employees come together with a common environmental interest,” Arvizu says. “We can help them to get organized and find an executive sponsor. This includes providing them with guidelines, best practices and key metrics for measuring their success.”

The number of site green teams has been growing, with groups active in St. Louis, Everett, San Antonio and Huntsville, Ala. They have already participated in some highly visible and successful projects. For example, the Huntsville Green Team played a key role in the site winning the 2008 Air Pollution Control Achievement Award from the City of Huntsville Air Pollution Control Board. Employees were involved in a range of energy conservation and recycling efforts at work and at home.

Arvizu said that the employee enthusiasm is by no means limited to the United States, and Boeing sites around the world are invited to participate. Employees in several nations—including Australia, the United Kingdom, Germany and Sweden—have contributed, and that is expected to grow.

And the tools used to share ideas and successes will also grow and change, he added.

“We know that in 12 to 18 months there will be new, very innovative and exciting enablers emerging from this environmental engagement program,” Arvizu said. “Using Lean+ continuous improvement principles, we will keep the program relevant for employees. If an enabler doesn’t get traction, we’ll need to make a decision whether it should be replaced.”

‘A PASSIONATE CONCERN’

The Employee Environmental Advisory Council holds virtual meetings each month to support the team from EHS. Arvizu said he’s been impressed by volunteers who have devoted considerable time to the development and testing of enablers. The council has a rotating membership to allow more employees to get involved.

“Many employees have a passionate concern about the environment,” Arvizu said. “Their commitment to environmental stewardship is helping to drive the program forward.”

In fact, having an effective corporate environmental program has become an important draw in attracting and retaining environmentally conscious workers.

Aileen Yankowski, EHS director of Compliance and Services, said the launch of the engagement program is well-timed, based on the widespread demand for corporate environmental leadership. It is a common expectation for companies the size of Boeing.

“Environmental issues have become very important to our customers, stakeholders and employees, and their calls for more aggressive programs have come at the same time,” Yankowski said. “They’re pointing us in the direction of a greener future.”

She said that much of the environmental work Boeing has been doing over the years has been handled in a low-key manner. Things like conservation, recycling and control of hazardous materials have been a basic part of doing business, but the company wasn’t making those actions visible enterprisewide.

Inviting action also puts added responsibilities on the shoulders of managers and the EHS organization, Yankowski added.

“Employees who make suggestions for environmental improvements are going to expect answers and, where appropriate, action,” she said. “It’s no longer good enough to reply, ‘Good idea!’, and put the idea on the back burner.”

Jeff Nunn, program manager for the SSG Conservation Initia-

Adopt-a-highway clean-ups are among the many projects taken on by Boeing Employees for Environmental Protection (BEEP) in St. Louis. Pictured in this cleanup are Tony Ham (from left), Elmer Dwyer, Cathy Butler, Bryan Kury and Tessa Baum.



ive, is a key partner in the EHS environmental engagement campaign and believes fully engaging all employees in this effort is vital to achieving our environmental targets. “Boeing’s employees and culture of continuous improvement will help drive environmental thinking and action into everything we do,” said Nunn. “Our goal is to embed conservation and environmental considerations into all our daily business processes so more and more it just becomes part of how we run our business.”

Mutter added that the senior leadership of the company has



At the KC-135 Program Depot Maintenance area in San Antonio, Alejandro Aguirre, non-destructive inspection technician, recycles cardboard boxes while Hope Gonzalez, environmental specialist, helps sort his recycle bin. LANCE CHEUNG/BOEING

also made environmental stewardship a priority, putting expectations in place for environmentally progressive products, processes and work habits. Internal environmental targets have been made public in the company's 2008 Environmental Report (see www.boeing.com/aboutus/environment/environmental_report).

"It supports our long-term growth and productivity initiatives, and responds to a changing business environment, where environmental policy is an important factor," Mutter said. "It also is consistent with Boeing's commitment to good corporate citizenship, of which environmental stewardship is a significant part."

Environmental expectations begin with such simple habits as recycling office paper and turning off the power to computer monitors after work. Even the smallest actions can add up in a company of 160,000 people.

The aerospace industry is highly competitive, but good environmental citizenship offers an opportunity for companies to work cooperatively. Just as manufacturers work together to improve safety, there are agreements in place to cooperate in protecting the environment.

Mutter noted that the environmental movement gained momentum in the 1970s following an experience shared by people worldwide. The Apollo 8 lunar mission in 1968 produced stunning images of Earth emerging over the moon's horizon. That inspired many throughout the globe to start thinking of Earth as a tiny island in the vast expanse of space—one with limited resources.

"The celebration of Earth Day began a short time later," Mutter said. "You could argue that the environmental movement has its roots in aerospace."

Boeing, which played a major role in the creation of the Apollo spacecraft and Saturn V launch vehicle, continues to explore new frontiers. Among those frontiers is the protection of our planet. ■

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To learn more about getting involved in environmental efforts at Boeing and in its communities, see Page 30.

Making a difference

For Boeing employees who are environmentally passionate, it's easy being green

Boeing employees from around the enterprise are taking part in efforts to make an environmental difference at work and in the community. Here's a look at three people who are involved in environmental activities.



RON BOOKOUT/BOEING

Cheryl Fieviet

Industrial engineer, St. Louis

Environmental activities: Fieviet serves as a director of Boeing Employees for Environmental Protection (BEEP) at the St. Louis site, a pioneering employee environmental group. It responds to benchmarking requests from other employees around Boeing who are thinking of forming site "green teams." BEEP is involved in recycling paper, cardboard, beverage bottles and cans, and wood, as well as conservation and clean-up projects. Fieviet participated in the EHS St. Louis key stakeholder workshop for environmental engagement in May.

“We do this on our own time because we believe it's the right thing to do. It's easy to get involved when you're passionate, and I'm very passionate about the environment.”



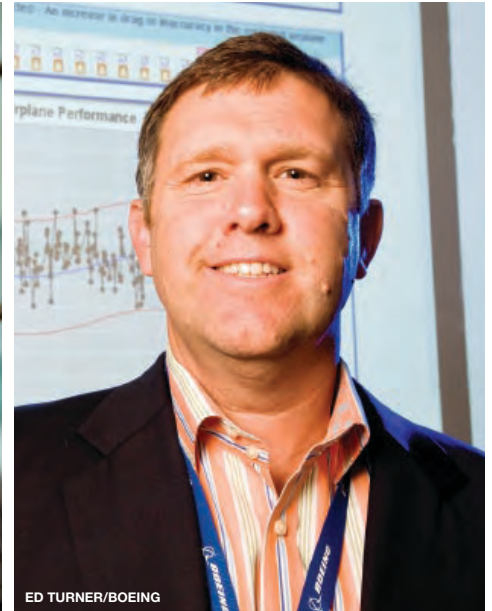
DAVID MOORE/BOEING

Jennifer Lao

Thermal Systems engineer,
El Segundo, Calif.

Environmental activities: Lao is a founding member of Green S13, a site green team formed earlier this year at the S13 building in El Segundo. The team works to implement green practices in the building and develops metrics to show the benefits. Green S13 recently held an e-waste collection day to recycle personal electronics equipment. Lao also has presented a business case for an enterprisewide purchasing standard for recycled content paper, a proposal undergoing feasibility tests. On May 12, Lao participated in the EHS Southern California key stakeholder workshop for environmental engagement.

“Groups like this help like-minded people collaborate on common goals and give them the support and motivation they need to influence change. It's a great feeling to know that I can help encourage sustainable practices for the good of the company and the environment.”



ED TURNER/BOEING

John Maggione

Senior manager, Airplane Health
Management, Tukwila, Wash.

Environmental activities: Maggione leads the Airplane Health Management program in Commercial Aviation Services (CAS), part of Commercial Airplanes. Airplane Health Management provides real-time decision support information via the MyBoeingFleet.com portal that helps airline customers keep their fleets operating at peak efficiency. This includes fuel and carbon dioxide performance monitoring, which are increasingly important to airline operations. Maggione also is the Environmental Performance focal for CAS Technical Services; a role that involves him in the development and integration of customer-facing offerings that improve environmental performance.

“I really enjoy working in the environmental performance area, because it's a way to bring value to our customers, to shareholders, and to our industry as a whole.”

Dig in!

How you can get involved in Boeing environmental efforts

Ready to help take part in environmental activities at your worksite and your community? There's a wide range of opportunities available.



