BOEING

Frontiers

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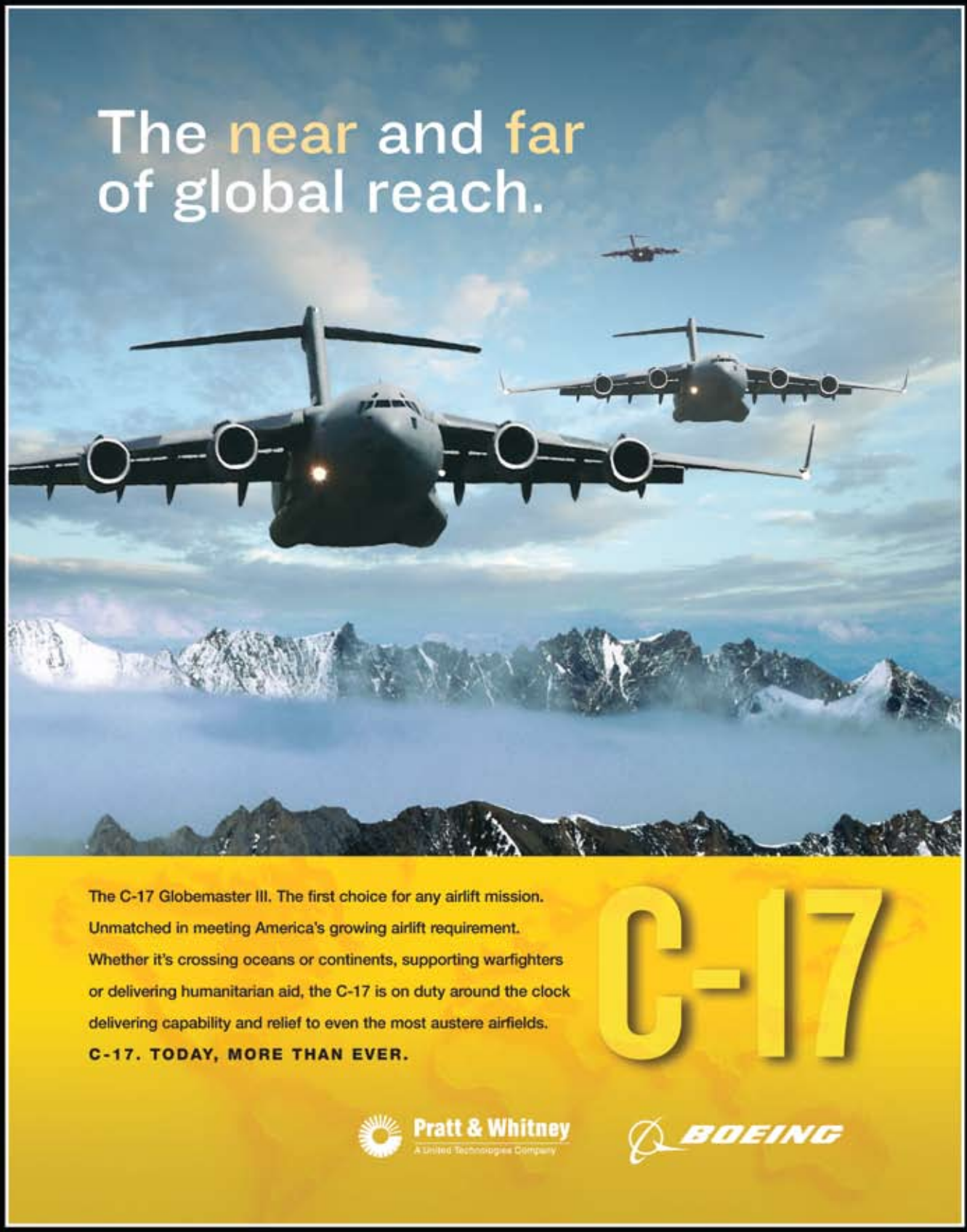
MARCH 2009 / Volume VII, Issue X

Lean+ in action

Across the company, Boeing people are working together to improve quality and productivity, provide better value to customers, and make Boeing more competitive.



This new C-17 team ad developed by Integrated Defense Systems positions the C-17 as the indispensable backbone of airlift capability. It communicates how the world depends on the C-17 for many vital missions. Look for this ad in key military and congressional publications.

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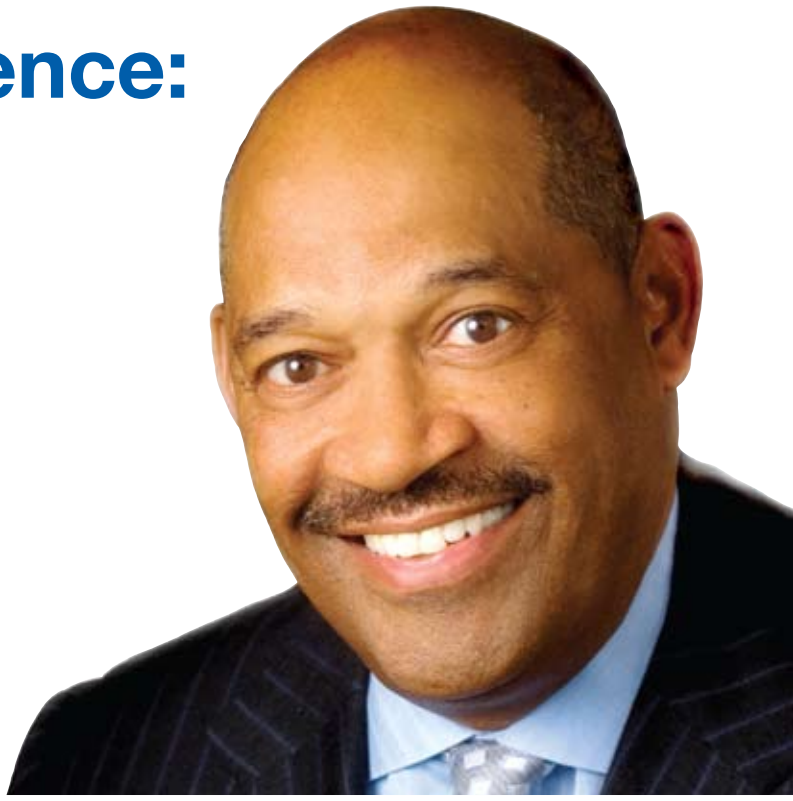
Longtime C-17 program employees Gary Beckum (from left), Greg Gaskin and Randolph Masada walk the C-17 for a visual inspection of the cargo package. Boeing recently delivered the 200th C-17. ROBERT SCHNEIDER/BOEING

INSIDE

Functional excellence:

Working together to accelerate performance

James Bell
Corporate President and Chief Financial Officer



We often speak of Commercial Airplanes and Integrated Defense Systems as the engines of Boeing. For optimum performance, the internal operating components of those engines need to work in integrated precision.

Our business support functions (from Engineering and Manufacturing to Human Resources and the Legal team) are the internal components. To ensure high performance and meet our customers' expectations, the functions must work in complete harmony with each other and with the business units.

The senior leadership team has been working hard to focus on improving functional management performance. It's a continuum, with functional discipline a critical start point and functional excellence the true goal:

- "Functional discipline" refers to a functional organization's ability to provide the people, process and tools required to support the business operations while mitigating risks and protecting the corporation. Functional focus on people, process and tools that ensures value-added, differentiated capability results in better performance, more robust risk mitigation and enhanced one-company operations. Seamless integration of businesses and functions provides competitive leverage, ensures compliance and delivers productivity.
- "Functional excellence" is the desired, advanced end-state where functional discipline is addressed in a holistic, proactive process manner that prevents issues and escapes; provides high assurance of compliance and good corporate governance; uses a common approach, language and process infrastructure; optimizes integration across all functions; and measurably fuels top business performance. It's about a framework that provides value-added, best-in-class functional capability across all disciplines, with predictive and preventative risk-mitigation controls.

Of course, we have great variability in the types of programs and customer types between Commercial Airplanes and IDS that must be addressed in our fundamental business operations. Yet the critical common thread is consistent delivery of functional capability across that range of programs and requirements. That's essential if we are going to satisfy our customers' needs.

Driving the delivery of that functional capability to a level of excellence characterized by consistency and commonality enables us to operate as one company and provide significant competitive leverage. Enterprisewide processes and tools are essential to provide functional performance, provide added value to the customer set, and protect the company.

The past year saw real progress toward those goals, with functions tightening process discipline, improving "one company" operations and developing their people. Finance, for instance, simplified and streamlined its processes, reducing its accounts by 80 percent and its controls by 70 percent, and improving quarterly financial closing cycle time by a factor of three. Engineering, Operations & Technology, meanwhile, shared leaders, people, work packages, quality improvement methods, metrics, Lean+ experts and common processes across the company. And the Office of Internal Governance stood up an enterprisewide Compliance Risk Management Board with representatives from all the businesses and functions to improve visibility of common risk areas and to improve controls across the enterprise.

Now it's time to up the gain. As a company, we continue to benchmark against others so we know what's "best in class." We continue to work on determining the appropriate architecture for more common and complementary systems. We continue to advance an integrated strategy for hiring, developing and retaining a work force with the skills we need now and will need in the future.

Integrating functional excellence into everyday business operations is essential to achieving the world-class business performance Boeing stakeholders expect and deserve. Ultimately, through functional excellence, we can all take pride in the fact that we will continue to conduct our business better tomorrow than we do today—and deliver even greater value to our customers so that they will return to us again and again. ■

Editor's note: James Bell leads the companywide functional-excellence effort at the request of Boeing Chairman, President and CEO Jim McNerney.

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LETTERS

"I would hate to see [your] reputation tarnished in some way." *—Timothy Lessard, Clearfield, Utah*

RING OF TRUTH

I was reading the article "Emerging better and stronger" (Page 20) in your February edition and I noticed the photograph of the U.S. Air Force captain inspecting the weapon carriage with GBU-39/B Small Diameter Bombs. I noticed something odd in the photo and it jumped right out me.

Being a former Air Force missileer, aircraft maintainer and maintenance trainer, I noticed that this captain was wearing a ring. As anyone who has ever had the pleasure of being a maintainer knows (as I have), the wearing of rings is strictly forbidden and is a personal safety violation. I'm sure I'm not the only one who noticed this item and this picture could be construed as a normal practice.

As a note to the editor, I believe it would be a good business practice to ensure the integrity of photos, safety or otherwise, before being placed in this periodical. It is a great publication, and I would hate to see its reputation tarnished in some way.

—Timothy Lessard
Clearfield, Utah

Editor's note: *We appreciate your comments and apologize for the oversight.*

Correction: On Page 13 of the February 2009 edition, the deadline for submitting expense reports was misstated. Expense reports must be submitted within 12 calendar days upon the completion of travel or incurrence of the business expense.

CALENDAR

March 10–15: Australian International Airshow and Aerospace & Defence Exposition. Geelong, Australia. See www.airshow.net.au

March 11–12: Defense Technology & Requirements. Washington, D.C. See www.aviationweek.com/conferences/dtarmain.htm

March 15–17: ISTAT (International Society of Transport Aircraft Trading) 26th Annual Conference. Scottsdale, Ariz. See www.istat.org

March 31–April 2: Aircraft Interiors Expo. Hamburg, Germany. See www.aircraftinteriors-expo.com

April 7–9: Air Cargo Management Group's 5th Annual Air Cargo, Express & Freighter Aircraft Workshop. Seattle. See www.cargofacts.com

April 21–23: Boeing Lean+ Conference. Anaheim, Calif. See http://leo.web.boeing.com/Events/LEC/Spring2009/LEC_Spring2009.cfm on the Boeing intranet

May 6–7: Airline Purchasing Expo 2009. London. See www.aviationindustrygroup.com

June 15–21: Paris Air Show. Paris. See www.paris-air-show.com

July 20–23: 19th Annual Symposium of the International Council on Systems Engineering. Singapore. See www.incose.org/symp2009

Sept. 8–10: Asian Aerospace 2009. Hong Kong. See www.asianaerospace.com

Sept. 13–15: 15th World Route Development Forum. Beijing. See www.routesonline.com

Sept. 15–17: Cargo Facts 2009. Seattle. See www.cargofacts.com

Nov. 15–19: Dubai Airshow 2009. Dubai, United Arab Emirates. See http://dubaiairshow.aero.

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

Good luck to you! The first 777 Freighter gets a water cannon salute from the Boeing Fire Department as the airplane prepares to depart Paine Field in Everett, Wash., for France. Air France took delivery of the first 777 Freighter on Feb. 19. TIM STAKE/BOEING

QUOTABLES

"It is no longer about buying and selling. It is now about being a fabric of the country."

—Vivek Lall, vice president and India country head for Integrated Defense Systems in India, about the importance of this market to IDS, in a Feb. 4 Reuters report

"It's a breakthrough airplane that significantly lowers the per-ton-mile costs."

—Ned Laird, managing director of the Seattle-based consultancy Air Cargo Management Group, about the Boeing 777 Freighter, in the Feb. 19 Seattle Post-Intelligencer. *Last month Air France took delivery of the first 777 Freighter*

"We cannot let our attention to internal efforts distract us from serving [our customers]."

—Jim McNerney, Boeing chairman, president and CEO, on the importance of Boeing staying fully engaged with customers as it adapts to today's economic challenges, in a Feb. 17 message to employees

IAM PROMOTIONS

No promotions listed for periods ending Jan. 30 and Feb. 6, 13 and 20.

ETHICS QUESTIONS?

You can reach the Office of Ethics & Business Conduct at 1-888-970-7171; Fax: 1-888-970-5330; Web site: http://ethics.whq.boeing.com

Sweeping changes

Why Rockwell International was involved in working on the Forward Swept Wing—and how this technology lives on today

By Erik Simonsen

During World War II one of the primary goals of fighter pilots engaged in aerial "dog fights" was to maintain a tight turn inside the attacker. After the war, aeronautical engineers were anxious to achieve air combat maneuverability superiority for future aircraft. It was believed that development of a Forward Swept Wing (FSW), which positions the wings' leading edges further forward in the airflow, could provide that capability.

Boeing predecessor company Rockwell International aimed to deliver this ability. Although the customer elected not to extend FSW technology beyond two demonstrator aircraft built by a competitor, work done by Rockwell has led to aerospace innovations that live today.

The FSW concept was not new. During World War II, U.S. engineers were aware of FSW problems that severely limited the speed of the German Junkers Ju 287 four-engine bomber. Although not intended for increased maneuverability, the bomber's FSW configuration enabled its bomb bay to be located at the aircraft's center of gravity.

In the quest for increased maneuverability, the top post-World War II U.S. fighter, the P-51 Mustang, was selected for the new wing. Boeing predecessor company North American Aviation designed an FSW P-51 concept. However, during wind tunnel tests the rigid aluminum wings twisted asymmetrically, indicating potential loss of control. Further testing determined the wings had to be limited to 15-degrees forward sweep. Increased speed and high g-force turns would lead to structural divergence, or wing separation. The FSW P-51 was never built.

But this initial study uncovered additional FSW advantages, including super agility; reduced drag, resulting in the need for a smaller engine; increased lift characteristics; reduced aircraft size; and smooth transonic/supersonic transition. Yet it would take decades of technological evolution before a fully capable FSW concept could actually take to the air.

Norris Krone, a retired U.S. Air Force colonel who joined the Defense Advanced Research Projects Agency (DARPA) in 1976, had long envisioned the advantages of forward swept wings. At DARPA, Krone continued to advocate the concept for modern fighters, and it seemed necessary technologies had matured. Advanced lightweight composite structures (30 percent lighter than metal) and aeroelastic tailoring (controlled flexing of the wings) helped pave the way. In addition, computerized flight controls were available to dampen out instability. Krone's dream was gaining traction.

A sophisticated flight test program became a reality in 1977, as the FSW program was initiated under the auspices of DARPA, NASA and the U.S. Air Force Flight Dynamics Laboratory. Technical gains would be applied to the forthcoming Advanced Tactical Fighter competition.

Three contractors submitted proposals. General Dynamics submitted a FSW variant of the F-16, but was eliminated from the competition. Grumman Corporation proposed a new design that used several off-the-shelf aircraft sections not directly involved in

"The FSW demonstrator program proved to be very successful in that we developed a high-tech design team, tools and insights at a time when there were few new designs in work."

– Mike Robinson, Phantom Works business development

FSW technology. These included the forward fuselage and cockpit of a Northrop F-5A, and the F-16 nose and main landing gear.

Rockwell International entered a "clean sheet" design named the Sabrebat—in keeping with the North American Sabre Jet legacy. The forward wing sweep was 40 degrees compared to 30 degrees on the Grumman design. To aid in high-angle-of-attack flight, Sabrebat featured a lower fuselage intake, similar to the F-16. In addition, the cockpit seat inclined 30 degrees, providing excellent all-aspect visibility.

Both designs included forward canards. Rockwell featured aft-swept canards placed above the main wing to alleviate wake interference. Grumman designed canards that interacted with the forward swept wings.