ENVIRONMENT INFORMATION CENTER

The Environment Information Center, at <http://ehs.web.boeing.com/enviro> on the Boeing intranet, is an enterprisewide one-stop Web resource dedicated to environmental stewardship. Visit it to:

- Explore environmental areas where you can make a difference.
- Get quick access to Boeing's Environment Report, EnviroFAQs, the EnviroBlog, EnviroWiki and other key resources.
- Investigate tips for practicing environmental stewardship at home, at work, on the road and in the community.
- Explore new features and review a compilation of Boeing's internally published news on environmental activities.
- Make suggestions to improve the environment.

Many of the activities listed below start with a trip to this site.

EMPLOYEE ADVISORY COUNCIL

The Employee Environmental Advisory Council (EEAC) is an employee-led team designed to guide Boeing's environmental engagement program. The council was formed to broaden the base of employee involvement in program decisions. The EEAC promotes scalability, replication, best practices and process commonality.

Want to get involved? EEAC participation is voluntary. This is an ongoing effort and membership rotates to ensure maximum opportunity for participation. Visit the Environment Information Center to obtain a nomination form.

Top: Boeing employees from Mesa, Ariz., maintain the Arizona Trail in the Sonoran Desert, about 45 miles from the Mesa site. BILL POOLE

Above: The Environment Information Center on the Boeing intranet is a companywide one-stop resource for environmental stewardship.

SITE GREEN TEAMS

To promote increased employee involvement and environmental stewardship, Boeing sites are encouraged to form employee-led Site Green Teams using an enterprise-supplied charter and toolkit. Leveraging lessons learned from green teams around the enterprise, sites are actively sharing and replicating best practices.

To get involved, visit the Environment Information Center for a PDF download containing a sample team charter, green team guidelines and best practices. Employees interested in forming a Site Green Team will find a wealth of knowledge from current Boeing green teams. Or send a note to the Environmental Engagement mailbox (GRP EHS Environmental Engagement in Outlook) and the environmental engagement program management team will provide more details.

ISO 14001

Boeing is committed to operating in a manner that promotes environmental stewardship. ISO 14001 is a global standard that helps Boeing continually improve environmental goals for reducing pollution and waste, increasing recycling rates and improving energy efficiency. Every employee at a site that is seeking ISO 14001 certification is expected to know Boeing's environmental policy.

To learn more about ISO 14001, visit <http://ehs.web.boeing.com/iso14001/training.asp> on the Boeing intranet and click on the link for ISO 14001 Awareness Training.

INITIATIVES DATABASE

The Initiatives Database supports Boeing's four growth and productivity initiatives. It allows employees to search for initiatives-related projects in the IDB (<https://initiatedb.web.boeing.com>) to find information, best practices and lessons learned that promote continuous improvement. The database facilitates replication of projects that can significantly reduce energy use, time and cost. It also is a helpful source to track the development of environmentally sound technologies.

If you have a potential environmental-related project success to share, contact your business unit IDB focal. Contact names are listed on the IDB Web site.

The screenshot shows the Boeing EnviroBlog interface. The main article is titled "Sustainable Business Success" and discusses the importance of environmental stewardship in business. It includes a sub-section "How Boeing is Making a Difference Today" with statistics such as "The 777 Environmental PP (Power Plant) Fuel-Burn Reduction: An A320neo will save 1 million pounds of fuel per year...". There are also smaller articles visible, such as "We have chosen to sell our approach...".

On the Boeing EnviroBlog, environmental leaders post updates and invite input from employees on eco-improvements.

SITE EVENTS

Site Green Events are sustainability-focused environment/ecology events that address recycling, commuting, energy and water conservation, sustainable transportation/biofuels, green business and other eco-related subjects. Earth Day, Bike-to-Work Day, Energy Awareness Month, Recycling Days and Site Fairs are examples of the environmental events sponsored by Boeing sites. These events are great opportunities to participate in environmental learning and stewardship. Employees with suggestions on volunteer opportunities should contact their local Global Corporate Citizenship focal (see <http://community.web.boeing.com/network> on the Boeing intranet).

ENVIRONMENTAL AWARDS

To celebrate success and recognize increased environmental stewardship, the Environmental Employee Engagement program is launching EnviroAwards, a recognition program, in 2009.

There will be three award categories: individual, team and site. For information on the nomination process, visit the Environment Information Center. The Employee Environmental Advisory Council will review nominations and announce award selections monthly.

ENVIROBLOG

Every other week a company environmental leader shares his or her perspective on the company's efforts to pioneer environmentally progressive technologies, reduce its environmental footprint and increase environmental efforts in the community. Read these posts at <http://environment.blog.boeing.com>.

To receive bi-weekly blog updates, join the EnviroEnthusiasts distribution list by sending an e-mail to EHSEnvironmentalEngagement@pss.boeing.com. Employees are welcome to join in the dialogue; ideas and suggestions are reviewed by enterprise subject matter experts and, if site-specific, forwarded to local site management for review.

CONSERVATION INITIATIVE

All of our choices make a difference. It's more important than ever that we use only what's needed, find ways to do more with less, and maximize recycling and reuse of materials. The Conservation Initiative offers suggestions for conserving energy and resources. Visit <http://energy.web.boeing.com> to explore critical issues such as energy conservation, renewable energy, sustainable site and building design, solid waste and recycling, water conservation, fleet management and alternative commuting. On this Web site you can join the Conservation Blog, learn who your conservation focals are by state, and access energy and water conservation tools.

—Christine Cranston



A U.S. Army pilot undertakes training in an Apache Longbow simulator, part of the Longbow Collective Training System. The trainer, located at Ft. Hood, Texas, is a networked system of up to six aircraft in one simulation that provides commanders, staff and crewmembers a superior capability for developing and sustaining combat skills.

BOEING

Keep 'em flying

Why Boeing is taking a companywide tack in investing in aircraft services and support

By Bill Seil

Designing and building an airplane requires a lot of expertise—and investment. But did you know that two-thirds of the life cycle cost for both military and commercial airplanes goes to keeping them operating efficiently after they've been delivered? Once an airplane is delivered to the customer, it needs to be properly operated, maintained, repaired and sometimes modified.

Boeing, through its two main support organizations—Commercial Aviation Services (CAS) at Commercial Airplanes and Global Services & Support (formerly Support Systems) at Integrated Defense Systems—helps its customers do this by providing air crews and ground crews with training, instruction manuals, test equipment and technical assistance. Helping CAS and Global Services & Support best meet these customer needs is the main objective of the new Support & Services domain. It's one of eight Technology Domains in Boeing's Enterprise Technology Strategy (ETS), designed to create a sustainable technical competitive advantage that increases Boeing's growth and productivity.

In each domain, different parts of Boeing are working together to develop a shared understanding of technology needs, capabilities and investments—and ultimately to provide the best support to Boeing's customers. The focus of the Support & Services domain is important to Boeing because businesses such as CAS and Global Services & Support account for a substantial portion of Boeing revenues.

"What we do has a tremendous effect on the reputation of Boeing products," said Steve Swaine, the domain's leader. "And we also are leveraging our technology to bring more support business into the company—even for aircraft and possibly other systems that we didn't originally build."

'CONSTANTLY EVOLVING' TECHNOLOGIES

The ETS' objectives are to ensure Boeing's technology plan supports the company's business strategies and provides competitive advantage; identify opportunities to optimize Boeing's investments across the company; create a "One Company" culture in sharing perspectives across the enterprise; and develop the portfolio using efficient, effective processes. The Technology Domains help integrate Boeing's business units and Phantom Works to ensure the technology strategy supports the company's near-, mid- and long-term business strategies and maximizes the yield of its technology investments.

The domains, headed by key experts in their fields and supported by a Senior Technical Fellow with special insight into a particular technology, have been developed to allow similar technical communities across the enterprise to develop a shared under-

standing of technology needs, capabilities and investments. The ultimate goal is to develop an integrated technology plan that benefits Boeing's customers and the company's bottom line.

"The support and services business is faced with a constantly evolving series of technologies," Swaine said. "We have to make sure that we are leaders in the field. Productivity is an important part of what we do, but we're also focused on growth. There's a special opportunity here to expand our product and service offerings."

The domain is taking a comprehensive look at support and services technology research. Specifically, it wants to ensure that money spent on this research is aligned with the business strategies of Boeing's business units. It's also working to share research results across the enterprise, and to eliminate inefficiency and duplication. An important part of this effort is working with the business units to clearly define their technology research needs.

One of the domain's biggest challenges is simply getting a handle on all of the technology research being done. CAS, Global

What it's made of

Each of the Technology domains in the Enterprise Technology Strategy has several subdomains that leverage specific technologies. The subdomains for the Support & Services domain are:

- **Assessment:** The technology needed to determine platform/system readiness and specify optimal corrective action.
- **Repair & Modification:** The technology needed to repair and upgrade platforms/systems post-delivery (including derivative mods).
- **Material Management:** The technology to plan, source, track (asset visibility), and allocate materials and their configuration throughout the supply chain over their entire product life cycle.
- **Tech Data:** The technology for creating, transforming, maintaining and delivering technical data.
- **Training:** The technology for creating, maintaining and delivering customer training. This includes printed materials, computer-based training, virtual/constructive simulation and live training.
- **Support Equipment:** The technology associated with infrastructure, special-purpose tools and test equipment required to maintain platforms/systems.
- **Support & Services Integration:** The technology that integrates other Support & Services domain technologies to automate overall support operations.

Services & Support and Phantom Works all have active research and development programs in the support systems area, each with different approaches. Until now there has been little effort to develop a central listing of R&D projects. “The Support & Services team provides important expertise to the e-Enabled products and services, like Airplane Health Management, that help us bring life cycle solutions to our airline customers,” said Lou Mancini, CAS vice president and general manager.

The Support & Services domain is organized around seven subdomains (see box on Page 33). “The categories we identified are traditional areas of support, so we had a fairly natural model for creating our subdomains,” Swaine said. “They also aligned well with our business units and with our customers’ needs.”

According to Swaine, establishing the subdomains has created a network for people to discuss projects and develop synergies—something that didn’t exist in a major way before. He also has chartered teams of experts from across the enterprise to develop integrated “enduring technology plans” that document the strategy, commitments, technical competitive assessment, intellectual property plan and yield plan for key technologies.

Mike Darnold, director, Integrated Logistics Support for IDS in Wichita, Kan., said the domain is of great value to programs that build military derivatives of Boeing commercial airplanes. The Support & Services domain, he said, is working to achieve greater commonality between IDS and Commercial Airplanes data systems used on the programs. These business units and Phantom Works also benefit from sharing ideas that can be adapted to other projects. “We’re not seeing any of this ‘not invented here’ syndrome anymore,” Darnold said.

Lee Hibbets, technology portfolio manager in CAS Product Development, is an enthusiastic advocate of the Support & Services domain. He recalled participating in a workshop Swaine organized that included employees who work in airplane health management. The participants shared information and began building a unified companywide technology strategy that coordinates the company’s investment in the future and leverages the best of

Boeing, he said. “The domain is a great forum for learning about and finding these technologies within the enterprise,” he said.

WHAT LIES AHEAD

CAS is finding similar opportunities by participating in other Enterprise Technology Strategy domains. Hibbets said the Environment domain can help develop more efficient aftermarket products and services for airline customers. The Networked Systems domain can generate technology that CAS could apply to e-enabled programs for commercial airplanes.

While many synergies exist, Swaine notes that not all technologies can be shared between business units. There are major differences between military and commercial products, as well as customer needs. The domain teams must take great care in determining which technologies can be adapted from one program to another.

Commercial Aviation Services and Global Services & Support both provide a wide range of support and services to Boeing customers. CAS focuses on five key capabilities: customer support, materials optimization, operational performance, training and fleet enhancements. Global Services & Support provides its customers with maintenance services, modifications and upgrades, integrated logistics services, and training systems and services.

While considerable work remains to be done, Swaine is pleased with the Support

& Services domain’s accomplishments thus far. The recent decision by Global Services & Support to hire a technology director will add momentum. Swaine said the domain has also made significant progress in the area of airplane health management.

Looking ahead, the Support & Services domain plans to develop a data base of all support and service technology research projects taking place within Boeing. Swaine envisions a tool that will capture and track the company’s investment in these activities, and enable leaders to analyze where improvements can be made.

There is also a need to identify similar work that is taking place at universities and companies outside of Boeing, Swaine said. That will help the business units to import technologies that support their business strategies. It will also guide the company in deciding which research should stay within the company and which projects should be sourced to outside research organizations.

“We are in a unique position in this industry, doing what no other company can do,” said Global Services & Support President Dennis Mulenburg. “We are leveraging the best of two very large businesses—Commercial Aviation Services and Global Services & Support—and taking advantage of multiple synergies and joint technology investment to achieve significant value for our customers.” ■

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Commercial Airplanes’ Operations Center in Seattle delivers round-the-clock, comprehensive support to airlines operating more than 12,000 Boeing jetliners worldwide. Boeing is taking an enterprisewide approach to developing technologies to bolster its support and services businesses.

MARIAN LOCKHART/BOEING

Making *'good things happen'*

IT support representatives in field, factories help cut costs, improve service

By Ron Glowen

Computing people who provide workstation support for the factory floor and field operations are taking the initiative to solve common problems—and have introduced a number of cost- and time-saving desktop technologies and procedures across Boeing.

This grassroots effort, led by Information Technology's Factory Field Computing Service Team, is taking hold at 10 manufacturing sites across the United States. It began when a shop floor desktop computing improvement team in Philadelphia began looking at leveraging existing support processes for their workstations and reached out to other factory computing support representatives across the enterprise. In discovering common areas of improvement, team members also realized a shared passion for providing the right solutions for the end user.

Today, the Factory Field Computing Service Team is actively collaborating on ways to improve quality of service while reducing associated costs. "It started with the realization that similar problems existed across different manufacturing sites, but also that creative solutions and new technologies were being adopted that we could share," said Dean Griffis, team leader and shop floor PC focal at the Boeing factory in Philadelphia.

In the past year, the team has introduced a number of desktop technologies and procedures, and exchanged process and technical solutions across sites. One example is e-Ticket, an online service developed in the Puget Sound region. This service uses existing help desk processes and is designed for factory and field end users to submit common computing issues directly to the vendor. This is both handy and efficient, as most shop floor users don't have telephones nearby to call the Boeing help desk. In one instance, a problem with integrating an array of laser projec-



Across Boeing, factory computing support specialists are joining forces to improve productivity and deliver innovative service solutions. Dean Griffis (right), shop floor personal computer focal in Philadelphia, goes inside a Chinook CH-47 to provide computing support to Joe Coghlan, manager for CH-47 Production Flight Test.

FRED TROILO/BOEING

tion devices in Puget Sound factories, used to mark aircraft for painting, was resolved by collaborating with a team in St. Louis.

Forming the Factory Field Service Team has improved communication and built relationships between factory sites. "Team members have an intimate understanding of their site and business processes," said Griffis. "As peers, we respect each other, acknowledge the unique differences at each site, and encourage participation." Added Steve Lynch, Commercial Airplanes' Common Shared Workstation Support manager: "Our focus is on the factory build process and the people on the shop floor."

The larger challenge for the team is to coordinate and integrate the common elements, processes and requirements for factory workstations, which have developed over time into site-centric and often unique configurations. The team sees itself as practitioners forming a Lean change advisory board that will work together with business, site and support organizations. Projects in progress include standardizing shop-floor computing support and imple-

mentation processes, working toward a more common workstation presence, and developing a catalog of production-worthy solutions for existing and new factory programs.

"I am extremely proud of our IT team members who have taken the initiative to reach out to their counterparts across the enterprise to collaborate," said Michele Martin, director of Computing & Network Operations (CNO) End User Services. "This is truly an example of the power of working together as 'One Boeing' to help solve common problems and to make a difference for the Boeing employees we support with our services."

"This is sharing at its best," said Radha Radhakrishnan, IT vice president of CNO. "What this team has accomplished is unbelievable."

Said Griffis: "It's simple. Let's work together to make good things happen." ■

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From the lab *to the field*

Albuquerque employees refine laser-tracking algorithms

By Walter Polt

On a sun-drenched field in Albuquerque, N.M., the scene looks like model aircraft hobbyists flying a radio-controlled airplane. But, attached to the craft with a rubber band and 20 feet (6 meters) of fishing line is a model rocket. As the airplane arcs in the sky, the foot-long (30-centimeter) rocket zips even faster. Less than 200 yards (meters) away, a sophisticated sensor tracks the movements of both the airplane and the rocket.

These folks aren't RC hobbyists. They're employees of Boeing SVS, part of Missile Defense Systems' Directed Energy Systems unit, responsible for advancing directed energy technology—a huge part of tomorrow's weaponry. They're testing the hardware and algorithms used in the Dual Line of Sight (DLOS) tracking system. This system is designed to extend the reach of Boeing's laser systems without compromising precision. The plane simulates an incoming unmanned aerial vehicle challenging the tracking system. The rocket simulates an incoming mortar round.