On Dec. 22, 1981, DARPA chose Grumman to build two X-29A demonstrators, relegating the Sabrebat to only a full-scale mockup. In December 1984, the No. 1 X-29A made its first flight at NASA/Dryden Flight Research Center at Edwards Air Force Base, Calif. As the aircraft cruised to an altitude of 15,000 feet (4,572 meters) and speed of 235 knots, the triplex fly-by-wire flight control system was pulsing 40 commands-per-second to counter the wings' inherent instability.

Mike Robinson, the Sabrebat program manager for Rockwell and now with Phantom Works business development, recalled that the Sabrebat FSW concept was based on the HiMAT (Highly Maneuverable Aircraft Technology) test flight experience (see Page 8 of the May 2007 *Boeing Frontiers*). "That program amassed a wealth of transonic/supersonic data on HiMAT's graphite composite variable-camber wing." Robinson continued, "The FSW demonstrator program proved to be very successful in that we developed a high-tech design team, tools and insights at a time when there were few new designs in work. Those technologies served us well in many subsequent programs. And the enabling technology was ultimately used on other programs during the ensuing two decades."

Although DARPA, NASA and the Air Force concluded that FSW technology would not extend beyond the X-29A, the program helped revitalize X-Plane research. It also led to innovative work such as the Boeing Phantom Works F/A-18 Active Aeroelastic Wing program, where an aircraft's wing surfaces change shape subtly in flight to provide improved control and better performance (see Page 68 of the December 2002/January 2003 *Boeing Frontiers*). ■

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Forward thinking

What capabilities were engineers looking for in a Forward Swept Wing design? Here's a list.

- Reduced transonic and supersonic drag
- First thin supercritical wing
- Advanced flight controls
- Higher maximum lift
- 25 percent reduction in landing speed
- Extreme high-angle-of-attack flight
- 20 percent reduction in size, compared to a similar fighter with conventional wing

PHOTOS:

FAR LEFT: Graceful interaction of the aft-swept canards and forward swept wings are depicted on the Rockwell Sabrebat full-scale mockup. BOEING ARCHIVES **LEFT:** A planform view of the Grumman X-29A FSW demonstrator over the Edwards Air Force Base, Calif., test range. NASA

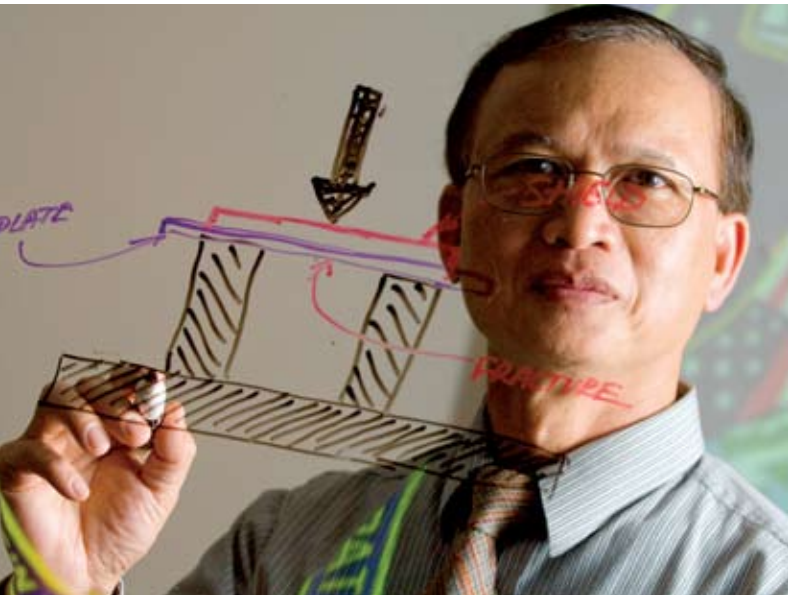
No substitute for hard work

NASA recognizes Boeing engineer for his role in making space vehicles safer

By Ed Memi

Duke Tran knows the value of hard work and its rewards. The Boeing engineer's expertise in space shuttle structure and his contributions toward making space vehicles safer has earned him the highest award for a non-government worker from the U.S. National Aeronautics and Space Administration.

Tran received the NASA Exceptional Public Service Medal last month for his work as a principal on a prestigious NASA study that examined how to improve the design of future spacecraft by using the lessons of the Space Shuttle *Columbia* tragedy.



During the study, NASA's Spacecraft Crew Survival Integrated Investigation Team report, Tran worked side-by-side with noted forensic doctors, astronauts and experts from other fields as they examined shuttle debris at Kennedy Space Center, Fla. The team performed a multidisciplinary analysis of the *Columbia* accident that focused on the crew, crew equipment and the crew module.

Tran used his knowledge as a subsystem manager on the shuttle's forward fuselage and crew module to help reconstruct how the orbiter broke up on re-entry in 2003. Impressed with his expertise and his scenario for how the breakup occurred, the team asked Tran to author a major section of the 400-page report released in December.

Tran immigrated to the United States from Vietnam in 1975 after the fall of Saigon (now known as Ho Chi Minh City) with a degree in electrical engineering. After a series of odd jobs, he went back to school and earned a bachelor's degree in mechanical engineering and joined Rockwell International in 1979. When the orbiters were built, Tran was the lead engineer for the forward fuselage on three of the five spacecraft.

Tran has spent most of his Boeing career in California and Houston supporting the forward fuselage and the pressurized crew module, which is suspended inside the forward fuselage. He was the lead engineer on the external airlock on the space shuttle so it could dock to the Russian Mir space station and later to the International Space Station. Tran also designed the lightweight composite lockers used on the mid-deck of the shuttle. After the *Challenger* accident in 1986, he helped design the new crew escape system, which added pyrotechnics and beefed up structures around the side hatch.

Tran began helping the *Columbia* team in 2004 part-time, while continuing to perform his Boeing engineering duties on the space shuttle's forward fuselage, crew module and crew transfer subsystems. "A NASA subsystem engineer had mentioned that a team was studying how the crew cabin broke up and what happened to the crew, and asked me to put together a briefing to talk about the crew module structures," he recalled.

As part of the study team, Tran made a number of recommendations to improve the spacecraft. "Making major changes to the shuttle and its structure might not be worth the added expense, since it will be retired, but [understanding] the breakup scenario will help us to design the next generation of spacecraft to perhaps strengthen sections so it breaks in a planned manner," he said.

Tran said he hopes to work on the space shuttle program until it stops flying and to continue improving the vehicle. He said the forthcoming Space Shuttle *Discovery* mission includes a new modification that improves the safety of the crew module.

Tran, who's wanted to be an engineer since he was a child, said he feels fortunate to work on the shuttle team and to be honored by NASA: "In the United States, you just have to do good work, and you will likely have success." ■

edmund.g.memi@boeing.com

PHOTO: Boeing space shuttle structures and payload design engineer Duke Tran last month received the NASA Exceptional Public Service Medal—the agency's highest award for a non-government worker. **PAUL PINNER/BOEING**


KEVIN FLYNN/BOEING

Partnership *in action*

On the Boeing-Australia agenda: A key airplane delivery—and preparations for an air show

GAIL HANUSA/BOEING

Recent and upcoming events illustrate how Australia figures prominently in Boeing activities.

At a beach-party-themed delivery ceremony held last month in a Boeing Field hangar in Seattle, startup airline V Australia took delivery of its first airplane, a 777-300ER, under lease from International Lease Finance Corporation. Among those speaking to attendees was Sir Richard Branson (above, in beachgoing attire), founder of the Virgin Group. V Australia is a new long-haul airline and the newest member of the Virgin Group.

Meanwhile, attendees at this month's 2009 Australian International Airshow can look forward to flying demonstrations from the Boeing F/A-18 Super Hornet—which flew in the last iteration of this show in 2007 (left). This year's show takes place March 10-15 at Avalon Airport, near Melbourne. At the event, Integrated Defense Systems plans to showcase products and services including the Wedgetail Airborne Early Warning & Control aircraft, P-8A Poseidon, C-17 Globemaster III, ScanEagle unmanned aerial vehicle, and Vigilare, an integrated air defense command and control system Boeing is developing for Australia. ■

St. Louis **electronics recycling** event set for March 12

Boeing Employees for Environmental Protection (BEEP), a Boeing-sponsored club in St. Louis, will conduct an electronics recycling collection event on March 12.

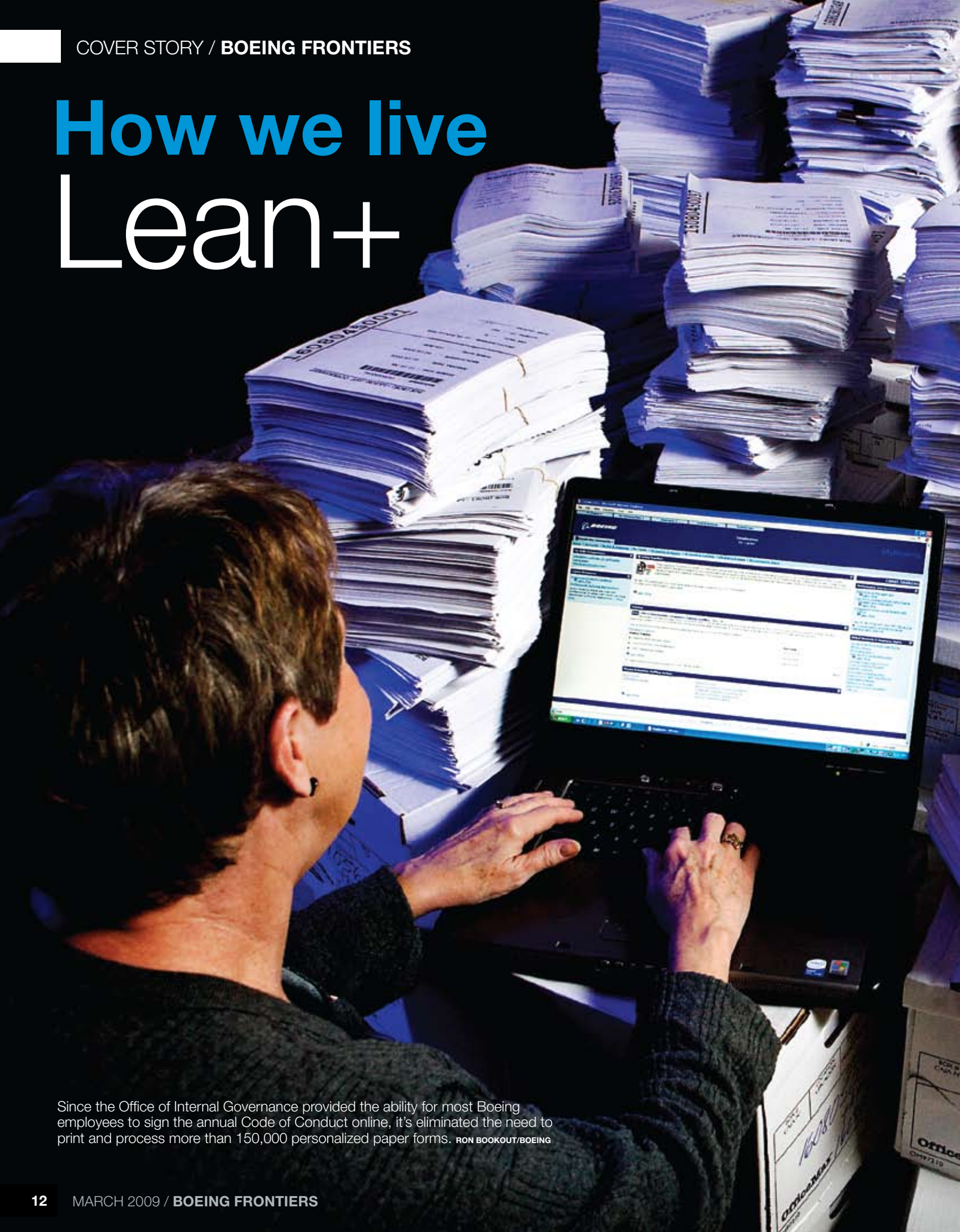
Unwanted electronic equipment can be dropped off from 7 a.m. to 9 a.m. and from 2:30 p.m. to 4:30 p.m. in St. Louis at the 270G parking lot (across Campus Parkway from the 270 building) and also in St. Charles at the 505H parking lot. Please note that a Boeing employee badge is required to access the St. Charles dropoff location.

BEEP is partnering with Web Innovations and Technical Services (WITS), a St. Louis–based nonprofit corporation that specializes in reuse and recycling of electronic equipment, for this event. WITS specializes in rebuilding and recycling PCs, but will accept any items that run on electricity (except large appliances) at this event. The organization rebuilds PCs using components from donated systems and makes them available to individuals and organizations in the community that are unable to afford new equipment.

WITS asks for a donation fee of $10 for each television and $5 for each for monitor, laptop and microwave oven. It will take other accepted electronics items for free.

BEEP and WITS conduct collections in March, June and September. The remaining 2009 collections are scheduled for June 4 and Sept. 17. For more information about BEEP, visit http://beep.stl.mo.boeing.com/aboutBEEP.jsp on the Boeing intranet. To learn more about WITS, visit www.witsinc.org. ■

How we live Lean+



Since the Office of Internal Governance provided the ability for most Boeing employees to sign the annual Code of Conduct online, it's eliminated the need to print and process more than 150,000 personalized paper forms. **RON BOOKOUT/BOEING**

Inside

Examples of this initiative in action abound across Boeing. Here's why it matters now more than ever.

By Lynn Steinberg

Employees from different organizations at Commercial Airplanes came together to solve a vexing quality issue. The Engineering team at Integrated Defense Systems deployed a checklist of simple ways to boost productivity and meet business goals. Shared Services Group used existing tools to help employees report travel expenses more efficiently and get reimbursed faster.

These are just some examples of how Boeing people are living Lean+, one of the company's four growth and productivity initiatives. Employees across the enterprise are using Lean+ to improve productivity, provide better value to customers, free up resources for growth, and make Boeing more competitive. That's especially important amid today's financial challenges.

Boeing Frontiers recently sat down with Bill Schnettgoecke, leader of the Lean+ initiative, to talk about what progress has been made, what opportunities and challenges lie ahead, and how Lean+ can help Boeing navigate these difficult economic times.

Q: When Lean+ was first introduced in 2006, many people thought it was about moving Lean from the factory to the office. But it's much more than that. Can you explain?

A: We knew we had great success with Lean in the factory environment. The overall approach, the principles, techniques and tools all worked. We also knew that there was enormous untapped potential in the non-factory environment, and that many of the same principles, techniques and tools applied. So we started using them more broadly, in back shops and offices, and across the value stream.

That first year, 2006, was really a time of exploration. We went all across the company, looking and learning, and discovered two things. First, that Boeing people were using a variety of approaches to get incredible results. We have unbelievable talent at this company, shaped in part by different customer bases and heritage company cultures.

The second thing we learned was that the results were better—and came quicker—when teams used a blend of tools to address a problem. And we thought, to use an old adage, "If Boeing only knew what Boeing knew."

So we started working to align and leverage what we had, creating one overarching continuous improvement approach that includes strategies, tools and resources like Lean, Employee Involvement and Engagement, Six Sigma, Process Management, Theory of Constraints, the Boeing Production System and others. We simplified, standardized and aligned the best of Boeing so we can be the best of industry. That's Lean+.

Q: Do you believe Lean+ has taken root at Boeing?

A: Where we see leaders embracing and teaching Lean+ is where we see it deeply embedded. Those leaders know the value and talk about it with their teams. And they're getting great results.

There is no longer a business or function at Boeing that can say, "This doesn't apply to us because we're not Manufacturing."

Lean+ *by the numbers*

Here's a quick look at some of the figures reflecting Lean+ in action at Boeing.

150,000

Approximate number of paper Code of Conduct forms eliminated—and that no longer must be printed, manually signed, gathered, tracked, mailed, scanned and stored each year—since an Office of Internal Governance team provided online signing capability on TotalAccess in January.

112,900

Approximate number of Boeing employees who took basic online Lean training and learned about making improvements in their business units and functions, since Lean+ was unveiled in 2006.

30,000

Gallons of water (113,600 liters) per day conserved by applying Six Sigma process improvements to chemical rinse operations at Commercial Airplanes' Fabrication division, where detail parts are anodized and alodined for corrosion protection.

23,000

Approximate number of classes eliminated since 2005 by applying Lean 5S practices (sorting, simplifying, sweeping, standardizing and self-discipline) to the list of courses Boeing's Learning Training and Development organization, business units and functions offer employees.

There are great examples of people, in every environment at Boeing, working together to improve. So we're getting traction because Lean+ really does apply to everyone.

At the same time, employees don't always consider their work as a product that can be measured to ensure it meets customer expectations for quality and value. People will say, "Engineering is an iterative process, so we have to redesign." Well, we do an awful lot of redesign because we didn't get it right the first time. And I know leaders like Charles Toups [vice president of Engineering and Mission Assurance for Integrated Defense Systems] are working this hard (see story on Page 18).