Because laser beams affect only what they touch, the DLOS system allows warfighters to focus on targets, without affecting nearby property or bystanders. The system also can repel incoming mortar rounds, giving warfighters a lifesaving advantage.

The DLOS laser-relay demonstrator will be suspended half a mile (0.8 kilometers) in the air, below a small blimp. It has a receiving telescope, designed to pick up a ground-based laser's high-energy beam, and a sending telescope. Looking through the latter, a remote operator can patrol the territory below. And if, for example, someone launches an unmanned aerial vehicle (UAV), the operator can in seconds dispatch a speed-of-light laser beam up from the ground laser and through the relay system to the UAV, destroying it in flight.



With Rick Lapinsky, Boeing technician, at the controls, Drew Riedle, Dual Line of Sight (DLOS) program manager, launches a test at Albuquerque's Balloon Fiesta field. The radio-controlled plane simulates an unmanned aerial vehicle challenging the DLOS tracking system. Lapinsky and Riedle have attached a foot-long model rocket to the plane by a 20-foot line to simulate an incoming mortar round. Riedle said these models "are harder than any real target we'll track." BOB FERGUSON/BOEING

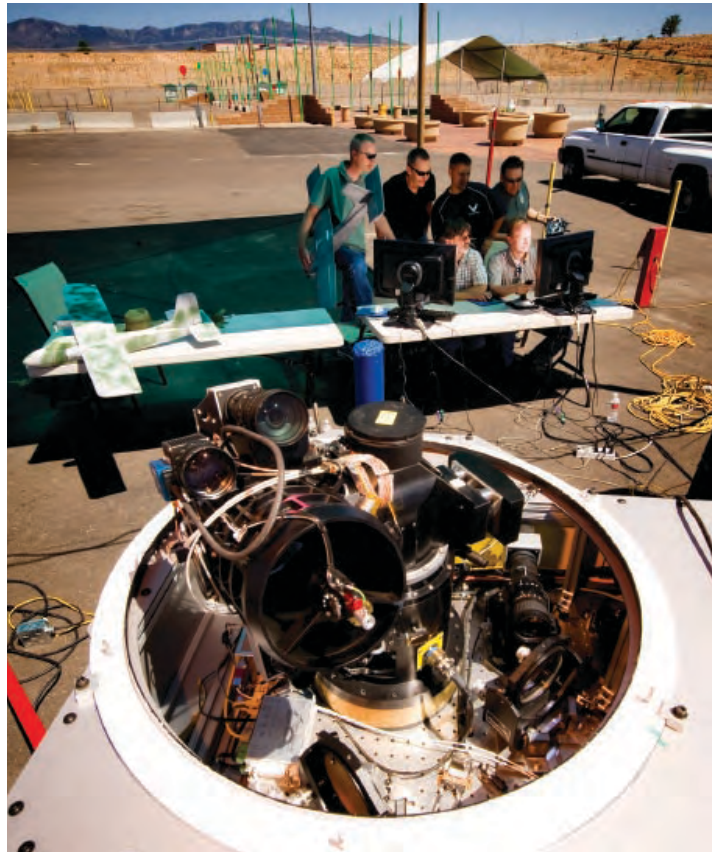
"We've totally rebuilt and light-weighted DLOS to 700 pounds and tested it," said Drew Riedle, DLOS program director. "We hung it from a crane and maintained the connection between a surrogate laser and the receiving end for several hours—while doing surveillance with the sending end, tracking moving objects on the ground."

Matt Ross, embedded-software engineer, described what's next: "If we are successful as planned, by this fall we will have proven that we can put to use these very pristine tracking capabilities we have been refining to shoot down an unmanned aerial vehicle by relaying a beam from a directed-energy weapon—to put energy on a target and only the target [not its surroundings]."

"It's time for the payoff—after years of investment—for (war-fighters) to be comfortable with lasers, and for the laser to save lives," said Lee Gutheinz, site executive and program director, Boeing SVS Inc. ■

RIGHT: Dwarfed by Rocky Mountains in the distance, this gimbal (multidirectional-movement-and-balance mechanism) points a camera aligned with DLOS's low- and high-resolution telescopes. The system automatically and smoothly tracks a radio-controlled model airplane flying fast circles and figure eights a mere 100 to 200 meters/yards away—and even tracks the model rocket careening frantically behind it. Using a computer mouse and joystick, Boeing SVS employees (seated, from left) Frank Zoltowski, optics engineer, and Matt Ross, embedded-software engineer, and (standing, from left) Chris Kiser, embedded-software engineer, Riedle, Jeff Waitkus, field-test engineer and DLOS deputy program manager, and Lapinsky test algorithms they updated since the last field-testing trip.

BOB FERGUSON/BOEING



Frank Zoltowski, optical engineer, studies the rugged design of the mirrors on the new Dual Line of Sight (DLOS) demonstrator system. When carried aloft, DLOS takes a high-energy laser beam sent from the ground and precisely redirects it toward targets such as improvised explosive devices, shoulder-fired missiles, unmanned aerial vehicles or in-flight mortar rounds.

BOB FERGUSON/BOEING



Ready for a tough test

GMD team prepares for complex missile intercept system trial

By Patricia Soloveichik

The world is watching—thanks to heightened news coverage of new ballistic missile threats—as the Boeing-led Ground-based Midcourse Defense program and its teammates approach their most complex test, set for the end of this year. The test will challenge the system's end-to-end ability to detect, track and destroy a lethal ballistic missile target.

Flight tests are part of an ongoing program of test and integration activities that are central to mission readiness for GMD, an operational element of the Ballistic Missile Defense System (BMDS) that's ready to defend the United States against a limited long-range ballistic missile attack.

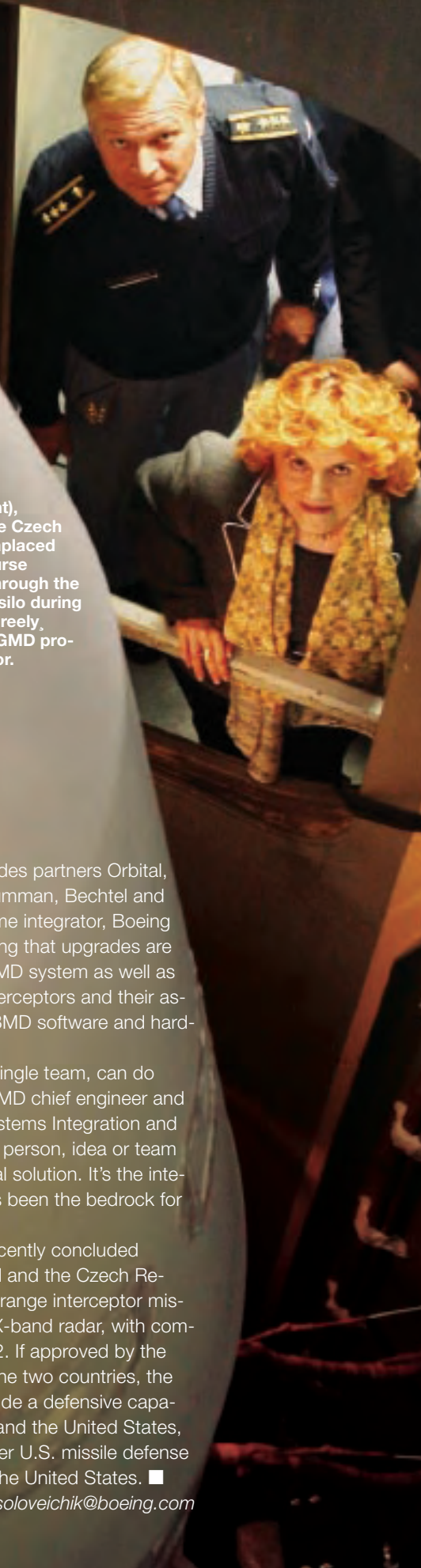
The test marks the first time every aspect of the system—including all radars, sensors, satellite centers, fire control nodes, and weapons systems associated with the long-range ballistic missile defense systems—will be tested together in a real-world missile shutdown. A test earlier this year focused on multisensor integration with a simulated interceptor. MDA has tested the interceptors in real-world intercepts, but did not have all MDA radars online as they will in the next test.

GMD is part of the Missile Defense Agency's complex communications network—the BMDS—that includes sensors, radars, and the sophisticated hardware and software capable of intercepting enemy missiles. The system consists of ground-based interceptors in Alaska and California, along with land-, sea- and space-based sensors and a sophisticated command-and-control system.

GMD interceptors are complex, requiring guidance and communications systems capable of hitting an enemy missile with pinpoint precision. The GMD interceptor carries no ordnance; instead, it relies on the force of a midair collision to destroy incoming ballistic missiles.

"Our customer has compared the complexity of this system to NASA's human space flight program," said Greg Hyslop, GMD vice president and program director. "The intensity of the mission is just as great. This is the United States' only defense against long-range ballistic missile threats. People's lives depend on our ability to get this right."

The GMD program, managed out of Huntsville, Ala., has had seven successful intercept tests, leading up to and including missile shoot-downs with operationally configured interceptors in 2006 and 2007. The upcoming test is designed to "push the envelope" to determine if there are issues with any aspect of the operational system.



Vlasta Parkanova (right), defense minister of the Czech Republic, views an emplaced Ground-based Midcourse Defense interceptor through the open blast door of its silo during a recent visit to Fort Greely, Alaska. Boeing is the GMD program's prime integrator.

MISSILE DEFENSE AGENCY

The GMD team includes partners Orbital, Raytheon, Northrop Grumman, Bechtel and Teledyne Brown. As prime integrator, Boeing is responsible for ensuring that upgrades are incorporated into the GMD system as well as integrating improved interceptors and their associated software into BMD software and hardware systems.

"No one person, or single team, can do this," said Norm Tew, GMD chief engineer and director of Weapons Systems Integration and Test. "It's never just one person, idea or team that provides the optimal solution. It's the integration of ideas that has been the bedrock for GMD's success."

The United States recently concluded agreements with Poland and the Czech Republic to install 10 long-range interceptor missiles and an advanced X-band radar, with completion planned for 2012. If approved by the parliaments of each of the two countries, the interceptor site will provide a defensive capability to protect Europe and the United States, and will be linked to other U.S. missile defense facilities in Europe and the United States. ■

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Raptor's first lady

Capt. Jammie "Trix" Jamieson is greeted by members of the Boeing F-22 team recently after landing in Seattle for an engineering cross-talk session and tours of the Raptor assembly center and avionics lab.

JOE ORSILLO/BOEING

F-22 aviatrix visits Seattle, values rapport with Boeing team

By Doug Cantwell

Her call sign is Trix. "It's short for aviatrix," she said. "No reference to the colorful breakfast cereal."

In spite of her efforts to keep a low profile, U.S. Air Force Capt. Jammie Jamieson draws crowds wherever her job takes her. As the first woman to fly an operational F-22 Raptor, the Air Force's most advanced fighter, she's an anomaly—but clearly a welcome one.

In Seattle recently with their F-22s for a visit with the Boeing Raptor team, Jamieson and Capt. Matt Byrne, both assigned to the 525th Fighter Squadron at Elmendorf Air Force Base, Alaska, participated in their first engineering cross-talk, which educated the F-22's developers as well as its end-users. The pilots also met many of the 1,200 employees who build the Raptor's wings and aft fuselage, integrate the avionics and software, provide the pilot and maintenance training and part of the fleet's sustainment. The visitors also toured the assembly center and a new avionics integration lab, chatted with employees, signed posters and answered questions.

Doesn't she find this part of her job fatiguing? "Not at all," Jamieson said. "In fact, I find it energizing. These are the guys and gals who really know the ins and outs of the airplane."

EDUCATING EACH OTHER

Jamieson saw the visit with Boeing engineers as a chance to expand her knowledge of the aircraft she depends on—and to educate them.

"As end-users of their product, we gave them our perspective as tacticians who have to prioritize information," she said. "We'd

tell them our idea for displaying data in a more useful way, and they'd tell us whether it's doable or not and suggest possible solutions."

At the assembly center, Production Operations Director Dave Pouliot noted that his guests were fascinated to see the inside of a wing under construction. "They found it enlightening to see where system components are located," he said. "They view the wing of a fielded aircraft only, without seeing the plumbing."

The visitors also took keen interest in the composite fabrication process. The wing skins and other Raptor parts are made from hundreds of layers of graphite tape. "It surprised them to find much of the airplane they fly is made from flexible fabric that's been cured into solid components," Pouliot added.

In the new Agile Integration Lab, the pilots got a close-up look at how their avionics and mission software are being modernized. Kelly Haynes, a systems engineer, said the conversation focused on the pilots' wish-lists for the next round of modernization, an ongoing process that keeps the Raptor dominant.

"We were all excited to have Raptors here," Haynes said, "but our customers seemed just as excited to have a face-to-face with the folks who are developing the next increment of mission capabilities." Their ability to execute effectively and come home safely rests largely on superior situational awareness, which makes software upgrades critical.

IT TAKES EVERYBODY

As she stepped into her G-suit before takeoff, Jamieson reflected on the visit. "Seattle has definitely been an eye-opener," she said. "It amazes me how many people it takes to design, develop, produce and maintain this airplane. We're the ultimate end-users of all that effort, but we make up a tiny piece of the whole process. It takes everybody to get us to that point." ■

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An office in the sky

Commercial Airplanes flight test engineers are hard at work up in the air

By Kathrine Beck

Commercial Airplanes flight test engineers work in the sky. For every new model or modified production airplane, tens of thousands of individual tests make sure that the airplane performs as designed and meets customer requirements. The tests also document compliance with the requirements of the U.S. Federal Aviation Administration and other regulatory agencies around the world.

Many of these tests are conducted in flight. Commercial Airplanes flight test engineers are in the airplane, hard at work when the tests are performed.

Flight test engineers collect and analyze data on all aspects of the airplane, from the engines to the entertainment system. Generally, six to 12 flight test engineers work on board, although there can be many more, depending on what's being tested.

Within Flight Test Engineering, the Flight Test Analysis group works closely with airplane programs on modified airplanes and the first airplanes of new products such as the 777 Freighter and the 787 Dreamliner. Flight Test Analysis designs the tests to get

the data that program engineers need to answer the question, "Did it perform as planned?"

Although some data comes from equipment already built into the airplane, much of the data is collected from electronic sensors, which can be smaller than a paperclip. Thousands of sensors can be attached to points all over the airplane with tape, adhesives or fasteners, and are marked with red paper tags. The sensors measure pressure, temperature, strain and position; these measurements are used to calculate parameters such as flight loads and airplane performance, which ultimately are used to validate performance for certification.

Another group of flight test engineers, Flight Test Instrumentation, is responsible for placing the sensors and other test equipment onto the airplane. These engineers design the installation, choose the sensors, work to develop the software package that will capture and record the information, and maintain all test equipment.

Each airplane is completely reconfigured for the testing phase, with test equipment, racks and seating for the engineers. In ad-

dition, safety equipment unique to that test flight is added for the test engineers. A secure rope railing, similar to those used in lobbies, is installed to guide the engineers in the dark should the interior lighting fail.

During the tests, miles of bright orange insulated wire send data from the sensors to computer screens on the airplane. That orange wire has to be snaked through the entire airplane from everywhere sensors are placed—inside and outside, including the landing gear.

Flight test engineers sit behind these screens, watching the numbers roll, making sure that data is captured properly and analyzing it in real time. Test data is collected, stored and later crunched by ground-based software to create paper reports and electronic files that go to airplane programs, customers and regulatory agencies.

After the flight test phase, red-tagged sensors and orange wiring are removed, along with the racks, safety equipment and other items. The airplane is then returned to the configuration the customer ordered.

The interior of one of these flying test labs looks like a computer classroom, except that it can cruise around the Puget Sound region at 30,000 feet (9,144 meters) and perform extreme maneuvers in harsh conditions anywhere in the world.

“The demands of the job are high sometimes, but this job gives you experience you can’t get anywhere else.”

—Mark Litke, test director, Flight Test Operations

Boeing airplanes are tested in all kinds of environments. Yuma, Ariz., can provide good hot-day data with ramp conditions at 100 degrees Fahrenheit (38 degrees Celsius). Performance at high-altitude airports is tested at mile-high Colorado Springs, Colo., or Lima, Peru. Iceland’s Keflavik International Airport has excellent runways and weather for cross-wind testing, and Juneau, Alaska, and China’s Linzhi Airport, in a mountainous Tibetan valley, offer ideal places to test difficult approaches.

Schedules are as challenging as the terrain. “At any one time, we have engineers all over the world, 24 hours a day, seven days a week, 365 days a year,” said Christine Walsh, chief engineer, Flight Test Engineering.