Q: You've often said you think Lean+ gives Boeing a competitive advantage. In what way?

A: We have 160,000 people at Boeing with a range of skills, knowledge and experience that very few companies can claim. Just think about the things we do: connecting people around the globe; providing warfighters the capability to safely carry out their missions; producing the technology that will reshape and redefine the future. Lean+ helps us capture that collective body of knowledge so we can deliver the highest quality and best value to our customers, while improving the way we work. It gives us a framework—with a common language, and common tools, principles and training—to take the amazing products and services we provide, and make them better than we did before and better than our competitors ever could.

Q: How can Lean+ help in today's difficult economic climate

A: Now more than ever, we've got to pull together and act with a sense of urgency. We've got to reach out and help one another work through the challenges we face. And we've got to focus on the projects that will create the most value for our customers and for the company. Because ultimately, that's what will secure Boeing's future and the future of its people.

Lean+ helps us do that. It creates an environment where good ideas can thrive, then be shared and replicated across the value stream, from our suppliers to our customers. And it provides tools, training, experts and other resources from across the enterprise. Chances are that someone in this company already has wrestled with and solved a problem very much like the one you're facing. So rather than reinventing the wheel, look beyond the boundaries of your individual business or function for answers.

Take advantage of Lean+ products and services. The Web site (http://leo.web.boeing.com/home.cfm on the Boeing intranet), which is being redesigned with new collaborative tools, is a great place to start. That will take you to the Lean+ Roadmap, an online, interactive guide to Lean+; and to the NavTool, an online resource that walks you through a five-step cycle of continuous improvement. At each step in that cycle you'll see a range of possibilities unfold, from easy-to-use self-help tools to resource lists for professional assistance, and you can choose the one that best suits you and your particular circumstance.

Q: Are you pleased with the progress you've seen?

A: I've been so impressed by what I've seen these last few years. People are dying to show you what they've done. They're so proud. And also gratified, because they've managed to free up time and resources that now can be devoted to new and creative endeavors, increasing opportunities for success.

As I see it, we have two challenges at this point. We need to take those pockets of excellence and make them universal. And we need to pay more attention to first-time quality. Lean+ is about the prevention and elimination of waste. Unfortunately, we can't always eliminate waste as fast as we've created it, so there are times when the improvements don't show up on the bottom line. We've got to address that.

Q: Where do we go from here?

A: We need more focus on first-time quality—on fostering an environment where everyone takes responsibility for getting things right, and refuses to accept, create or pass along defects.

We've still got lots of opportunity for improvement—and we need to go after it, immediately and aggressively. We've got to be relentless about preventing and eliminating waste. We've got to continue to work on common principles, language, training and tools because that makes it easier to share successes and accelerates productivity improvements across the company.

We've got to operate as one Boeing and get aligned behind Lean+. That starts with leaders who enable it and expect it, leaders who teach it and talk about it with their teams. And it depends on each one of us at Boeing getting engaged in continuous improvement, reaching out for new ideas and sharing our successes. In the end, that's what will make Boeing the benchmark for productivity, free up resources for growth and help us be the best—and best integrated—aerospace company in the world. ■

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Bill Schnettgoecke, leader of the Lean+ growth and productivity intiative, said Lean+ creates an "environment where good ideas can thrive." **RICHARD RAU/BOEING**

Getting back to **business**

Lean improvements in travel, expense processes save employees time

By Stephen Davis

It's now easier for Boeing travelers to book cost-saving itineraries, submit accurate expense reports and be reimbursed quickly, thanks to the Shared Services Travel & Expense Services (T&ES) team applying Lean+ principles and tools.

Nearly 1,000 Boeing employees travel on company business every day. To get them into airplanes and nightly accommodations, account for their expenses and pay the bills is a job that takes lots of behind-the-scenes activity. Process improvements here help reduce costs for organizations, since travel is the second-most controllable cost for most, after labor.

"Our goal is to provide travel and expensing tools that save employees time, reduce travel costs and improve compliance. It's a top-priority service improvement in SSG. Ultimately our aim is to increase productivity for Boeing," said Yvette Winn, director of Travel & Expense Services.

T&ES began by using the Value Stream Mapping (VSM) tool, where those involved in a process create a chart showing all its steps. They used the resulting diagram of the employee travel process to guide their Process Management initiatives.

"Because we recognize that people have experienced difficulties with our process, we looked at it from end to end—from when travelers book trips through when they complete their expense reports and see final payments to themselves and the Boeing credit card," Winn said.

The VSM activity involved users of travel services, people in organizations who oversee and interact with travel systems and processes, as well as supplier representatives. Participant Melanie Faulkner, from Commercial Airplanes' Customer Relations team, helps 25 co-workers expense their frequent travel to U.S. and international customer sites. "The travel-process frustration level is high with my co-workers, so I felt obligated to get everything out on the table," she said. "I felt I was listened to on every point."

As with any mapping activity, participants highlighted "kaizen bursts," or areas of actionable improvement. "I like to think of each kaizen burst as a voice of our travelers, giving us advice as to what are the most important improvements for us to work," Winn said.

The kaizen bursts are influencing improvements in several T&ES Process Management initiatives. "The VSM showed us how we affect travelers," said Nate Seibel, T&ES manager for Lean+ and Process Excellence. "It was easy then to identify the measures that matter most and improve processes accordingly."

Jim Johnson (from left), Cory Peters and Yvette Winn, leaders of Shared Services' Travel & Expense Services, work on the 84-foot (25.6-meter) long current-state map of the "book-to-pay" process, from booking a trip to making payment. RICHARD RAU/BOEING

These improvements include:

- For incomplete online expense reports, T&ES now gives users a better view of what information is missing. Users have responded, updating information quickly. That's led to a nearly 50 percent reduction in audit cycle time, faster reimbursements and increased reconciliations.
- Starting last September, travelers began seeing an immediate online view of the required expense-report receipts they faxed to T&ES. Submittal accuracy soared to 98 percent because people who accidently faxed illegible documents took immediate action.
- A new feature in TRIPS, Boeing's online booking system, now allows travelers to hold flight choices for about 24 hours before purchasing. Since about a third of all reservations are changed—often within the first 24 hours of purchase—this has reduced the number of canceled or unused tickets.

"Using Process Management and Six Sigma tools, we keep an eye on our operational metrics and constantly adjust. That's how we have really embedded a Lean+ approach into our processes," Seibel said. In addition, he said, many of the VSM insights were included in an upcoming major upgrade to the online expense tool, on the Boeing intranet at http://expense.boeing.com, that's scheduled for this year. The upgrade will further reduce expense cycle time and traveler effort.

"We care about our Boeing travelers every step of the journey," Winn said. "We must make the entire travel experience as easy as possible so they can focus on doing their business for Boeing." ■

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Below th

Team finds a revealing solution to ongoing 777 interior challenge

By Dan Ivanis

Hidden in the Cost of Rework, Repair and Scrap (CORRS) database at the Commercial Airplanes twin-aisle factory in Everett, Wash., was evidence of a costly nuisance lurking behind the interior sidewalls of every 777 passenger airplane.

As part of his job, Matt Boyle, an interiors quality representative who's since become a support cell manager, regularly monitored the database, which tracks the monthly average cost of rework per airplane. Looking for improvement opportunities, Boyle developed a specialized report that grouped CORRS costs by module (for instance, galleys or seat tracks) and displayed the top five for the month.

"Two things emerged quickly," Boyle said. "First, the top five issues were always the same—the order varied, but it was always the same five issues. Second, sidewalls [airplane interior walls] were always among the top five."

From his background in interiors, Boyle had a good idea what was causing rework. Window reveals—clear plastic interior windows and the surrounding frame, which are supposed to snap easily and snugly into cutouts in the sidewalls—did not work like they were supposed to. Mechanics had to twist and bend the reveals to fit them in place, often popping them into place by using a skin wedge, a hand tool with a thin metal blade.

What emerged from this discovery was a textbook example of Lean+ in action: a team effort that involved people taking the initiative, preventing and eliminating waste, and securing the support of appropriate colleagues to provide a benefit to Boeing and its customers.

"This solution really demonstrates the power each of us has to make a difference—to our team, to Boeing and ultimately to our customers," said Alison Timidaiski, 777 Boeing Production System leader and Boyle's manager. "Matt suspected a problem, analyzed the data to verify and engaged all the right people in finding a solution that ensures first-time quality."

ROOT CAUSE

According to Boyle, the structure of the reveal was just a little too big to fit in the cutout, and the placement of the clips on the back of the reveal interfered with part of the sidewall. "There was always this gut-wrenching snap, crackle, pop and you just hoped you weren't breaking something," he said.

The twisting, turning and sharp metal tools sometimes led to minor, cosmetic—but conspicuous—cracks to the sidewall beneath the window reveal, which must be removable so fuselage windows can be accessed for cleaning and other tasks. "We have vinyl repair technicians who can do incredible things. But often as not, customers would insist on replacing the sidewall because the damage is so visible to passengers," Boyle said.

Replacing a sidewall presents several problems: To access the sidewall, seats frequently must be removed. Because sidewall patterns are unique, Boeing Fabrication's Interiors Responsibility

Mary Dougherty, a flight line mechanic at the Commercial Airplanes facility in Everett, Wash., prepares to replace a 777 window reveal. Using an employee's idea and a lot of teamwork, the window reveals were recently redesigned to greatly reduce sidewall damage during the manufacturing process. **GAIL HANUSA/BOEING**

e surface

Center (IRC) often had to interrupt regular operations to manufacture single replacement panels. The damage often occurred after a customer requested that certain windows be cleaned—and a delay in replacing a damaged panel threatened on-time delivery.

With the approval of his management and the support of the IRC, Boyle pursued the matter. Christer Bjorkegren of Commercial Airplanes Material and Process Technology (M&PT), the factory support organization in the business unit, investigated the assembly process and determined the parts were built according to design and that three-dimensional measurements and interference simulations were required to further assess the situation. Metrology expert Wayne Clark of M&PT's technology organization used advanced scanning technology to precisely measure all parts of the production assembly. He then used that data to perform a virtual assembly, which confirmed that the structure and clips interfered with the remove-replace procedure. M&PT also helped Boyle develop a prototype modification by grinding down part of the window structure and using smaller clips in a slightly different location.

"We brought in a representative from our vendor who makes the window reveal," Boyle said. "He had no idea. He said, 'If my product is doing that, we need to fix it.'"

PROMISING RESULTS

Kristina Gustin, an IRC design engineer, helped Boyle take his project the rest of the way. "I investigated to make sure the solution would work and not interfere with any of the surrounding components. Chaz Wichman [with IRC estimating] and I worked together on the business case development," she said. "Matt's initial design was pretty much there when he came to us. I just tweaked it a little where needed."

Gustin, who has since moved to the 787 Dreamliner program as a propulsion engineer, quarterbacked the change through the various management, technical review and change boards that had to sign off both at the manufacturing and production levels. "Even with a change that seems, physically, relatively minor, there are so many things to be considered. It was a long, long list," she said.

The change was implemented late last year and the results are promising. Of the 140 777s built before the change, about half required a sidewall replacement. In the 22 since then, only four have required sidewall replacements due to these cracks.

"That's really only part of the story because you know our customers are having the same problem," Boyle said. "They have to clean the windows, so they are dealing with the same issues."

Tom Pellerin, a 777 interiors mechanic who deals with window reveals regularly, is sold on the change. "They pop in and out much easier. You don't have to fight them, and I can put my skin wedge away."

What did Boyle find most revealing about this experience? "Probably the most important lesson I learned through this was how many people and groups are available to help you in this company," he said. "You just need to dig beneath the surface to find them." ■

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Engineering better **performance**

An IDS group is making simple yet high-impact changes in behavior that help meet productivity targets —and support Lean+

By Richard Esposito

Shut off your e-mail. Block out five minutes to read this story, and finish it once you've started it. Those steps, in a nutshell, represent some of the simple yet powerful productivity-enhancing behavior changes advocated by Integrated Defense Systems Engineering's 10X initiative.

A functionwide imperative, 10X represents an aggressive pursuit of high-impact Lean+ behaviors. The goal: Over the next 15 months, achieve a tenfold improvement in first-time quality and a 50 percent reduction in engineering cycle time.

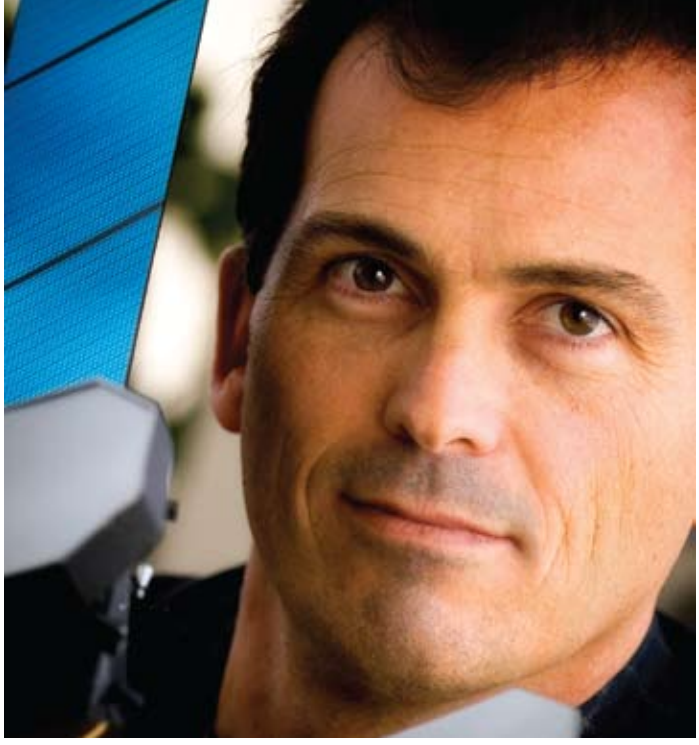
In a recent audit, the Government Accountability Office found that major defense acquisition programs are, as a set, running more than $260 billion above initial contract commitments. Charles Toups, vice president of IDS Engineering and Mission Assurance, said that the industry and Boeing are not blameless. The company's military customers require and deserve better performance, and the lean-themed 10X improvements are one powerful way for Boeing to deliver.

"A close look at the new data on the costs we at IDS incur due to poor quality shows that engineering contributes the most to the cost of poor quality," Toups said. "This is why IDS Engineering is applying Lean+ on a massive scale to improve this critical area. Not just a little, but a lot. Not just soon, but today. And not just in a few spots, but everywhere we can."

The experience of one engineering team on the Joint Tactical Radio System's Ground Mobile Radio (GMR) Program demonstrates what gains can be made from following the first three items on an Engineering Lean+ Checklist of seven simple but powerful 10X rules:

- Establish clear priorities to separate and permit focus on the most important tasks and allow them to be finished first.
- Eliminate bad multitasking—instead, focus and finish.
- Limit the release of work in process (unfinished work) in order to deliver earlier.

The Wideband Networking Waveform team, comprising systems and software engineers who write, test and certify software code, thought about Lean in the past. "But Charles' approach boiled it down to a checklist, giving the team workable ideas," said Joyce Neiman, JTRS GMR deputy program manager, Network and Waveform Products.



Among those "workable ideas" was a sharp reduction in the time spent in meetings and in monitoring and reacting to e-mail. But perhaps the biggest—and measurable—bang for their buck came from an effort to establish clearer priorities in dealing with a backlog of more than 100 software anomaly reports, which are the code writer's equivalent to trouble tickets.

First, the team mapped out and streamlined the anomaly report closure process. Next, each one of 43 people was assigned an anomaly report to close, with ownership from inception to closure. The results? Before adopting the new approach, the team was closing an average of two anomaly reports a week. And within four weeks of implementing the new approach, the team was closing 20 per week. What's more, the team burned down the backlog three months early and now has a stable, high quality base on which to build more code.

Pat Goggin, chief engineer of C3 (Command, Control, and Communications) Networks, agreed that the simplest changes can yield powerful results. "Think about it at home: When I mow the lawn, I don't do part of the front lawn, stop to go work on the car, and then return to mowing the lawn. You do things to completion," he said.

"As more teams show results and more programs completely embrace these methods, we believe they will achieve substantial gains in engineering quality, drive down the cost of rework, and channel those benefits to make their programs more successful. It can make a huge difference for our company, for the commitments we make to customers, and for the missions our products enable," Toups said. "The stakes are high, and these changes are vital." ■

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PHOTO: Charles Toups, vice president of IDS Engineering and Mission Assurance, says his organization is using Lean+ "on a massive scale" to improve quality. **BOB FERGUSON/BOEING**

Let's get it **done**

Try these 7 easy-to-implement ways to improve your productivity

Here are the productivity-enhancing behavior changes set forth in the Lean+ Checklist from Integrated Defense Systems' Engineering organization.

1. **Establish clear priorities.** Separates the important tasks from the rest, permits focus on the most important jobs and helps those tasks to be finished first.

2. **Eliminate bad multitasking: Focus and finish.** Reduces stress, defects, work in progress, cycle time and switching costs.

3. **Limit the release of work in process to deliver earlier.** Permits focus, controls multitasking, and helps leadership create a productive environment.

4. **Prepare! Start → Finish.** Refers to starting only when you have everything you need. Improves productivity, reduces defects and mitigates the time spent by key resources reacting to issues.

5. **Use checklists to prevent defects and traveled risk.** Ensures work is performed to the right level of quality and completeness, and prevents costly downstream rework and risk.

6. **"Face into" and resolve issues quickly.** Refers to the visibility, transparency and responsiveness to see and address issues, ensure quality and reduce delays.

7. **Drive daily execution.** Focuses the team on the daily closure plan, applies attention where required, and provides feedback against goals.

PHOTO: The members of the Joint Tactical Radio System's Ground Mobile Radio Wideband Networking Waveform team used Lean+ principles to clear a backlog of corrective work. Shown from left are Ankit Patel, Jason Fair, Henry Shu, Diana Biera-Smith and James Freckelton. MICHAEL GAIL/BOEING

Never missed **a beat**

How the F-15 team modernized its factory without disrupting production of this fighter jet

By Kathy Cook and Terence Williams

Perhaps the one thing more challenging than building and delivering F-15 fighter aircraft to air force customers worldwide is to do so while radically modernizing the factory where the aircraft is built.

Yet the F-15 team in St. Louis did exactly that: In a major project that took a mere 11 months and ended in December, the team revamped the aircraft's entire production line and equipment to speed production, cut costs and boost competitiveness—all while maintaining a stringent schedule to build and deliver 24 F-15s to the Republic of Singapore. Their story exemplifies how Boeing teams can use the Lean+ growth and productivity initiative to meet performance goals.

"The F-15 is a great aircraft," said Mark Bass, vice president, F-15 program. "Customers across the globe want the capability it brings to their air forces. But we're always looking for ways to reduce its cost to make it even more attractive. The top priority while making these changes was to make sure we delivered high-quality aircraft on time."

Toward that end, the team, led by High Performance Work Organizations, took lessons from St. Louis' F/A-18 assembly team, which had already transitioned to a more efficient setup known as a pulse line. (An HPWO is a group of co-workers who are responsible for a common function or product, share common goals and exercise self-determination in continuously improving the quality of their output and the efficiency of their processes. The teams are part of Boeing's employee involvement and engagement efforts.) They even borrowed one of the key architects of that project, Doug Cook, an industrial engineer who was able to help them accomplish in essentially one year what took two years on the F/A-18. The C-17 team in St. Louis, which makes seven major assemblies for this aircraft, also helped by giving up storage space. That gave the F-15 crew ample room to set up the new pulse line.

In the F-15 team's old configuration, work was not divided evenly among stations; tooling was duplicated at various positions on the line; and the aircraft had to be moved by crane

> "The top priority while making these changes was to make sure we delivered high-quality aircraft on time."
>
> *– Mark Bass, vice president, F-15 program*

between tooling frames. By contrast, the new pulse line divides work evenly between 10 stations; the tools and parts at each station are unique to that station; and the aircraft is moved while within the frame. (The frame includes a floating sled base to allow for easy movement.)

The biggest change was to the shape of the assembly line itself—from a U to an L—which reduced the number of crane lifts and made it easier to maneuver the center fuselage through the line.

Thanks to their actions, the team met the plan's goal for reducing the time the aircraft spends in each of 10 workstations (beginning with the aircraft's center fuselage) to 18 days, a 25 percent improvement. In the new configuration, once a jet moves into station 1, it goes through the pulse line without stopping.

The value of a pulse line comes from its consistent work flow: Assembly work is performed continually, unlike the old system, where an aircraft could sit idle at one position while work was completed at a previous position.

One challenge in setting up the new pulse line was that the work had to be completed backward, in a sense, according to Cook. "Ideally, when you do something like this, you'd like to build station 1 first, then 2 and so on," he said. But space constraints meant they had to build stations 8, 9 and 10 first "because that was the area we were able to clear out first."

Lean+ integrator Rich Schilf said this change is just one part of a larger effort to streamline the F-15 line and continually improve both the quality of the product and the safety of the work area. Other efforts under way include changing to monolithic parts, changing from sheet metal to machined parts, redesigning tools and work areas to be more ergonomic, using lasers to better align parts and working with suppliers to reduce lead times. ■

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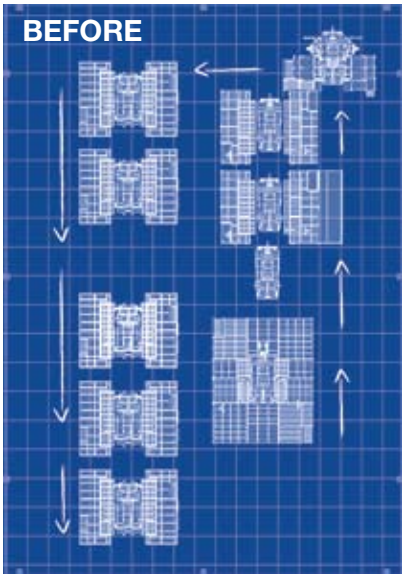

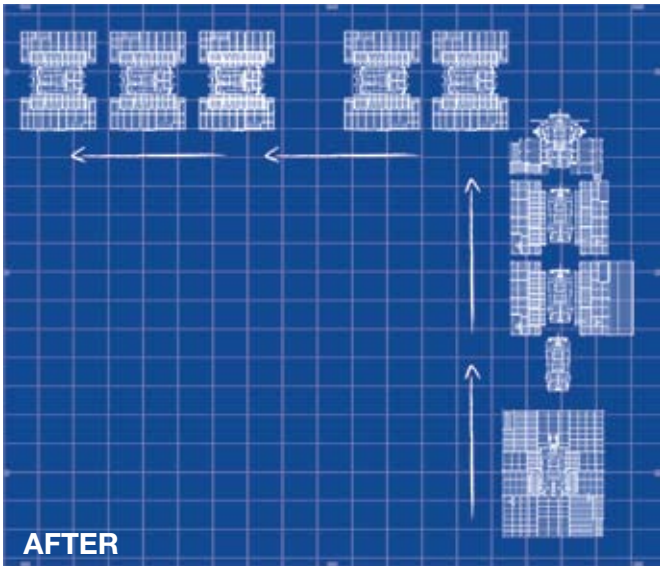

The diagrams above depict the path of the F-15 line before and after its recently completed modernization. The top diagram shows how the assembly had to undergo a tight U-turn; the above diagram reveals how the turn is now in an L-shape, which helps cut time and costs.

PHOTO: The F-15 program's work in revamping its factory configuration while staying on its production schedule shows how Lean+ can help Boeing teams meet performance goals.
RON BOOKOUT/BOEING

Leaner, greener

Suppliers play role in Boeing's environmental efforts, efficiency measures

By Dean Tougas

The measures of environmental performance at Boeing tell a compelling story of progress in process and product design, along with corresponding declines in energy use and waste. But in the view of Mary Armstrong, Boeing vice president, Environment, Health and Safety, that does not tell the whole story.

"We are focused on solutions that go far beyond our own four walls," she said. "It is really a life-cycle approach that looks at the impact of our products and processes through the entire value chain." To Armstrong, that means engaging with suppliers who provide raw materials, parts and supplies to Boeing, as well as with those who buy and operate Boeing products.

A survey of Boeing's supply base shows a diverse range of suppliers (see sidebar on Page 23) that represent many industries, each with important knowledge and capabilities to share. Aerospace parts suppliers partner with Boeing on process and technology breakthroughs to reduce chemical emissions. Electrical equipment suppliers and energy providers work to reduce energy demands. And suppliers in many industries are focusing on reducing packaging. As suppliers take a growing role in Boeing's environmental strategy, a team from Boeing Supplier Management is integrating activities that involve those suppliers.

Doug Perry, who manages the Site Services procurement group in Shared Services' Supplier Management organization, leads the EHS Supplier Engagement Team. For Perry and his team, the first step is to build on existing relationships in high-priority areas. "We've found many of our suppliers are eager to work with us on environmental projects," Perry said. "Working with those companies is a natural starting place."

Pallets of recycled paper will soon be arriving at Boeing as Dell, the company that provides Boeing with printers and copiers, begins stocking the machines with paper containing 30 percent post-consumer content. JIM ANDERSON/BOEING

"We'll expect our suppliers to have the same level of commitment to this as we do inside Boeing."

– Doug Perry, Supplier Management, Shared Services Group

In coming months the team will launch events to bring additional suppliers together on specific, targeted environmental projects, including various Lean+ process improvements. "In Boeing's view," said Perry, "It is very clear that being Lean is also being green."

As an example, Perry cited a pilot project at several Boeing buildings in Renton, Wash., involving OfficeMax, Boeing's office supply provider. A team featuring members of each company is using Lean+ tools to drastically reduce packaging waste and fuel use to benefit Boeing, OfficeMax and the environment.

Boeing Supplier Management, Site Services and OfficeMax experts held a Lean workshop to identify unnecessary ordering,

In Renton, Wash., Boeing joined with OfficeMax to design a Lean-inspired system of office supply ordering. Members of the project team from Boeing include (from left) Jane Gladney, Linda Flegel and Barbara Brown. JIM ANDERSON/BOEING

shipping and delivery practices that produce a larger-than-necessary environmental footprint. The team found that random supply orders result in OfficeMax trucks making daily trips to Boeing sites, even when an order is small and not urgent. And, with each order packed in its own cardboard box, the process generates a large amount of packaging that must be recycled.

As a result of the Lean workshop, Boeing and OfficeMax will begin testing a new approach that cuts deliveries and replaces cardboard boxes with reusable containers—all while implementing Lean and efficient methods for managing office supplies.

"We think this idea—or a variation of it—is probably the right thing to do across the enterprise," Perry said.

Similar projects with suppliers are happening at aircraft assembly sites.

A Commercial Airplanes technical team has been working with suppliers for years to redesign shipping crates for aircraft parts. One recent project focused on the packaging of interior panels for the 747-400 freighter conversion. The project slashed the number of crates from 99 per aircraft to 14, reduced handling time by four hours and trimmed storage space by 2,300 square feet (214 square meters).

Meanwhile, a Boeing Lean+ process improvement team from Integrated Defense Systems in Long Beach, Calif., worked with insulation blanket supplier Orcon Mexico to implement lean production and delivery practices. The C-17 Lean Team and the supplier focused primarily on reducing inventory and eliminating unnecessary handling, said Jim Kuwada of Supply Chain Management and the project's sponsor. But Kuwada said the activity created environmental benefits. Among them:

- Paperless order processing
- Delivery in reusable rolling carts (replacing 5,600 cardboard boxes annually)
- Reduced transportation costs and emissions
- 3,000 square feet (279 square meters) of warehouse space freed up

"The project resulted in a process that is much easier on the environment," Kuwada said.

Moving forward, Boeing will involve more suppliers. While the projects will vary according to the supplier's industry and unique capabilities (see sidebar above), each project will provide lessons to be shared with the broader supply base. According to Perry, getting suppliers to collaborate with Boeing and each other will help Boeing achieve its longer-term goal of direct engagement with all suppliers.

"We don't plan to ask suppliers to meet specific carbon-reduction targets in the same way that we are doing ourselves. But we'll expect our suppliers to have the same level of commitment to this as we do inside Boeing." ■

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Supplier landscape surveyed

With thousands of suppliers worldwide, Boeing recognizes that engaging suppliers is not a one-size-fits-all proposition. The Supplier Engagement Team of Boeing's Environment, Health and Safety organization is carefully analyzing the Boeing supply base to understand what suppliers are doing to reduce impact on the environment—and learn about programs and processes they have developed to be good environmental stewards.

Approximately 130 Boeing suppliers agreed to participate in a study conducted by the Carbon Disclosure Project. The CDP is a research organization that's assembled the largest corporate greenhouse gas emissions database in the world. It annually publishes reports that provide detailed analysis of how the world's largest companies are responding to climate change.

"The survey results will help us understand some specifics on their greenhouse gas emissions and emission reduction targets," said Susan Miller, a procurement manager in Shared Services Group who helped coordinate the survey for Boeing. According to Miller, Boeing will use the survey data to help the company shape a set of long-range expectations for its supply base in a way that's practical and adaptable to the diverse array of Boeing suppliers.

"We see many suppliers are already on this journey with us," said Miller. "And we've invited the others to join us. The momentum will only grow as we're joined by every Boeing supplier."

—Dean Tougas

Welcome aboard!

Why mergers and acquisitions play a part in IDS' growth plans

By Stanley Holmes

The days of the blockbuster mergers of aerospace and defense giants may have come to an end for now. But smaller deals are still happening. In fact, Boeing last year closed on six targeted acquisitions that bolstered Integrated Defense Systems' capabilities and remains in the market for deals that fit IDS' carefully calibrated growth strategy.

The common thread that ties these deals together: relatively small companies selected for their products, their position in growing markets, and the incredible talent and customer knowledge of their people.

Mergers and acquisitions will continue to be an element of the IDS growth strategy, IDS executives said. "All of these acquisitions are tied to our strategy of becoming more vertically integrated and also moving into adjacencies that we think will grow faster than the rest of the (U.S.) defense budget," said Jim Albaugh, IDS president and CEO.

A good example is the purchase of Insitu Inc., makers of the ScanEagle, a leading tactical unmanned aerial vehicle. Given the constrained budgets and needs of customers, demand for unmanned aerial vehicles is expected to continue to develop and

The U.S. Marines use the ScanEagle unmanned aerial vehicle in Iraq. Boeing and Insitu, which Boeing has acquired, developed and built ScanEagle, which serves intelligence, surveillance and reconnaissance needs. U.S. MARINES

Integrated Defense Systems has sought smaller firms that can "augment and accelerate strategies and customer intimacy," says Chris Raymond, vice president of Business Development.
BOB FERGUSON/BOEING

grow. "We wanted to have an internal capability and a strong established position with customers," Albaugh said.

The other five companies fall into the intelligence, command and control and logistics markets. Tapestry Solutions, Federated Software, RavenWing, Kestrel Enterprises and Digital Receiver Technology are known for their robust software capabilities and knowledge of key customers. Boeing officials said they believe these markets will also grow faster than the U.S. defense budget.

M&A activities for Boeing are conducted in partnership between the business units and corporate Business Development and Strategy, led by Mike Cave. "Our role is to support the businesses with a centrally managed, repeatable process that evaluates, values, conducts due diligence, negotiates and closes transactions," said Cave. "We help marry our functional expertise with business unit strategies, ultimately to strengthen the company's overall competitive position."

As IDS and Boeing's corporate M&A team built a pipeline of roughly 70 candidate companies worldwide, a close collaboration developed between the two groups in identifying priority markets to pursue growth. It is a marked improvement from how Boeing evaluated companies in the past, said Joe Lower, vice president, Corporate & Strategic Development. It all starts with a strategy. "What really changed in the past 18 months is that IDS identified markets that were priorities for growth, and we worked together to pursue targets that could address needed capabilities or customer access," Lower said. "This is not a single-company approach, but rather a market-based pursuit."

Corporate Development works closely with Chris Raymond, vice president of Business Development for IDS, and his team, led by Bill Bonadio. The two groups sift through the candidate companies. If they agree there is a fit, then Corporate Development actively pursues the targeted company. "It is almost a seamless transitioning team," Lower said. "It's a highly integrated, coordinated approach." And one that appears to be helping position IDS in key growth markets.

Boeing Frontiers caught up with Raymond, one of the architects of the strategy, to learn more about this new M&A approach.

Q: Why are mergers and acquisitions an important part of the IDS growth strategy?

A: As we looked at our future, we realized we needed to more actively pursue adjacent markets and select vertical capability. M&A is a great way to accelerate strategies; I don't think M&A is in itself a strategy. When you have a market-based strategy, then M&A is a great way to more quickly gain the needed people and products. Internally generated, or organic, growth is always our priority, but M&A is a great way to augment that growth and accelerate it.

Q: The six acquisitions closed in 2008 serve different defense-related markets. Explain the common theme behind these acquisitions.

A: We wanted to selectively get more vertically integrated in some areas and move more quickly into adjacencies. We started taking a harder look at some companies in the unmanned market, in the intelligence market, and in the services and logistics market. Those were adjacent areas we identified as having higher interest to us. They're also areas where we thought we could accelerate our strategy via acquisitions for the products those companies have—and for the people and customer intimacy they have.

Q: These firms are generally smaller-size companies, rather than big mergers. It seems that for the IDS strategy, less is more.

A: That is certainly true in our case. The approach has been to acquire smaller companies that can augment and accelerate strategies and customer intimacy. And then what we have to work hard on bringing those companies into Boeing in a way that we get the appropriate amount of integration—but, at the same time, not integrating them so fully that we destroy or constrain the intellectual property we wanted to gain in the first place.