Another group of flight test engineers—Flight Test Operations—makes sure the tests are scheduled efficiently and safely. Operations builds the long-range testing schedule, maintains weekly schedules, and flies and directs tests on board. Efficient scheduling is important because it minimizes flight test length and fuel use. Other members of the group manage test configuration requirements daily and provide maintenance crews with configuration direction. Proper sequencing prevents rework and makes sure that tests in similar weather or airplane conditions are scheduled together. Flight Test Operations also is responsible for ensuring that all testing is performed safely.

“The demands of the job are high sometimes, but this job gives

you experience you can’t get anywhere else,” said Mark Litke, a test director for the Flight Test Operations group. “It combines engineering with the excitement of being in the cockpit.”

Flight engineers from all three groups—Analysis, Instrumentation and Operations—are on board each test flight. “These three teams work closely together,” said Walsh. “It’s one of the few organizations in the company where you literally pack up your bags and spend weeks on the road with co-workers. We need to understand each other’s jobs and roles and responsibilities, and we have to all learn together.”

Of course, the 500 or so flight test engineers in Commercial Airplanes also spend time on the ground designing tests, equipment and processes and preparing and analyzing data. Sometimes they perform tests in airplanes on the ground or they monitor flight tests from the telemetry room, where they can watch the airplane in action on video, review transmitted data and communicate with the pilots in real time.

But even when in the office, their hearts are never far from flight. When flight test engineers see co-workers standing at the window, looking out on Seattle’s Boeing Field through binoculars, they tend to emerge from their cubicles with their own binoculars, asking, “What are you watching?”

“These folks love airplanes,” Walsh said, and she understands just how they feel. Walsh sends her mother pictures of the Boeing airplanes she helps test, and they end up on the refrigerator with other family photos. ■

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PHOTO: Engineers from the Instrumentation group in Flight Operations, Test & Validation Andrew Cherny (from left), Kinita Harris and Harold Matsuoka check flight test instrumentation aboard WF002, the second 777 Freighter flight test airplane. During actual flight tests, these engineers monitor the instruments and data being collected. JOE PARKE/BOEING

Electromagnetic technicians Byron Moore (from left), Tim Cooper and Lance Benjamin use a spectrum analyzer and signal source generator to certify shielding effectiveness at a shielded anechoic chamber in Huntington Beach, Calif. A shielded room blocks outside radio frequency (RF) interference from getting in and classified signals from getting out. Frequency Management Services handles duties such as these as part of its enterprisewide responsibility over RF spectrum use at Boeing.

JOE OLMOS/BOEING



On the right wavelength

Access to radio frequency matters to Boeing, to the estimated value of \$20 billion. Here's why it's critical—and here's who's securing this access

By Marcy Woodhull

How much is a Boeing program worth? Millions, hundreds of millions or even several billion dollars. What about one with an estimated market value of more than \$20 billion? That's the value of Boeing's access to radio frequency (RF) spectrum.

Boeing uses RF spectrum to wirelessly transmit and receive data in applications such as operating cranes and other factory tools and systems; communicating on the factory floor; connecting fire and security personnel; and testing and operating its products. Simply put, without RF spectrum, Boeing's products could not operate.

However, spectrum is a limited resource that's highly sought. To ensure that entities seeking spectrum can get access to it, it's

tightly regulated by the U.S. and international governments. That's why Frequency Management Services, the 34-person Shared Services Group team that has enterprisewide responsibility and expertise over use of RF spectrum, plays a critical role at Boeing.

"With the continuing proliferation of unmanned aircraft systems (UAS) throughout the world, there's an increased emphasis on command, control and communications when integrating these unmanned aircraft with manned aviation in unsegregated airspace. Frequency Management Services plays a critical role in ensuring Boeing's access to this vital shared resource," said Jed Sturman, director, Policy & Certification in Unmanned Aircraft for the Advanced Systems organization of Integrated Defense Systems.

THREE MAIN MISSIONS

As stated in Boeing Procedure PRO-3271, FMS has the authority to procure, operate and protect Boeing radio licenses and spectrum in support of present and future Boeing operations and business requirements.

FMS has three main missions, according to FMS Director Audrey Allison:

- Facilitate business partners' access to the radio frequency resources they need to support their operations and the products they manufacture.
- Ensure Boeing's compliance with these licenses and the overarching federal and international regulations and laws that cover the use of radio frequency spectrum.
- Be a strategic business enabler. FMS advocates for changes to regulations, laws and standards in the United States and around the world that support the requirements of emerging Boeing products and services.

"Proactive regulatory support and representing our company with one voice can provide Boeing with a key competitive advantage in the global marketplace," Allison said. "Working together as one company is the most expedient approach."

According to Michael Kato, FMS senior manager, the spectrum marketplace is dynamic. "Our organization is well-versed in working with the appropriate government agencies on behalf of Boeing including the Federal Communications Commission and the National Telecommunication and Information Administration in Washington, D.C.," he said.

Yet FMS can't perform its role effectively without a close working relationship with business partners and functional leaders. In 2005, an executive-level process council was established to serve as Boeing's internal governing body over spectrum policies, strategies and issues and for coordinating Boeing views on spectrum issues. Kato chairs the Spectrum Governance Council, which includes representatives of business units, non-U.S. subsidiaries, functions and related councils.

FMS, which includes employees based in the United Kingdom and Canada, also represents Boeing's spectrum interests before regulators in other countries and international and regional intergovernmental bodies devoted to radio regulation.

For example, Boeing maintains more than 175 spectrum authorizations worldwide for the operation of IDS' Boeing Broadband Satcom Network. Additionally, FMS has obtained frequency clearances in 200 countries for the operation of new wireless devices for the 787 Dreamliner airplane.

"Currently, FMS is teaming with Commercial Airplanes to obtain dedicated spectrum for the future operation of wireless sensors on airplanes," said Mohamed El Amin, FMS's London-based international director. "That would help make airplanes lighter, more fuel-efficient and more reliable." ■

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One-stop service delivery tool

Frequency Management Services (FMS) obtains about 700 spectrum authorizations a year. There's an increasing trend for requests thanks to the growing complexity of Boeing programs and products.

To improve the authorization process, FMS created the Consolidated Frequency Management System (CFMS), a Web-based system at <http://cfms.web.boeing.com> on the Boeing intranet. This system streamlines the process while storing critical compliance assessment information.

"Obtaining access to radio frequencies often requires long lead times to obtain licenses or authorizations, so we encourage employees to consult us as early in the planning process as possible," said Bob Douglass, FMS Enterprise Spectrum manager.

CFMS enables the tracking of service requests from initial consulting, through requirements validation, to government coordination, to the publishing of a Boeing Authorization Memorandum. This site supports the companywide Lean+ and Internal Services Productivity growth and productivity initiatives.

"CFMS is the culmination of over three years of collaboration with our business partners, with the goal of providing a one-stop service delivery tool for Boeing's RF spectrum needs," said John Herpy, manager of CFMS and FMS Systems and process improvement leader.

—Marcy Woodhull

FMS by the numbers

Here's a quick number-driven look at what Frequency Management Services does to support Boeing.

48 ■■

Number of different kinds of business partner service requests the Consolidated Frequency Management System (CFMS) supports 24 hours a day

200 ■■

Number of countries FMS has obtained frequency clearances in for wireless devices onboard the 787 Dreamliner airplane

20 billion ■■

Value in U.S. dollars of Boeing's access to radio frequency spectrum each year

175 ■■

Number of spectrum authorizations Boeing maintains worldwide to operate Integrated Defense Systems' Boeing Broadband Satcom Network

700 ■■

Number of spectrum authorizations FMS performs in a year

186 ■■

Number of RF enclosures tested and certified each year by the FMS Electromagnetics Group

Special delivery

MHI helps Boeing again earn U.S. Customs' top global supply chain security rating

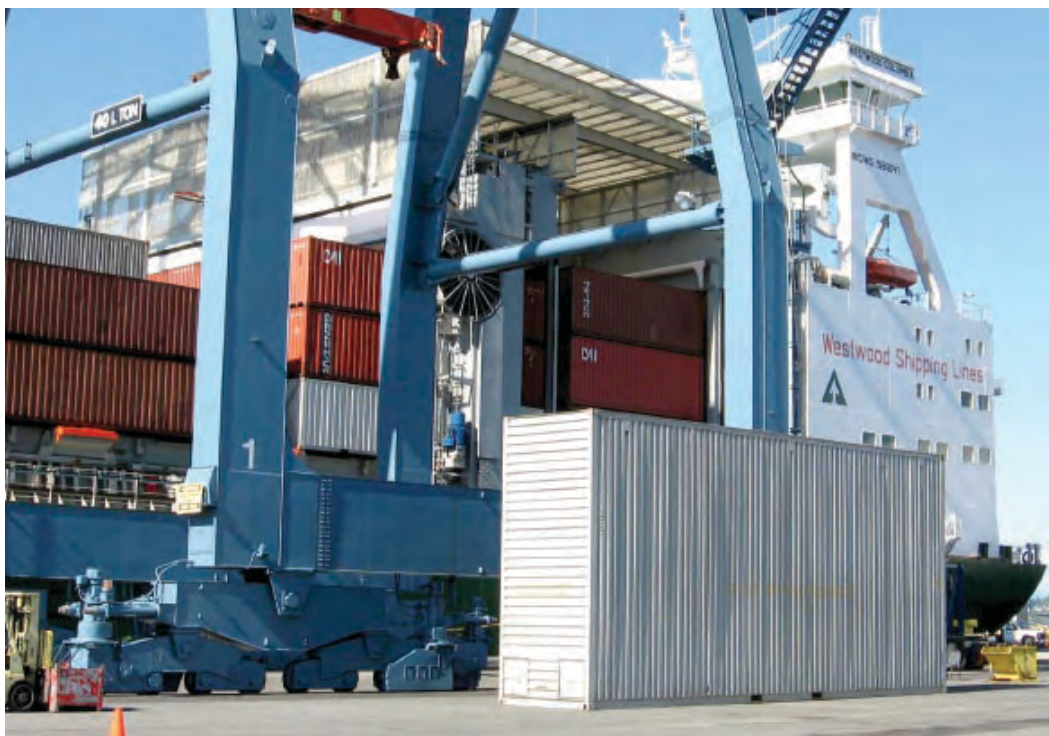
By Patrick Summers

U.S. Customs and Border Protection has again recognized Boeing's rigorous standards of global supply chain security by revalidating the company's standing as a Tier 3 importer, the highest rating in the agency's Customs–Trade Partnership Against Terrorism (C-TPAT) program. The Tier 3 designation means fewer Customs inspections and gives Boeing cargo priority handling if a security threat or incident forces the temporary closure of U.S. ports or border crossings.

Maintaining the high C-TPAT rating, which Customs and Border Protection (CBP) officially granted in July, is critical to protecting the integrity of the global supply chain and the Boeing Production System. "Boeing is a just-in-time manufacturer. We can't afford long delays in the flow of parts and material from our international network," said Corey Jones, supply chain security specialist. "The C-TPAT program helps Boeing minimize the risk of delay or disruptions due to security inspections that otherwise might occur."

One of Boeing's largest global suppliers, Japan-based Mitsubishi Heavy Industries (MHI), played an important role in the Tier 3 revalidation. Once a company initially earns top-tier C-TPAT status, which Boeing first received in 2005, Customs reviews and revalidates the rating every three years by scrutinizing the security procedures of a single partner who will represent the entire global supply chain. This year, Boeing and CBP chose the Mitsubishi plant in Hiroshima as the revalidation focus.

"MHI is one of the largest suppliers of major aircraft structures that we use in our programs. They perform important, high-



value work for Boeing," said Mike Will, one of the Supplier Management procurement agents who helped Boeing prepare for the revalidation. "They have a good record of adjusting and adapting to changing business requirements and helping Boeing develop solutions. For example, they also took part in an ocean container security demonstration project."

The Hiroshima plant is one of five MHI facilities in Japan performing work on Boeing parts and structures. It produces fuselage sections for the 747, 767 and 777 aircraft. MHI builds 787 Dreamliner wings at a different location.

In this year's C-TPAT revalidation process, two CBP specialists spent a full day in May reviewing security plans and procedures onsite at the Hiroshima facility. Jones accompanied the specialists and MHI officials during the visit. He said the revalidation involved about four pages of comprehensive security criteria and requirements. Customs assessed MHI's compliance with the criteria and revalidated Boeing's Tier 3 status, a rating earned by only 250 of the 8,000 companies enrolled in the C-TPAT program.

"This is a major milestone in the Supply Chain Security program. I especially appreciate the help of our MHI partners who devoted so much time and effort to

Boeing's revalidation," added Ken Konigsmark, Supply Chain Security senior manager.

Mitsubishi also is gratified by the revalidation. "We are very pleased that MHI could contribute to this result," said Junya Nakazato, one of several MHI officials who coordinated the company's role in the revalidation process. "I am proud this is an outcome that Boeing and MHI achieved jointly. It indicates our strong partnership and is a good example of what Boeing and MHI can accomplish working together."

CBP began the C-TPAT program after the September 2001 terrorist attacks as a voluntary government-industry partnership to enhance the security of supply chains sending cargo through U.S. ports and border crossings. Boeing joined the program in 2003 and earned the Tier 3 rating in 2005. ■

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PHOTO: At the Port of Everett in Washington state, components for Boeing airplanes enter the United States from international locations. U.S. Customs and Border Protection recently revalidated a supply-chain security rating for Boeing. **PORT OF EVERETT**

Boeing stock, ShareValue Trust performance

ShareValue Trust is an employee incentive plan that allows eligible employees to share in the results of their efforts to increase shareholder value over the long term.

The program—which runs for 14 years and ends in 2010—features seven overlapping investment periods. The program is currently in Period 7.



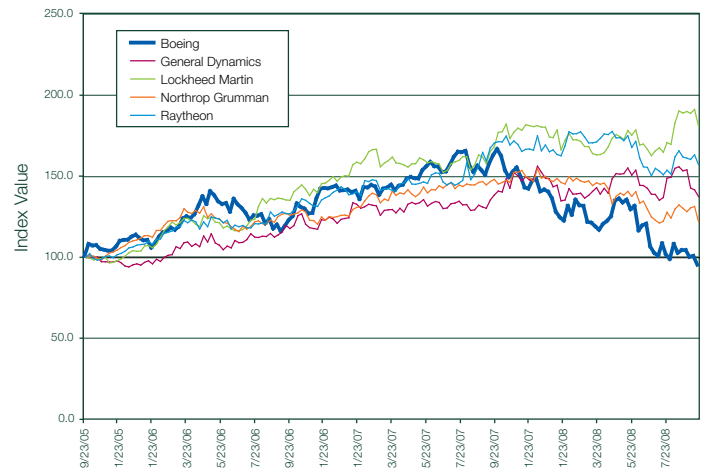
The above graphs show an estimate of what a “full 4-year participant” ShareValue Trust distribution (pretax) would be for Period 7 if the end-of-period average share prices were the same as the recent price shown.

The share price shown is the average of the day’s high and low New York Stock Exchange prices. Updates to participant/employment data will be made periodically. For more information on the ShareValue Trust, visit <http://www.boeing.com/share>.

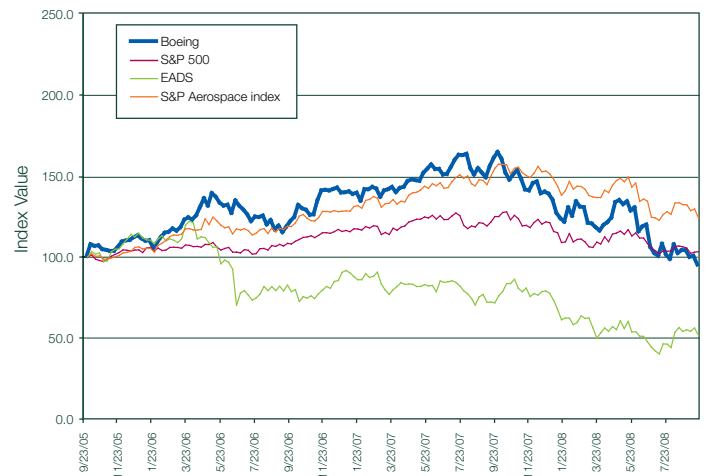
STOCK WATCH

The chart below shows the stock price of Boeing compared to other aerospace companies, the S&P 500 index and the S&P 500 Aerospace and Defense index. Prices/values are plotted as an index number. The base date for these prices/values is Sept. 23, 2005, which generates three years of data. The prices/values on that date equal 100. In other words, an index of 120 represents a 20 percent improvement over the price/value on the base date. Each data point represents the end of a trading week.