Q: How does today's recession affect opportunities for further acquisitions?

A: On the opportunity side, valuations have probably come down in certain markets, in others they have not come down as much as you might think. But I believe that's the result of the big aerospace companies having strong enough balance sheets, coming out of this last business cycle, to still pursue acquisitions, at least at the smaller to mid-tier level.

Obviously a large acquisition is a different issue. Everybody is going to be more thoughtful about that at a time when their financial liquidity is more constrained.

I think the smaller to mid-tier players, when you see something that can help augment a market strategy or accelerate a market strategy, will remain fairly active. So the valuations may not have come down as much as you would think in spaces like intelligence, cyber security and even unmanned vehicles, because everybody is looking at those as future growth areas. As long as it is not breaking the bank, there is still a fair amount of interest from potential buyers.

Q: How many companies do you consider as potential merger or acquisition candidates at any one time?

A: We probably went from not having a pipeline 18 months ago to maybe 60 to 70 companies we might be interested in.

Obviously, you want strategy to drive the potential acquisitions. They have to fit with our strategic growth plan. Occasionally, a company comes from out of the blue and you want to use your strategy as the filter, because you may have to move fast.

Q: Are you mostly looking at U.S. companies?

A: It is mostly U.S. at this point. We try to keep track of the international companies, and we are working to further build the international pipeline.

Q: How does IDS make sure its acquisitions turn out to be to be successful?

A: Appropriate integration is very important. I think first and foremost we don't want to do anything that can erode the innovation and customer intimacy they have. But the key is making sure that they get attached to an IDS business and that their work force is brought in not only for their current portfolio, but to integrate the team and their know-how for other areas of growth in that business. They already have a lot of customer intimacy and knowledge that we may not have had as deeply. ■

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Added to the roster

Here's a look at the companies Boeing acquired in 2008 to boost Integrated Defense Systems' capabilities.

RavenWing Inc.: Provides mission critical information technology to the intelligence community, U.S. Special Operations Command and the U.S. Department of Defense.

Insitu Inc.: Holds a leading position in the small tactical unmanned aerial vehicle market and makes the ScanEagle, a leading lightweight UAV. The transaction accelerates Boeing's unmanned vehicle strategy, which IDS targeted as a rapidly growing market to pursue.

Digital Receiver Technology Inc.: Is a leading supplier of tactical signal intelligence, or SIGINT, equipment to the U.S. government. This acquisition supports the IDS strategy to further penetrate the command, control, communications, intelligence, surveillance and reconnaissance market by adding key capabilities in digital signal processing hardware and software for wireless surveillance.

Tapestry Solutions Inc.: Specializes in services and software systems that improve the tracking and distribution of equipment, spare parts and personnel for the U.S. Department of Defense and other government agencies.

Federated Software Group Inc.: Represents another key piece of the IDS strategy to penetrate the logistics command and control market and build capabilities that complement Tapestry Solutions.

Kestrel Enterprises Inc. and Skarven Enterprises Inc.: These companies, which are jointly owned and operated entities, provide mission-critical information technology to the U.S. intelligence community and certain U.S. defense contractors. They provide data fusion and information sharing capabilities that allow real time processing of massive amounts of streaming data.

Who ya **gonna call?**

24-7 Boeing team helps steer Air Force air crews through emergencies

By Forrest Gossett

A Boeing-built B-52 Stratofortress bomber was on a routine U.S. Air Force mission last year when the flight crew reported a problem that was cause for major concern. While the aircraft was climbing, it experienced a hydraulic-system issue coupled with a serious flight-controls failure.

And there was the possibility that things could get worse. The crew was concerned about a complete loss of the rudder-elevator hydraulics, which would make controlling the airplane almost impossible. The crewmembers called back to the base for assistance. At the receiving end of the call was Lt. Col. Alan Parmater, 11th Bomb Squadron assistant director of academics, who that day was tasked with helping crews handle sticky in-flight situations.

Members of the Boeing Emergency Response team include (from left) Trent Linder, Matt Archer, Jeff Howell, Bob Snellenberg, Dennis Struve, Rick Kahler and Sean Martin. TED WHITESIDE/BOEING

Normally the Air Force handles in-flight emergencies, many of which go unreported to Boeing. But once in a while, something happens that's so serious the Air Force seeks additional flight guidance from Boeing. This was one of those times—a situation that required a team of Boeing experts to provide critical support.

After talking with the crew and going through the emergency checklist, Parmater called the Boeing in-flight emergency response team. The team, made up of five core members who can contact 20 or so other Boeing experts who are on call around the clock, is carrying on a 50-year tradition of providing support for B-52 and KC-135 crews experiencing in-flight emergencies.

Bob Snellenberg, the team's leader, said each time their pager sounds, team members know that lives could depend on their actions and knowledge. "When that pager sounds, we know it's serious, and we move quickly," said team member Matt Archer, an engineering safety manager. "Dinner, sleep, night out with the family—all takes second place."

Snelleberg added that his group's input is just one part of the larger team effort. "The Air Force is very good at resolving problems," he said. "Frequently, we are called in just to confirm what the crews are thinking about how to handle the emergency."

Over the years, Snellenberg said there have been many memorable opportunities to help. Among them: During a KC-135 flight over Turkey, the aircraft's starboard main landing gear disconnected and was literally hanging from the plane. The team's biggest fear was that when landing, the loose gear could interfere with the airframe and rupture a fuel line or spin the aircraft out of control.

Working with the Air Force, the Boeing crew advised the pilot to decrease fuel load, make plans for a crash landing, and land the plane with the barely attached gear. During the landing, the damaged gear rotated back to the proper position and wedged against the airplane structure, allowing a near normal roll-out to a stop.

In the B-52 emergency, the Boeing team worked with the aircrew and formulated a plan. As half of flight-control hydraulic power for the airplane had been lost, it was crucial that a landing be made quickly before the system deteriorated even further. Boeing recommended an expeditious landing despite adverse weather conditions. The plane was diverted to Dyess Air Force Base, Texas, where it circled near the runway while the airplane burned off fuel, reducing weight, and where it landed without incident.

"Their expertise is credible because they have history on these weapons systems," Parmater said of the Boeing team. "They are an important part of the team." ■

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Braced in space

Boeing's newest Earth observation satellites are providing the most precise weather information ever. That's important for people preparing for storms.

PHOTOS:

RIGHT: The third of three new Boeing-built GOES satellites finishes thermal-vacuum testing at Boeing's satellite factory in El Segundo, Calif. **BOB FERGUSON/BOEING**

ABOVE: Betty Kwan is responsible for GOES' suite of sensors used to track space weather. **GLADYS WICKERING/BOEING**

By Dave Garlick

When a major storm is looming, people and authorities depend on accurate weather information to make the right preparations. Knowing where and when a hurricane or an outbreak of severe weather will hit helps forecasters give more accurate warnings—which potentially can save lives and property.

To meet this important need, Geostationary Operational Environmental Satellites (GOES) were built for NASA to help National Oceanic and Atmospheric Administration (NOAA) scientists and weather forecasters produce real-time weather and environmental data and solar imaging. That data also provides support for U.S. Coast Guard search and rescue missions.

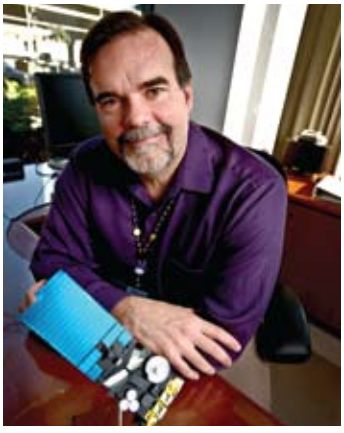
To provide forecasters with even more accurate information, Boeing is building and fielding the world's most advanced multimission weather and Earth observation satellites. Boeing built and launched the trailblazing satellite GOES-13 in 2006; it's currently in a geostationary "storage" orbit waiting for the opportunity to replace one of two existing weather satellites nearing the end of their useful lives. To round out this service, GOES-13 will be followed by GOES-14 and GOES-15 (currently called GOES-O and GOES-P), identical satellites also built by Boeing. These spacecraft will produce data that is two to three times more precise because of their stability in space.

"When you do a side-by-side comparison of the previous series of GOES satellites, their pictures move around significantly. Ours stay steady as a rock," said Doug Hein, a Boeing technical fellow. "The effect is like watching video shot from a tripod versus the same video shot from a hand-held camera. The steadiness comes from precision spacecraft pointing technologies."

STABLE AT ANY TEMPERATURE

Most materials used to build satellites will twist and distort as the temperature in space fluctuates from 200 degrees Celsius (392 degrees Fahrenheit) in full sunlight to -200 C (-328 F) in Earth's shadow. Even a slight warp will throw off the satellite's aim from 22,300 miles (35,900 kilometers) up in geosynchronous orbit.

With the new GOES spacecraft, Boeing engineers solved this problem by using a thermally stable platform called the optical bench, which can handle the huge temperature swings without distortion. All GOES' instruments that need stability, such as the imager, sounder and the "star tracker," are attached to it.



The imager produces visible and infra-red pictures of Earth's surface while the sounder looks down through the atmosphere to gauge temperature and moisture levels. Star trackers—officially known as the Stellar Inertial Attitude Determination system—use the stars to determine where the satellite is pointing.

"The instruments and the pointing sensors don't move relative to each other, so in effect what you're doing is flying the bench," said GOES program director Charlie Maloney.

TV-ready weather video is really a series of pictures taken every 15 minutes or so by a weather satellite and strung together for a time-lapse effect. Combine that with data from the sounder and you get invaluable information forecasters can use to predict a storm's direction and speed. Taking steady time-lapse pictures from a free-floating platform such as a satellite in geosynchronous orbit requires extraordinary accuracy and repeatability. Indeed, from its orbit 22,300 miles above Earth, GOES-13 can point its imager at a spot on Earth and keep it there so accurately that it would be like focusing on the winning side of the coin tossed at the Super Bowl while flying in a plane 4,500 feet above the stadium.

Boeing engineer Betty Kwan has been working on GOES almost since its inception 10 years ago. She is responsible for the 12 different sensors on the space-facing side of GOES that monitor space weather and magnetic fields. Scientists and forecasters at the Colorado Space Weather Prediction Center use the data to watch for solar flares, which can erupt at any time with a force equal to 100 million hydrogen bombs and blast a huge amount of highly charged particles out into the solar system. This electromagnetic soup can damage satellites, disrupt power grids and radio communications, and pose a radiation hazard to astronauts or aircraft flying near the poles.

"GOES contributes to the planet and our national interests, and ultimately it can save lives," Kwan said. "Those who are working on GOES feel they're providing a critical service to the nation, something we're all very proud of."

Boeing's GOES team now is preparing for the launch of the second satellite in late April. GOES-O, which will be renamed GOES-14 after launch, was completed in 2005 and has been in storage waiting for an available Delta IV launch vehicle.

"We put GOES-13 up, there were a lot of doubters about whether or not it would perform like we said it would," said Maloney. "GOES-O is our opportunity to prove that GOES-13 wasn't a fluke. Our satellites are that good." ■

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PHOTO: GOES Program Director Charlie Maloney and his team completed GOES-O in 2005. The spacecraft, which has been in storage since then, is slated to be launched in April.
GLADYS WICKERING/BOEING

Seeing is believing

Three employees share what it's been like to watch the C-17 program progress from prototype to success

By Cindy Anderson

Millions of hands have touched the C-17 Globemaster III during the airlifter's history from prototype development to the recent 200th delivery. And there are scores of stories to tell along the journey.

No better to share a few of those stories than Gary Beckum, Greg Gaskin and Randolph Masada, who are part of the second-shift crew at the Long Beach, Calif., C-17 factory and who have dedicated their careers to perfecting the aircraft.

The journey for Beckum, a senior manager of the frontline Integrated Product Team, began before the first C-17 rolled out of Boeing's final assembly facility in Long Beach and took its first flight on Sept. 15, 1991. Beckum, like his father before him, toiled over the pre-construction plans that were to become the C-17 Globemaster III. After a tour of duty in Vietnam, Beckum worked on commercial jets and then in the early '70s he helped develop the prototype (YC-15) that would evolve into the C-17. "We built those first planes by hand," said Beckum. "No tooling, no computers. We did everything the old fashioned way."

When Air Force requirements shifted toward longer-range operations for strategic airlift, the YC-15, with its innovative high-wing concept, was doubled in size and was given stronger engines and more cargo area—effectively turning it into the C-17 of today. Three C-17s were built before production began (S-1 for static testing, D-1 for durability testing and T-1 as the first test plane).

Beckum spent the better part of the '80s transforming an engineering concept into a fully functioning production line. Every piece of the aircraft, down to the last rivet, had to be identified and sourced to an intricate network of internal and external suppliers. There were wing panels to develop, parts to order and people to hire and train.

"When I worked in Advanced Planning in 1985, it felt like we were working in slow motion getting drawings from engineering and planning how and where it was all going to be assembled," Beckum said.

There were other challenges to overcome in those early days. Beckum had started on DC-8s and Gaskin (now team leader of

interior installation cargo for the C-17) on DC-9s, so they both knew how to assemble an airplane. But the commercial line couldn't spare employees, and they had to look outside the company to find staff to build the C-17.

While the team was coming together, so was the process. Gaskin remembered that they were still building tooling for each step of the process while the production line was building the airplane.

The process wasn't fast enough, and the Air Force put C-17 production on a short leash. "The Air Force basically told us to get our act together, or they were not ordering more airplanes," Beckum said. "I wore sunglasses on the way in to work the second shift and wore sunglasses home as the sun was coming up. Twelve-plus hours a day, seven days a week. But it didn't matter. We were behind schedule; we did whatever we needed to do to deliver the aircraft."

Masada, a manufacturing engineer in installation cargo, remembered the tenuous production start. "The fear of stopping

the line after 40 planes pulled everyone together," Masada said. "Then, the Air Force said OK you made it, let's go for 60. Then we got to 100 and celebrated."

Production of the next 100 jets focused on productivity improvements. Gaskin remembered how tedious and time consuming it was to sort through open bins to assemble and install each detail. His team evaluated the process through a Lean event and recommended a kitting process. "Each mechanic now has a kit with whatever parts they need at the point of use, meaning there are no extra parts and no waste," he said.

The final product has become the world's leading advanced airlifter and has set more world records than any other mobility aircraft in history. The C-17 Globemaster III fleet has logged more than 1.5 million flying hours, and the program has won the prestigious Collier Trophy in 1994 and the Malcolm Baldrige National Quality Award for quality and performance in 1998.

"This 200th plane is symbolic of all of the hard work and dedication by our team in Long Beach, Macon (Ga.), St. Louis and across Boeing, as well as our hundreds of suppliers around the world," said Jean Chamberlin, vice president and general manager of Global Mobility Systems. "The C-17 is the absolute best military transport flying today, and American forces tell us day-in and day-out they are proud to have it deployed wherever they are around the world."

With the latest airlifter delivery, there are now 183 U.S. Air Force C-17s flying missions around the world. Another 14 C-17s fly missions for international customers including the Royal Air Force, the Royal Australian Air Force and the Canadian Forces. Rounding out the 200 advanced airlifters are the three prototypes (S-1, D-1 and T-1) that played an integral role in development.