Boeing vs. U.S.-based competitors



Boeing vs. stock indexes and international competitors



Comparisons: 4-week, 52-week	Price/value as of 9/19/08	Four-week comparison		52-week comparison	
		Price/value as of 8/22/08	Percent change	Price/value as of 9/21/07	Percent change
BOEING	59.76	65.55	-8.8%	102.59	-41.7%
U.S. COMPETITORS					
General Dynamics	82.39	92.00	-10.4%	82.96	-0.7%
Lockheed Martin	110.88	115.77	-4.2%	103.20	7.4%
Northrop Grumman	65.52	70.00	-6.4%	79.55	-17.6%
Raytheon	58.52	60.26	-2.9%	63.44	-7.8%
INT'L COMPETITORS					
EADS*	14.27	15.07	-5.3%	20.28	-29.6%
U.S. STOCK INDEXES					
S&P 500	1255.08	1292.20	-2.9%	1525.75	-17.7%
S&P 500 Aerospace and Defense Index	362.26	386.52	-6.3%	453.64	-20.1%

* Price in Euros

RETIREMENTS / The following employees retired in August from The Boeing Company.

Merrilyn Stewart, 30 Years
Gerald Strang, 23 Years
Kenneth Sundberg, 40 Years
Douglas Swarts, 39 Years
Kathleen Sybrant, 11 Years
Patrick Taylor, 19 Years
Bobby Thomas, 41 Years
Barbara Tolle, 12 Years
Sam Tran, 20 Years
Charles Trendley, 16 Years

Joel Trevino, 26 Years
Alfred Trommler, 16 Years
Douglas Tulip, 26 Years
Walter Ullman, 18 Years
Patrick Urabe, 23 Years
Robert Van Allen, 15 Years
William Vanamerongen, 34 Years
David Vogler, 34 Years
Craig Votava, 23 Years
John Wagner, 39 Years

Jimmie Walker, 20 Years
James Wallace, 43 Years
Linda Watson, 28 Years
Stephen Weixel, 37 Years
Patricia Whitbeck, 27 Years
Sharon Whitlatch, 10 Years
Patricia Whitley, 33 Years
Glenn Wiest, 34 Years
Floyd Williams, 33 Years
Hope Williams, 27 Years

Emma Wills, 37 Years
Vicki Winston, 26 Years
Margaret Wolff, 27 Years
Kenneth Yamamoto, 21 Years
Frank Young, 28 Years
James Young, 37 Years
George Zabokrtsky, 21 Years
Robert Zoelch, 18 Years
Debra Zydek, 29 Years

IN MEMORIAM / The Boeing Company offers condolences to the families and friends of the following employees.

Charles Anderson, general assembler/installer; service date Jan 22, 1980; died Sept. 3

Loretta Arnold, accountant; service date Aug. 24, 1991; died Aug. 23

Darrell Dollinger, manufacturing change management specialist; service date Feb. 6, 1979; died Aug. 31

Robert Goslin Jr., flight test mechanic; service date Aug. 1, 1983; died Sept. 1

Terrence Knutzen, millwright; service date March 6, 1976; died Aug. 24

Craig Lewis, product review engineer; service date July 30, 1980; died Sept. 5

Valerie Maher, procurement agent; service date Dec. 12, 1978; died Aug. 31

Jack Mason, systems engineering support analyst; service date May 13, 1985; died Aug. 18

Gene Matthews, process review engineer; service date April 7, 1978; died Aug. 20

Jonathan Mayhan, manufacturing technician; service date May 11, 2007; died Aug. 30

Constance McKenna, office administrator; service date Jan. 3, 1989; died Aug. 27

Russell McMullen, technical designer; service date Nov. 6, 1992; died Aug. 31

David Otten, project management specialist; service date Feb. 11, 1993; died Aug. 25

Paul Plizka, machine tool maintenance mechanic apprentice; service date May 26, 2006; died Aug. 27

Christopher Schumacher, electrician maintenance/installer; service date Sept. 20, 1972; died Aug. 31

Mark Van Leuven, aircraft assembly mechanic; service date April 3, 1979; died Sept. 1

Felix Vigil, aircraft painter; service date May 4, 1987; died Aug. 27

AROUND BOEING

Historic Boeing airplane makes transcontinental flight

The Boeing Model 40, the first production commercial airplane built by Boeing, again took to the skies in a transcontinental flight last month. Sponsored by Boeing and its wholly owned subsidiary Jeppesen, the flight between New York and San Francisco commemorated the 90th anniversary of airmail service in the United States and honored the individuals who made today's global aviation system possible. One of these pilots, Elrey B. Jeppesen, founded the company that bears his name.

This Model 40C, one of three in existence, was delivered in May 1928 to Pacific Air Transport, a subsidiary of Boeing Air Transport, to carry mail between Portland, Ore., and Oakland/San Francisco. In October of that year, the airplane disappeared in dense fog en route to Portland. Years later, Pemberton and Sons Aviation, which specializes in finding and restoring antique airplanes, found the wreck in southern Oregon. The lengthy restoration took 62 volunteers 18,000 hours over eight years. For photos of the reenactment, visit www.airandspacemag.com.

Engineering magazine for minority groups ranks Boeing as No. 1 employer

Readers of *Workforce Diversity for Engineering and IT Professionals* magazine recently rated Boeing the top employer of 2008. In this survey, the publication asked high-tech professionals to rank the companies and government agencies where they would most like to work or that they believe would provide a positive working environment for members of minority groups.



Boeing completes first BBJ 3

Boeing recently completed the newest member of its business jet family, the BBJ 3, which is based on the Next-Generation 737-900ER (Extended Range). In addition to narrowbody BBJs, Boeing also sells VIP versions of its 787 Dreamliner, 777, 767 and 747-8 models to private operators. **JIM ANDERSON/BOEING**

"The survey results show Boeing is making good progress in its efforts to attract, recruit and retain the best possible technical work force for the future," said John Tracy, chief technology officer and senior vice president of Engineering, Operations & Technology. "Increasing the diversity of our technical work force strengthens it because we gain a broader range of new ideas, perspectives and solutions for satisfying our customers' needs and improving our productivity," he said.

To read the rankings, visit www.eop.com.



Long Beach Site Services Maintenance Operations

The Boeing C-17 facility in Long Beach, Calif., like all facilities in Southern California, depends on its air conditioning systems to keep critical systems—and employees—cool. Two chilled water plants cool the site: a system in Building 58 supports the paint hangar and one in Building 52A chills all other buildings. In August, one of the chillers caught fire. We in Site Services, along with the Boeing and Long Beach Fire Departments, quickly responded.

Following the fire, we realized we needed to ensure that we had reliable backup systems in place. Our 10-year-old systems had never been required to feed chilled water to all locations from just one plant. Site Services heating, ventilating and air conditioning technicians, plumbers and managers developed a plan to open the piping connecting the two plants and shut down the chiller at Building 52A. This would allow us to test the ability of the Building 58 chiller to support the entire site and, if successful, allow us to completely shut down

the damaged chiller for repairs.

We believed there was enough capacity in either plant to provide adequate chilled water for the entire site, so we set out to connect piping between the plants and conduct tests. Our priority was to cooperate and to work together safely to avoid interrupting the flow of chilled water to critical systems. The end result was the output flow from Building 58 was more than adequate to supply the needs of the C-17 facility.

Had we not taken the initiative to test the system in this manner, or had the test failed, the site would have needed to rent a portable chiller and related electrical feed. This would have imposed a cost of \$63,500 per month for three months or more. The test proved a way to save money—and provided peace of mind. Future benefits of linking the two systems will be less wear and tear on the equipment due to reduced run-time requirements, and less worry about downtime during preventive maintenance.

On equipment:

Bob Ingram

Front row, from left:

Roger Jackson, Joe DeAlmeida, Alfonso Gomez, Steve Radigan

Middle row, from left:

Tom Mason, Gregg Palcek, Richard Miller

Back row, from left:

Joe Cardenas, Julian Silora, Dave Frieman, Bob Friegman, Mike Foy, Danny Grisham

GINA VANATTER/BOEING



WHAT IF SOMEDAY WERE TODAY?

Boeing proudly supports those who open the doors for people of all backgrounds, making the dreams of tomorrow a reality today.



Global corporate citizenship refers to the work Boeing does—both as a company and through its employees—to improve the world. This ad reflects Boeing's commitment to organizations that provide opportunities to help people of all backgrounds achieve their goals.

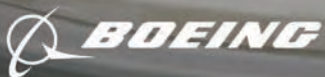


THERE IS HOPE IN EVERY HAND.

Sometimes the greatest strength can come from the gentlest touch.

There's a power in the simple act of reaching out to help someone in need.

Boeing proudly supports all who give hope to those who need it most.



Global corporate citizenship refers to the work Boeing does—both as a company and through its employees—to improve the world. This ad illustrates Boeing's commitment to promoting the well-being of the most vulnerable residents in communities worldwide.