"I like the idea that I can see changes happen, and employees really can make a difference," Gaskin said. "I'm also really proud when I see the C-17 in the news and hear about all the good that it's doing." ■

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PHOTOS:

LEFT: Gary Beckum (from left), Randolph Masada and Greg Gaskin have dedicated their careers to building and improving the C-17 Globemaster III for the U.S. Air Force and international customers. **ROBERT SCHNEIDER/BOEING**

TOP: The 200th C-17 Globemaster III heads for the paint shop. It recently was delivered to Charleston Air Force Base, S.C. **BOEING**

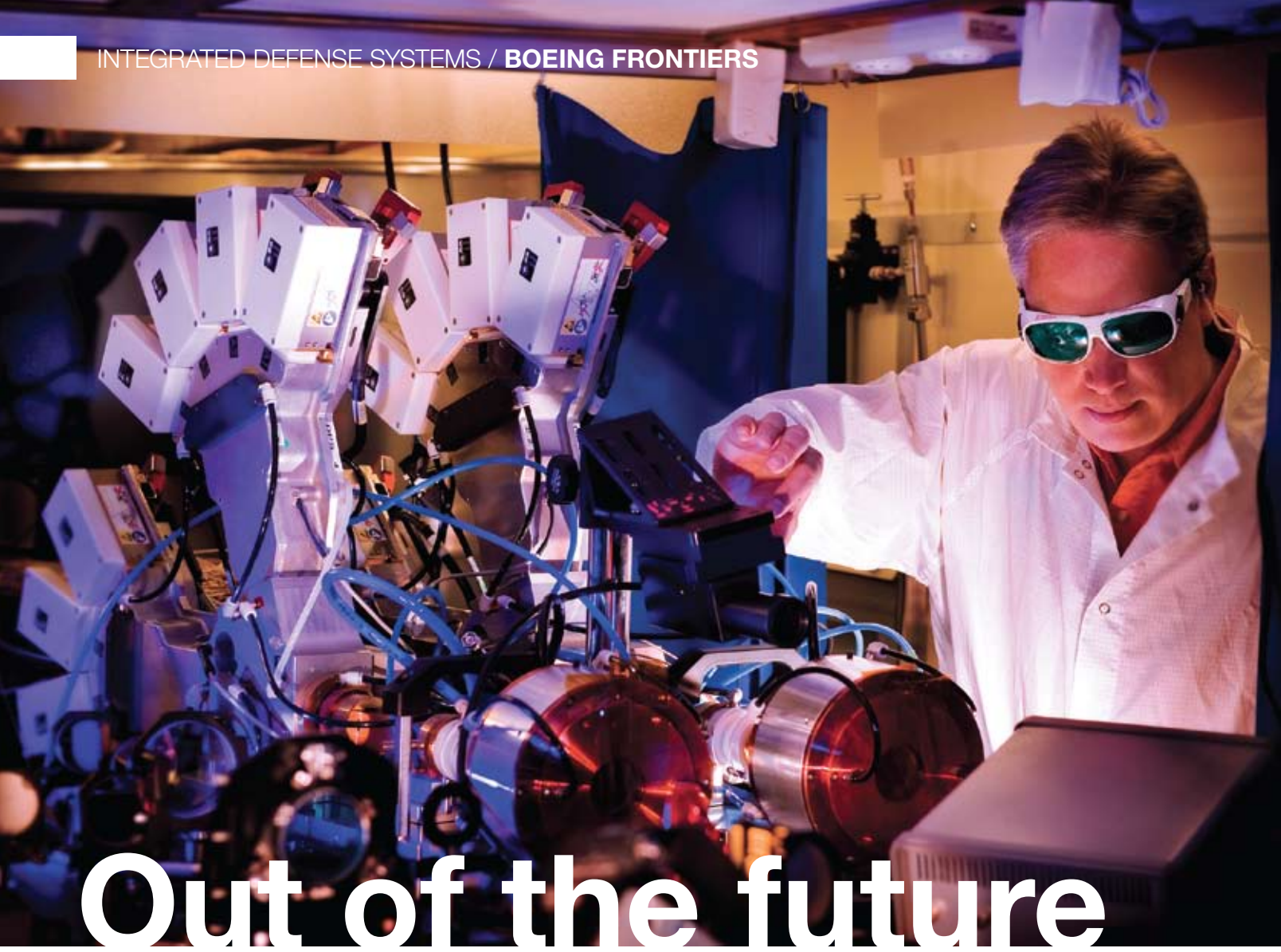
C-17 GETS BOOST FROM DOD, UAE

The C-17 program last month got a boost from two customers.

The U.S. Department of Defense announced a $2.95 billion contract to supply 15 additional C-17s for the U.S. Air Force. The contract is part of the government's 2008 fiscal year supplemental defense spending bill. Jean Chamberlin, Boeing vice president and general manager of Global Mobility Systems, noted that this order will keep the C-17 production line moving well into 2010.

In addition, the United Arab Emirates said it plans to purchase four C-17 Globemaster III advanced airlifters. A UAE spokesman made the announcement at a news conference at the IDEX defense exhibition and conference in Abu Dhabi.

"We remain vigilant in our efforts to provide an affordable option to meet the needs of the Air Force and international customers," Chamberlin said.



Out of the future

A team works on a system that will demonstrate laser weapons' capabilities

By Lynn Farrow

Lasers are the weapons of the future. And Lee Gutheinz and his team are taking Boeing's solid-state tactical laser weapon system—the Relocatable High Energy Laser System (RHELS)—out of the future and into the field.

"We want to get the system into the hands of warfighters who are in the best position to test and critique the system," said Gutheinz, site executive and program director of Boeing SVS, a Boeing subsidiary in Albuquerque, N.M.

With RHELS, Boeing has taken a more direct approach than some of its competitors, who are still trying to develop weapons-grade solid-state lasers in the lab. Boeing has applied to the system commercial, off-the-shelf, thin disk laser technology that's used in the manufacturing industry for welding. Using this technology requires less space, power and cooling; and because the technology's already been proven, Boeing is getting a jump on its competitors in the development of this system.

According to Gutheinz, RHELS is a "pre-prototype" of a tactical laser weapon. It's designed to demonstrate all the functions—including lethal engagement at short range—of a future tactical laser weapon. He noted that RHELS itself is not designed for operational deployment; instead, it's "a tool to provide future users with the opportunity to become familiar with all the capabilities of laser weapons in a quasi-realistic field environment."

Boeing's Directed Energy Systems group in West Hills, Calif., has repeatedly tested the type of laser system RHELS will use, achieving more than 20 kilowatts of simultaneous power plus beam quality and run time targets. The successful tests bring the system one step closer to being fielded—and indicate the laser can be scaled up to a 100-kilowatt-class system based on the same architecture and technology.

RHELS combines many futuristic ideas into one weapons-grade laser system. It brings together a solid-state laser, a high-performance tracking beam control system and the necessary laser cooling and power conditioning into an easily transported, 40-foot (12.2-meter) standard shipping container. RHELS runs on electricity and produces its beam by directly converting electricity

> "[The system] had to be rugged, reliable, compact and user-friendly. RHELS is all of the above."
>
> *– Ron Dauk, RHELS program manager*

into laser light. High beam power is crucial for military use, as is beam brightness (how well you can focus a spot on a target). The beam control, or pointing system, tracks targets such as rockets, mortars and unmanned aerial vehicles. It can place a high-energy laser beam on a target to destroy it.

The laser system features four industrial thin-disk lasers combined into a single 10-kilowatt laser, mirrors and telescopes that find and track the target, and a refrigerator and water pump to extract heat.

The fully-integrated RHELS system will begin testing this year at Kirtland Air Force Base, N.M. From there, it will be used to perform field demonstrations on a variety of Tactical High Energy Laser concepts—including Counter Rocket, Artillery and Mortar (C-RAM) applications, Counter Unmanned Air Vehicles, and potentially Counter Man-Portable Air Defense Systems. Boeing will also look to use the RHELS system as the ground laser source for the Tactical Relay Mirror System, which redirects laser energy to allow the system to "shoot over the hill" and engage C-RAM launch sites directly.

RHELS is designed to be transported on the back of a semi-trailer truck. Like the desktop computer, whose ancestors once filled whole rooms, this 10-kilowatt system may be large now. But it's just the first step in the development of a laser system that will eventually produce 100 kilowatts from a 20-foot (6.1-meter) container.

"We wanted more power and more capability in a smaller package," said Ron Dauk, RHELS program manager. "So Boeing integrated several commercial lasers, capitalized on its experience with optic systems and systems integration, and developed [RHELS]. It had to be rugged, reliable, compact and user-friendly. RHELS is all of the above." ■

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PHOTOS: FAR LEFT: Dave Bossert, laser system engineer, adjusts instrumentation inside the Relocatable High-Energy Laser System shipping container. BOB FERGUSON/BOEING

LEFT: top the Relocatable High-Energy Laser System, Karl Schrader (left), Associate Technical Fellow, and Paul Rodney, systems engineer, confer about the telescopes within RHELS. Below, Jerry Kienle, integration technician (white shirt), and Ron Dauk, RHELS program manager, review final checklists. BOB FERGUSON/BOEING

Cell technician George Ruschner verifies the position of a baffle in the 787 tailcone assembly. In an ergonomic improvement, an industrial robot will spot weld the baffles in place. JIM COLEY/BOEING

You say you want a **revolution**

An Auburn, Wash., team is bringing breakthroughs to parts manufacturing

By Jeff Wood

You probably know how implementing a moving line has eliminated waste and increased efficiency at the Commercial Airplanes factories in Renton and Everett, Wash. But an equally profound innovation is changing the way airplane parts are manufactured at the fabrication facilities in Auburn and Frederickson, Wash.

The introduction of product cells is facilitating breakthroughs in cycle time, quality, material usage, productivity and manufacturing cost. Product cells are mini production lines with all the equipment and resources an operator needs to fabricate a particular part, from raw material to deliverable product. A single operator, called a cell technician, is trained on all the equipment and processes in the product cell.

"Product cells are helping us drive down lead times and they also create new opportunities for technicians and mechanics," said Kim Smith, director of Auburn Machining and Emergent Operations, and Advanced Metal Structures Boeing Fabrication, Commercial Airplanes.

'U' GOT IT!

In traditional manufacturing, large, complex machines perform the same operation on a wide variety of part families, according to AMS operations leader Matt Eha. A particular part family follows a complex path through the factory, queuing up at each machine. This can lead to process bottlenecks as costly parts compete with inexpensive parts for processing time on the same machine.

The U-shaped product cells help untangle the flow by taking crucial parts out of the queue. "The key concept of product cells is 'no shared resources,'" said Eha. "Self-contained product cells help eliminate traffic jams, simplify scheduling and make product flows more predictable."

A product cell produces one part at a time at a rate keyed to demand for the product. Working on one product at a time, the cell technician can catch defects immediately and correct the problem at its source before more defects are produced.

CELL TECHNICIANS IN CHARGE

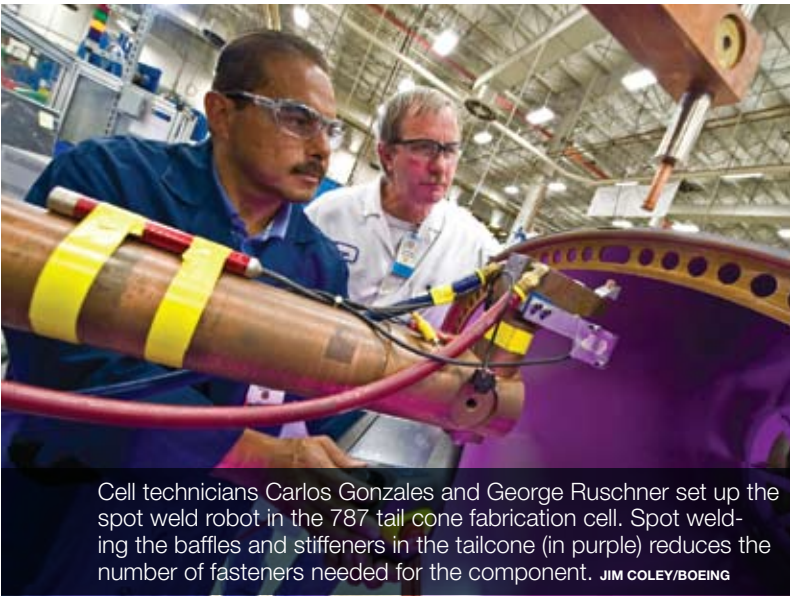
A single cell technician, empowered to perform all phases of the fabrication process and understanding how the cell fits into the overall supply chain, operates the cell. "You have to know how your suppliers work and how your customers are going to use the product," said cell technician Carlos Gonzales.

Cell technician Gerald Roxbury, who's trained to operate multiple cells, said he enjoys the variety. "I can produce several different products in different areas of the building, all in the same day," said Roxbury. "It's fun to work with different product teams and learn more about what goes into an airplane."

Eha estimated that as cellular production expands, fully trained cell technicians will have opportunities to rotate through as many as 20 product cells. "The ability to shift cell technicians increases flexibility to meet variable demand and satisfy urgent requirements," said Eha.

STRUCTURED INNOVATION

Product cell development is a highly structured team activity involving Manufacturing Engineering, Material and Process Technology, Tool Design, Equipment Engineering and the Moonshine Shop. (From a Lean perspective, "Moonshine" is the practice of resolving issues by creating mockups and performing simulations with inexpensive resources.)



Cell technicians Carlos Gonzales and George Ruschner set up the spot weld robot in the 787 tail cone fabrication cell. Spot welding the baffles and stiffeners in the tailcone (in purple) reduces the number of fasteners needed for the component. JIM COLEY/BOEING

The team uses advanced lean techniques to break the manufacturing process down into a detailed series of steps, or transformations, said AMS support manager Brian Hughey. For example, cutting a piece of raw material to size would be one transformation; drilling holes would be another. "The goal is to simplify the product design and the production process, together," Hughey explained.

With a map of the sequence of transformations, the team identifies "right-size" equipment—equipment that's no bigger and no more complex than is needed for a given transformation. The team then determines whether to build the equipment in house, purchase it off the shelf or purchase and modify. According to Hughey, right-size equipment generally costs less, requires less specialized training to operate and is easier to maintain than general-purpose equipment.

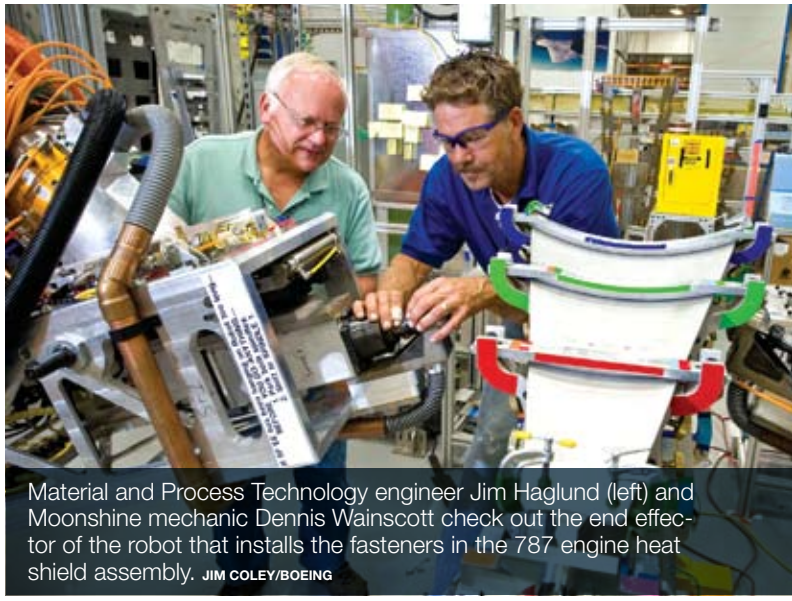
Before obtaining any equipment, the team puts the proposed product cell through a "try-storming" exercise. Using a scale model or full-scale mockup built by the Moonshine Shop, the team tries out all imaginable operational conditions—including when things go wrong. "This provides confidence that the new product cell will deliver the promised improvements and that the cell will integrate with supplier and customer processes," said AMS Lean practitioner Leon Schloer.

MOONSHINE MECHANICS' ROLE GROWS

The Moonshine Shop at AMS has evolved into a process improvement laboratory that serves the Boeing enterprise and even Boeing suppliers, according to Auburn site director Dave Moe.

Originally focused on relatively simple items such as point-of-use carts, bins, and storage racks, the group's experience and creativity quickly earned opportunities to engage in more challenging problem-solving. "At AMS, the Moonshine Shop is central to breakthrough improvement efforts," said Moe. "Today, the Moonshine Shop gets involved in implementing robotic processes and redesigning the production flow for a whole building."

"The collaboration between the technical community and operations is key," said Rob Larsen, Technical Fellow with Material and Process Technology. Added Moonshine mechanic Ronald Potts: "It's a real give-and-take between equipment engineers, Site Services and equipment operators to hammer out a solution that works on the factory floor."



Material and Process Technology engineer Jim Haglund (left) and Moonshine mechanic Dennis Wainscott check out the end effector of the robot that installs the fasteners in the 787 engine heat shield assembly. JIM COLEY/BOEING

Hughey said double-digit improvements are typical. For example, the 787 tailcone cell cut lead time by 66 percent and the number of units in production by 80 percent. "The breakthrough improvements in lead time and cost have helped AMS win competitive bids for parts production contracts," said Hughey. "Product cells and integrated lean improvement teams are making it possible for the Auburn fabrication facility to take on new business while meeting customer expectations for existing products." ■

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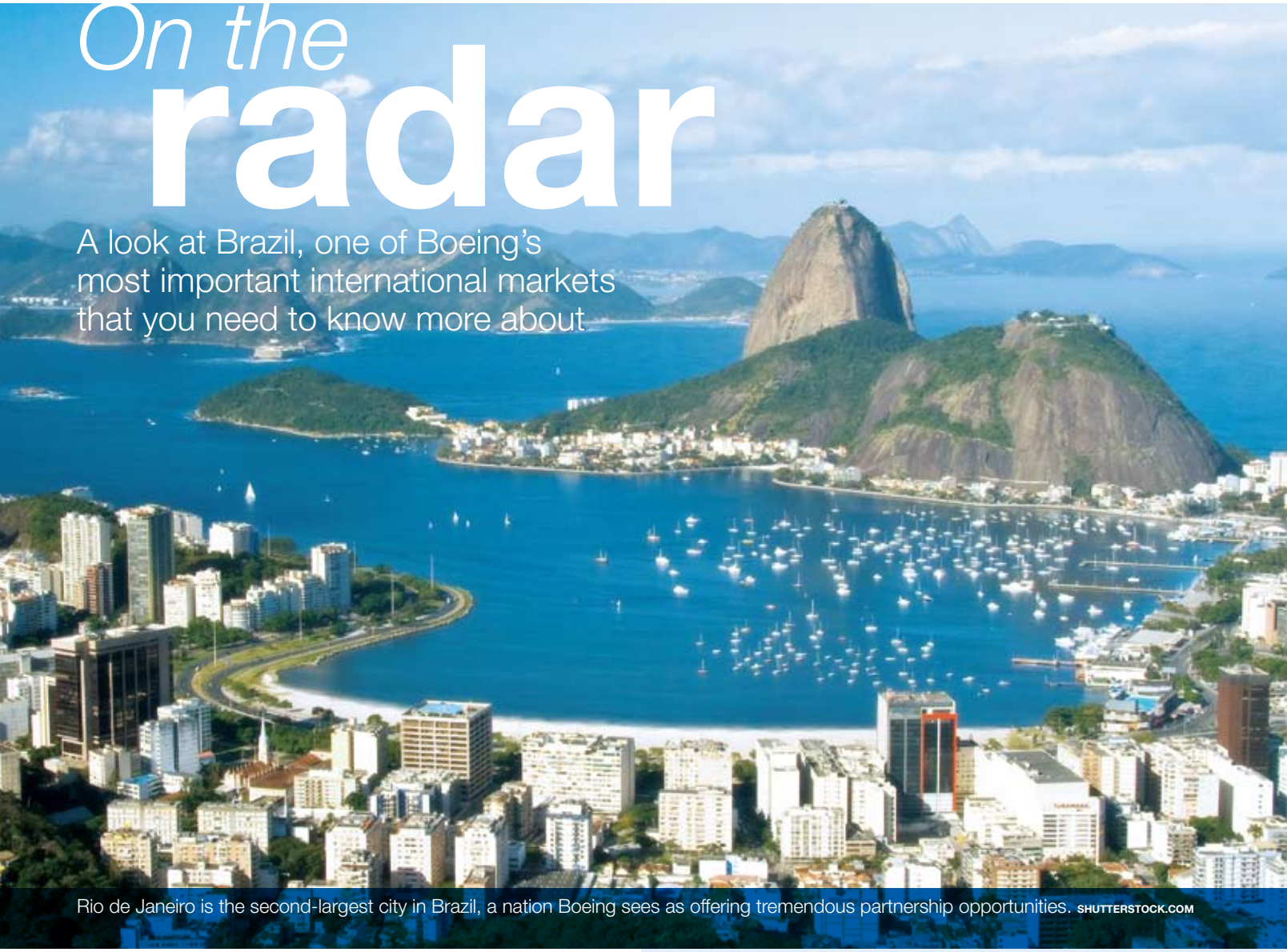
On the radar

A look at Brazil, one of Boeing's most important international markets that you need to know more about



Rio de Janeiro is the second-largest city in Brazil, a nation Boeing sees as offering tremendous partnership opportunities. SHUTTERSTOCK.COM

By Eric Fetters-Walp

Travelers gravitate to Brazil for the tropical green of the Amazon's lush rainforests and the renowned sunny beaches of Rio de Janeiro. But this South American nation long known for its physical beauty also is an up-and-coming economic power.

Brazil is home to key Boeing airline customers and is embarking on defense modernization efforts. It's also seeking new avenues for cooperation between its growing aerospace industry and international counterparts. As a result, Commercial Airplanes and Integrated Defense Systems see promising opportunities in Latin America's largest nation. "Predictions of Brazil's emergence to prominence on the world stage have been made for years," said Ihssane Mounir, Commercial Airplanes' vice president of sales for Latin America and the Caribbean. "It's clear that Brazil's time is now and that, despite the current economic downturn, it is assuming its predicted prominence as one of the world's most important economies."

Brazil *at a glance*

Location: South America, bordering the South Atlantic Ocean

Area: 3,286,488 square miles (8,511,965 square kilometers); comparable in size to the 48 contiguous U.S. states

Population, 2008: 196.3 million

Capital: Brasilia

Official language: Portuguese

Other major cities: Sao Paulo, Rio de Janeiro, Recife

Total gross domestic product, 2007: $1.3 trillion; ranked 10th worldwide

Estimated GDP growth rate, 2007: 5.4 percent

Main export partners: United States, Argentina, China, Netherlands, Germany

Sources: Federative Republic of Brazil; *Central Intelligence Agency World Factbook;* World Bank

Brazil is one of the so-called BRIC economies—along with Russia, India and China—that are expected to account for 40 percent of global economic growth over the next decade, according to the consultancy Ernst & Young. Boeing's Current Market Outlook (www.boeing.com/commercial/cmo) predicts airline traffic within Latin America will increase by 6.7 percent annually over the next two decades, making it the highest growth region outside the Asia-Pacific market. If air traffic expands in line with predictions, the number of airline passengers transported in Brazil will double between now and 2014 to 100 million annually, said David Barioni Neto, president of TAM, Brazil's largest airline.

Meanwhile, Brazil, the world's fourth-largest democracy, is on the verge of fortifying its military air power, having soliciting bids for a major fighter aircraft contract scheduled to be awarded this year. "I think Brazil is becoming more aware of its place in the world. The nation wants to be a player on the world stage," said Joseph McAndrew, IDS regional vice president of Business Development for Europe, Israel and the Americas.

> "Brazil is becoming more aware of its place in the world. The nation wants to be a player on the world stage."
>
> *– Joseph McAndrew, IDS regional vice president of Business Development, Europe, Israel and the Americas*

AIR TRAFFIC INCREASED IN '08

Why is Brazil poised to take off as an economic and political power? "The question is why it hasn't happened before," said Alec Watson, managing director of Hills & Co. and a consultant to Boeing. With the world's sixth-largest population and an economy that's stabilized over the past decade, Brazil has all the right ingredients to grow, he said.

"It's a huge place with a lot of people, underdeveloped transportation systems, a growing middle class and great wealth," all of which bode well for expanding air traffic, said Watson, who lived in Brazil when he was a U.S. consul and then deputy chief of mission at the U.S. embassy there. Indeed, as many parts of the globe saw commercial air traffic drop in 2008, Brazil's domestic airline traffic increased by more than 7 percent.

For decades, one national airline, Varig, controlled the country's civilian air traffic. After deregulation in 1992, a number of carriers were launched, but many faded by the early part of this decade. The two dominant airlines from that period, TAM and GOL, now are modernizing and adding to their fleets to prepare for growth. GOL, modeled after U.S. low-cost carrier Southwest Airlines, has expanded quickly with an all-737 fleet. TAM recently began buying 777-300ER (Extended Range) jetliners.

"Despite the world economic downturn, we are optimistic. We made a bold decision to maintain our operations in 2009, and even to add a new route or international flight," Neto said of TAM, which ended 2008 with 85 percent of the market for international flights originating in Brazil. TAM estimates growth this year of 5 to 9 percent for domestic flights and is increasing seating for its international flights by up to 20 percent.

Eight-year-old GOL, meanwhile, has proven to be a prominent Boeing customer, having ordered 127 Next-Generation 737s and secured purchasing rights on another 40 airplanes, said Jose Sicilia, Commercial Airplanes' sales director for Brazil. GOL's parent company purchased Varig in 2007 and last year replaced all Varig 767s operated on international routes with 737-800s. GOL also plans to aggressively replace its older 737s over the next four years. Additionally, Boeing and GOL worked together to develop the short-field performance package, a Next-Generation 737 enhancement that lets operators fly increased payload in and out of airports with runways less than 5,000 feet long (1,520 meters). That technology is used at the Santos-Dumont airport in Rio de Janeiro, which serves as one end of the lucrative link between that city and Sao Paulo.

"The modernization plan guarantees that GOL's fleet will maintain its status as one of the youngest and most modern in the world," said Fernando Rockert de Magalhães, technical vice president of GOL and Varig.

Despite Brazil's political and cultural ties with Europe, Boeing and Airbus compete on an equal basis for business from Brazil's major airlines, Sicilia said. Brazil is home to the world's third-largest airplane manufacturer, Embraer. In fact, startup Brazilian airline Azul Brazilian Airlines plans to fly an Embraer-only fleet.

DEFENSE NEEDS GROW

Coinciding with this economic growth in Brazil is a boost in its defense needs. As South America's largest air force, the Brazilian Air Force (FAB) has a long history of distinguished service. Today, the FAB operates more than 700 aircraft for tasks ranging from humanitarian missions to Amazon Surveillance System administration.

Boeing is one of three finalists to provide 36 fighter aircraft for the FAB's F-X2 program. Last year, Brazil narrowed the competition to Boeing's F/A-18 Super Hornet, Dassault's Rafale and Saab's Gripen NG. The decision for this contract—one of today's largest fighter competitions and a pact with potential to expand over the contract's life—is scheduled to be announced this spring.

Winning the F-X2 contract could lead to greater defense and industrial cooperation between Brazil and the United States in general and Boeing in particular. According to McAndrew, Brazil's purchases to date of Boeing-built military assets include Harpoon antiship missiles and a few KC-137 airborne tanker and transport planes, based on the 707.

"There's a fantastic opportunity for us in Brazil," said Bob Gower, vice president of the F/A-18 and EA-18 Programs. "Their needs are growing from a defense perspective."

Boeing has reason to be confident, Gower said. As the world's most advanced multirole combat aircraft, the Super Hornet has advantages with its twin-engine configuration and rugged design, allowing long-range capability over maritime and remote territorial regions, he noted. Other benefits include its situational awareness (with its Raytheon APG-79 Active Electronically Scanned Array ra-

Brazilian Defense Minister Nelson Jobim sits in a Super Hornet, which is a finalist in the nation's fighter aircraft competition.

dar and integrated electronic warfare suite), its ability to carry a versatile weapons load, a strong logistics support backbone and an active production line. What's more, the aircraft's service life with the U.S. Navy will last at least through 2035. That means Brazil can be confident the fighters will be kept at the cutting edge of their capabilities over at least the next two decades.

If Brazil opts for the Super Hornet, it would be the aircraft's second export customer after the Royal Australian Air Force, which is acquiring 24 F/A-18Fs, McAndrew said. He added that the aircraft's track record with the expansive nations of the United States and Australia make it a natural choice for Brazil's large territory.

In addition to which aircraft best fits the nation's needs, Brazilian officials are considering which company can help the country enhance its defense industry through technology and training.

Patricia Warren, IDS regional director for Industrial Participation, said the 16 members of the Super Hornet industry team can offer significant value when it comes to industrial opportunities. Projects offered to Brazilian industry range from F/A-18 work packages to training in manufacturing practices to the transfer of aerospace technologies. Boeing also could contribute to and collaborate with Brazil's advanced alternative energy and biofuels research sector, Warren said.

In return, winning the F-X2 contract and expanding Boeing's presence in Brazil could lead to future contracts with the nation's armed forces. "It's a completely new market for IDS," Warren said.

One thing everyone is certain of is Brazil's economic and cultural vitality. Its world-class airlines and Embraer's competitive products exemplify Brazil's capability in aviation, technology development and integration, said Sicilia, who added that some are surprised by the country's similarities to the United States. He said he's been impressed by Brazil's size and diversity, as well as its "very warm and gracious" people.

Gower, who has traveled there several times, agreed. "You see that they are, in my opinion, getting ready to make big strides in the global economy," he said. "It's a very energetic place." ■

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Who's who among B

Here's a quick look at some of Brazil's major carriers.

GOL LINHAS AÉREAS INTELIGENTES

Headquarters: Sao Paulo

Fleet: 104 airplanes, all 737s, including 737-300s and Next-Generation -700s and -800s. GOL has 23 more 737s on order.

Customer base: Using a discount model similar to Southwest Airlines in the United States, GOL holds about 35 to 40 percent of the domestic air travel market.

Did you know: Since launching operations in 2001, GOL has been South America's fastest-growing airline.

Brazil's airlines

TAM LINHAS AÉREAS

Headquarters: Sao Paulo

Fleet: 129 airplanes, including 777-300ERs (Extended Range) and 767-300s. TAM has four more 777-300s on order. The airline also flies Airbus and Fokker aircraft.

Customer base: As of late 2008, TAM held 85 percent of the market for international flights originating in Brazil. The airline's international destinations include cities in the United States, France, the United Kingdom, Italy, Germany, Spain, Argentina, Bolivia, Chile, Paraguay, Uruguay, Venezuela and Peru.

Did you know: TAM is Brazil's largest airline.

AZUL LINHAS AÉREAS BRASILEIRAS

Headquarters: Sao Paulo

Fleet: Azul plans to operate 42 Embraer E-Jets by 2012.

Did you know: Azul was launched in 2008 by David Neeleman, who founded JetBlue in the United States.

Other Brazilian airlines include Webjet, a low-cost carrier that flies about a dozen 737s; Avianca Brasil (formerly OceanAir), which has Boeing 737s and 767s in its fleet and 12 787 Dreamliners on order; and Varig, once Brazil's national airline, which was bought in 2007 by GOL's parent company. Brazil-based ABSA Cargo Airline, owned by Chile's LAN Airlines, operates Boeing 767-300 Freighters and is an early customer for the new 777 Freighter.

Brazilian airline GOL operates a business model similar to U.S. carrier Southwest Airlines—right down to using an all-737 fleet.

JIM ANDERSON/BOEING

SHUTTERSTOCK.COM

Fall back, *spring forward*

What is resiliency? Here's an explanation of what it is—and how building it can help your emotional well-being amid the uncertainties of today.

By Susan Birkholtz

The Chinese philosopher Confucius said, "Our greatest glory is not in never falling, but in rising every time we fall."

A lot's been falling lately—home prices, retirement savings balances, the stock market, consumer confidence, and increasingly, people's spirits. These stresses, plus the worries and strains of daily life, can wreak havoc on your emotional and physical well-being. And working at a high-tech company like Boeing, where fast-paced change is inherent, doesn't make coping any easier.

"When you put the demands of program schedules, management changes and budget-cutting against the backdrop of what's happening in the rest of the world, you begin to see what employees are dealing with," said David Root, a certified Employee Assistance Program counselor who supports the El Segundo and Sylmar sites in California through ValueOptions, Boeing's EAP provider.

Although you may not be able to avoid what's going on at work or in the world around you, experts agree that how resilient you are is key to determining how well you perform and grow at home and at work.

So what is resiliency? Al Siebert, author of "The Resiliency Advantage," describes resilient people as those who can overcome adversity, bounce back from setbacks, and thrive under extreme, ongoing pressure without acting in dysfunctional or harmful ways. What's more, Siebert said, the most resilient people recover from traumatic experiences stronger, better and wiser.

Considering that research says most people spend about 75 percent of their waking hours involved in some work-related activity, being resilient at the workplace is extremely important. In fact, resiliency researchers Salvatore Maddi and Deborah Khoshaba, authors of "Resilience at Work: How to Succeed No Matter What Life Throws at You," contend that resilience amid stressful situations and rapid changes determines your ultimate success in the workplace—even more so than experience or job training.

CULTIVATING 'HARDINESS'

So what can you do to become more resilient? According to Maddi and Khoshaba, the key to building resilience is to increase your "hardiness," a pattern of attitudes and skills that preserves your performance and health by helping you think and act constructively during stressful circumstances.

Maddi and Khoshaba organize this pattern of attitudes and skills into what they call the 3Cs:

- **Commitment.** You generally move toward life, rather than away from it. You view your work as important and worthwhile enough to warrant your full attention and effort, and you stay involved in people and events around you, even when the going gets tough.
- **Control.** You believe and act as if you can influence the events that take place around you. Instead of feeling powerless, you actively seek solutions to workday problems. You also can distinguish what in your environment is open to change—and what is outside your control, and thus must be accepted.

- **Challenge.** You meet unexpected or unwanted change head on and find ways to leverage it to your advantage, rather than seeing it as a negative that you must avoid. You try and understand and learn from stressful situations and turn them into opportunities for personal growth.

TRANSFORMATIONAL COPING

According to Root, developing these attitudes will increase your ability to deal with change effectively through what authors Maddi and Khoshaba call "transformational coping." This behavior means that "when presented with a stressful event, you do not react to it immediately as a threat, but rather take a mental step back to put the event into the context of your ongoing life plan, and try to understand how it fits in," Root said. "Once you understand the situation, you can then decide on the best course of action to resolve the situation that will be the most favorable to your overall well-being. Choosing to act decisively changes the dynamics of the stressful event or experience."

> "When you don't feel well on a consistent basis, it's more difficult to be optimistic about your life."
>
> *– Julie Haiwick, Enterprise BoeingWellness*

According to Julie Haiwick from the Enterprise BoeingWellness program, maintaining a strong physical foundation is necessary to building emotional hardiness.

"When you don't feel well on a consistent basis, it's more difficult to be optimistic about your life," said Haiwick. "During stressful times, making sure you are eating healthy foods, exercising and getting enough rest become even more important. Taking care of your health also includes getting the appropriate wellness screenings for your age group and making sure your numbers—your weight, blood pressure, glucose levels, etc.—are in the normal range. Being able to handle the tough times will be that much easier if you are feeling well physically."

Root stressed that having a strong, supportive social network is very important to cultivating and maintaining emotional resilience. "Talking to people who have known you in better times can help you to see the big picture and encourage you to think more objectively with less emotion about a stressful situation and act in a way that is most beneficial for you," he said.

For those whose social network may be lacking, or if problems seem insurmountable even after discussing them, professional help also is an option.

"I tell people to think of me as a coach rather than a therapist, because that's really what I do," said Root. "In sports, a coach's job is to draw out and hone an athlete's innate abilities. Most people have the ability to overcome their own challenges. It's just a matter of having someone to help you sort them out and gain valuable perspective so you can face them with confidence." ■

Well Being tools *to help you cope*

Boeing provides several programs and resources to help employees deal with stress and build resiliency.

- **Employee Assistance Program:** Employees and eligible family members have access to an experienced counseling professional for up to six free counseling sessions for help with personal problems. In the United States, call 1-888-719-5788. Outside the United States, call Canada collect at +1-905-270-7658.
- **EAP articles online:** Employees can access a number of helpful articles on a wide range of topics, including coping with a job loss and avoiding work burn-out. Visit the EAP Web site on the Boeing intranet at http://eap.web.boeing.com.
- **Legal and financial counseling:** U.S. employees have access to legal and financial solutions through the company's EAP vendor, ValueOptions, which provides access to a network of lawyers, certified public accountants, certified financial planners and budget specialists. For a consultation referral, call 1-866-719-5788 and choose Option 3. Normal business hours are 6 a.m. to 5 p.m. Pacific Time. For emergency legal referrals, access is available 24 hours a day, seven days per week.
- **Family Care Resources:** Boeing Family Care Resources experts help you find solutions for a broad range of issues in your own community—everything from finding assisted living options for your parents to preschool daycare and summer children's programs. Online articles about a variety of subjects also are available. Reach Family Care Resources by calling 1-800-985-6895 (U.S.-based employees only) or visiting www.liveandworkwell-boeing.com.
- **Other resources:** For a one-stop resource on Boeing stress management opportunities, visit www.boeing.com/stressmanagement. And for tips on "How to survive the stress of the 21st century," view a recent Boeing Education Network online workshop available on demand on the Boeing intranet at http://leadcoursesearch.web.boeing.com.

Boeing's Well Being initiative is designed to make it easier for employees to understand and access the wide range of valuable benefits, programs and tools the company offers in the areas of health (physical and emotional) and retirement planning. The effort is integral to Boeing's success: Research shows that a healthy and financially fit work force—one able to perform at its best—is good for employees and good for business.

The real deal

For Boeing, international trade counts, even in bad times. Here's a look at the myths and truths of trade.

By Tim Neale

To the general public, Boeing is best known for its commercial airplanes and defense and space products. But in political circles, Boeing also is well-known for its strong advocacy of international trade.

"Boeing plays a leading role in debates over U.S. trade policy, including policies and programs designed to ensure U.S. competitiveness and help workers displaced by trade," said Tim Keating, Boeing senior vice president, Public Policy. "The reason for that is simple. As a global company and one of the largest U.S. exporters of manufactured goods, Boeing benefits perhaps more than any other company from international trade—as do all Boeing's employees."

Unfortunately, public support for international trade tends to be lukewarm when times are good, and can be downright chilly when times are bad as they are currently. Fear of unemployment fuels protectionist sentiment. So do numerous myths about trade that protectionists have fostered through the years. Yet Boeing leaders strongly emphasize that global trade directly supports the company's growth—and that Boeing's international sales support the company's jobs in the United States.

"As trade barriers come down, the global economy becomes more efficient. Increased efficiency spurs global economic activity, and that in turn drives up business and leisure travel, shipments by

Inside

air, and the demand for Boeing products and services—including defense and security products and services," Keating said.

How important have global markets become to Boeing? Here are some telling statistics:

- 40 percent of total company revenue now comes from customers outside the United States.
- Non-U.S. carriers and leasing companies that do business globally combine to account for nearly 90 percent of Boeing's current commercial airplane backlog, by dollars.
- International sales currently contribute almost 14 percent of Integrated Defense Systems overall revenue, and the plan is to increase this to 20 percent in the years ahead.

While international trade supports Boeing's growth, it also can help improve productivity. "Global partners help make our own products and services better and more competitive, to the benefit of all Boeing stakeholders—customers, employees, suppliers and investors—in all parts of the world," said Keating.

"That's why it's so important that Boeing stays fully engaged on trade issues—working to fight protectionism, lower barriers to trade, ensure that trade is fair and help workers displaced by trade," he added. "That's also why it's important that Boeing employees have a good understanding of the benefits of trade to our company, to the U.S. economy, and to global prosperity. Employee support of Boeing's efforts to champion international trade is critical to our collective future."

To address some of the common misperceptions about international trade, *Boeing Frontiers* spoke to Greg Dole, director, Commercial Trade Policy, for Boeing. What follows are seven myths about trade, and his response to each of them.

Myth #1: Trade is destroying high-paying manufacturing jobs and forcing millions of American workers into lower-paying service jobs.

Dole: It's true that manufacturing jobs have been trending downward, but studies have shown that foreign competition affects only about 15 percent of the U.S. work force and therefore plays a minor role in this trend. It's also important to note that employment growth in the service sector of the U.S. economy has more than compensated for the job losses in manufacturing. Before the recent economic downturn, U.S. employment had risen by more than 30 million jobs over the past 20 years. Most of those jobs are in the service sector, where 85 percent of American workers now make their living. And contrary to what some people say, very few of those service workers are flipping hamburgers. Most are middle-to-upper income workers such as teachers, policemen, firefighters, doctors, nurses and accountants. Many work for companies whose customer base extends outside the United States. When it comes to services, the United States is No. 1, with a trade surplus of nearly $120 billion in 2007 and more than $130 billion in 2008.

PHOTO: Boeing mechanics in Everett, Wash., load the lower lobe of section 41 for the first 747-8 Freighter. The airplane will play a major role in international trade—specifically, in the global air cargo arena. **GAIL HANUSA/BOEING**

The Super Hornet appeared at the Aero India air show last month. International business plays a major role in Integrated Defense Systems' growth plans. KEVIN FLYNN/BOEING

Myth #2: The United States hardly makes anything any more, and no nation can be strong economically without a strong manufacturing base.

Dole: True, there are things that American workers used to make that now are made in other countries, and it's important to retrain the workers displaced by such shifts so they have the skills needed to find new employment. However, contrary to popular belief, the largest manufacturing nation is not China or Japan or Germany. It's the United States, which also is one of the top three exporters of manufactured goods. The U.S., Germany and Japan each exported more than $1 trillion of manufactured goods in recent years, and together accounted for 25 percent of worldwide exports. High-value items made in America, and in many cases exported to customers in other countries, include machine tools, medical equipment, food products, computer software, chemicals, pharmaceuticals—and of course, commercial airplanes, defense products and satellites. The U.S. aerospace industry last year exported nearly $100 billion worth of goods and services.

And many imported products have content that originated in the United States—for example, shoes and clothing from Asia made with American leather, cotton and synthetics.

Myth #3: Trade is pretty much a one-way street, as evidenced by the United States' enormous trade deficit, which is eating away national wealth.

Dole: The United States does have a large trade deficit, but let's put it into perspective: It equates to about 5 percent of U.S. gross domestic product. It's significant, but manageable. It's also likely that key factors behind the trade deficit will change over time.

As developing nations grow richer through trade, they spend more on U.S. goods and services. We've seen that with China, whose imports from the United States last year grew at a significantly faster rate than its exports to the U.S. Trade deficits change the value of the U.S. dollar against other currencies, and right now that makes American goods and services cheaper for people in other countries, spurring U.S. exports. Behavioral changes could have the biggest impact of all. The average American carries more debt, saves less and uses more energy than the average person in other countries. Changes in those factors would affect the trade deficit, and there are recent signs of change in all three areas.

Myth #4: Trade is enabling a foreign takeover of the United States, as foreign interests use the money they earn selling goods to us to buy American assets.

Dole: Direct foreign investment in the United States is indeed substantial, but that's a plus for our economy. In 2008, despite the economic downturn, foreign direct investment in the United States exceeded $2 trillion. That investment came primarily from companies in Europe, as well as Japan and Canada. That money was used to build factories, stores, homes and offices—and create jobs. Foreign-owned businesses in the United States currently employ nearly 5.5 million Americans. What's more, foreign investment demonstrates confidence in the U.S. economy. People invest here because they see the potential to make money here. There are national security concerns with some foreign investments, but there are stringent U.S. regulations in place to address those concerns.

Myth #5: The United States has lost its competitive edge.

Dole: In fact, the United States is ranked No. 1 on competitiveness factors by the World Economic Forum. U.S. workers are among the best trained and most productive in the world. The United States also has an unmatched environment for starting new companies, and is better than any other nation at translating R&D expenditures into innovative new commercial products. In 2007, American inventors registered 80,000 patents, more than the rest of the world combined. U.S. companies and workers field a strong team, and that's why U.S. exports were a bright spot in an otherwise dismal economy the last two years. In fact, exports accounted for 40 percent of U.S. GDP in 2007.

Myth #6: The United States would be better off if it bought only American-made products.

Dole: First of all, other nations would retaliate, drying up mar-

Greg Dole, director, Commercial Trade Policy for Boeing, says protectionist trade policies would imperil U.S. exports and jobs.

FRED TROILO/BOEING

kets for U.S. exports. Many of the 57 million Americans whose jobs are tied to international trade—including Boeing workers—would be hurt in the process. Second, closing our market to foreign goods would be inflationary. Pretty much everything we buy would cost more. Third, imports provide real value that American consumers want: greater product choice; greater product innovation; fresh vegetables, seafood and flowers year-round; and lower prices. Fourth, competition from abroad forces U.S. companies to become more innovative and productive. Fifth, trade better enables American companies and their employees to take advantage of foreign-made components, services and innovations to make their own products and services better.

Myth #7: Trade has hurt America because the U.S. government has done a poor job negotiating and enforcing trade agreements.

Dole: Actually, the trade agreements that U.S. government officials have negotiated in recent years have been serving U.S. workers and business interests very well—in particular, the bilateral free trade agreements (FTAs) since typically those agreements significantly lower existing tariffs on U.S. goods. For the first six months of last year, the United States ran a trade surplus in all categories, including manufactured goods, with the 17 nations with whom the United States has FTAs.

As for enforcement, international trade agreements have provisions for settling disputes and a means for enforcing rulings in those disputes. The U.S. government has aggressively pursued grievances; remember, it filed a complaint against the European Union for the government subsidies provided to Airbus. It's true that trade agreements don't always treat all nations the same, but that's because all nations are not the same. Some are more developed than others, and trade agreements often recognize that fact by affording some protection to some industries for some period of time. However, trade agreements must provide tangible benefits to all its parties. Otherwise, there would be no agreements. ■

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Subsidy dispute:

When actions violate trade rules

As in any competition, it's important to have rules—and to blow the whistle when competitors violate the rules. That's what happened more than four years ago when the U.S. Trade Representative (USTR) filed a formal complaint with the World Trade Organization (WTO) against European governments for the subsidies they provide to Airbus. Of particular concern to USTR and Boeing is the "launch aid" governments give to Airbus for new aircraft development.

"The interest rates charged for these so-called loans are below the rates available from commercial lenders," said Ted Austell, Boeing vice president, Executive, Legislative and Regulatory Affairs. "In addition, Airbus repays the money, if it repays it at all, only as it delivers aircraft to customers. That gives Airbus a significant competitive advantage, considering the capital-intensive nature of the commercial airplane business."

This aid also protects Airbus from the full consequences of market miscalculations. A 2004 study by aviation experts suggested that Airbus would never repay the billions of dollars of European loans to develop the slow-selling A380.

On the heels of the U.S. filing, the European Union (EU) filed a counter-complaint alleging U.S. subsidies to Boeing. The EU claimed that the U.S. government subsidizes Boeing's commercial airplane business through defense and NASA pacts. Responding to that charge, USTR noted that defense and NASA contracts—where government money is paid for products and services delivered—are entirely legal under WTO rules. "In addition, Airbus parent EADS is itself a major defense contractor and each year receives substantial amounts of product-specific R&D funding from European governments," Austell said.

The issues behind both complaints are complex, and the filings voluminous, which is why the WTO panels reviewing the complaints have yet to rule. A preliminary ruling in the U.S. complaint is expected this summer, and a preliminary ruling in the EU case is expected about six months later. Final rulings typically follow within weeks of preliminary rulings and rarely diverge much from the preliminary decisions.

"The stakes in both cases are high," said Austell, who noted that USTR and Boeing are confident of a positive outcome in both cases. "The WTO rulings will affect the competitive playing field for Boeing and Airbus, and they will establish important precedents for other nations that want to enter the commercial airplane business."

—Tim Neale

Wanna talk trade? Boeing's right there

The skyline of Shanghai reflects the growth of the Chinese economy. Boeing played a key role a decade ago in efforts to normalize U.S. trade relations with China. SHUTTERSTOCK.COM

When international trade is the subject of a policy debate, Boeing is on the field and typically in the middle of the action.

A decade ago, Boeing led the private-sector charge to convince Congress to normalize trade relations with China—a nation whose airlines have purchased some 700 Boeing commercial airplanes and are expected over the next 20 years to buy another 3,400 jetliners. Boeing helped secure congressional approval for market-opening bilateral trade agreements with Singapore, Australia, Bahrain, Oman and a regional pact with several Central American countries. The company also supports congressional passage of agreements with Colombia, South Korea and Panama.

Going forward, Boeing's top priorities include reviving the so-called Doha round of multilateral trade negotiations under the auspices of the World Trade Organization. According to Christine Ramsdell, director, Legislative Affairs for Boeing, studies estimate that a successful round would expand international trade by $336 billion. On the other hand, trade could decline by more than twice that amount if nations adopt more protectionist policies. "That's a real danger given current economic conditions throughout the world," she said.

Boeing also would like to see Congress grant the president Trade Promotion Authority (TPA). "TPA is considered essential to the successful negotiation of mutually beneficial trade agreements because it would allow the executive branch to present trade agreements to Congress for an up or down vote, without any amendments," Ramsdell said.

While expanding global trade is a key Boeing trade objective, it's not the company's only goal. "We recognize that the rules governing trade must be fair to all parties and vigorously enforced, and that the government and industry must partner to help workers and small companies adjust to the new, global business environment," Ramsdell said.

Boeing is working with leading industry groups in Washington, D.C., to support U.S. government efforts to level the competitive playing field through negotiations and enforcement actions. The business community would like greater access to foreign markets, greater protection for intellectual property rights, and greater international cooperation on regulatory matters.

"Most important of all, we're advocating the expansion of government programs that help displaced workers learn new, marketable skills," Ramsdell said. "It's been more than 40 years since Congress passed the Trade Adjustment Assistance Act. It's too narrowly focused and needs to be modernized, and federal training programs need to be better coordinated with the business community to ensure a better match of skills to needs."

The business community itself has stepped up to the training challenge in a very big way. According to the American Society for Training & Development, U.S. companies and private organizations spend nearly $130 billion annually on employee learning and development, or more than $1,000 per worker. Boeing's commitment to employee development easily beats that average: Last year the company spent an average of about $5,500 per worker on employee training programs, from leadership training to tuition reimbursement for employees attending outside institutions.

—Tim Neale

Trade 'critical' to growth, productivity

An overwhelming majority of Commercials Airplanes' backlog comes from non-U.S. carriers and leasing companies. That's one of the main reasons why trade policy is important to this Boeing business unit. *Boeing Frontiers* spoke to Travis Sullivan, managing director of Geopolitical and Policy Analysis for Commercial Airplanes, to get more information about why international trade matters.

Q: Why is a free trade policy important to Commercial Airplanes?

A: International trade is critical to our growth and productivity. In terms of growth, one only has to recognize that nearly 90 percent of Boeing's commercial backlog (by dollars) is made up of orders from airlines outside the United States and leasing companies that do business globally. Looking forward, non-U.S. markets will account for 80 to 85 percent of demand over the next 20 years. Trade policies help to enable exports and also stimulate economic activity, which increases air traffic demand and, consequently, airplane demand.

On the productivity side, existing international trade policies have substantially reduced or eliminated tariffs on airplanes and many airplane parts. These policies have driven cost reductions for our customers and continue to save millions of dollars for Commercial Airplanes in supply chain costs each year.

Q: How significant is Commercial Airplanes' contribution to U.S. exports?

A: We are one of the nation's top exporters. If you look at public trade data, U.S. aerospace products totaled $99 billion in 2008, with civil aircraft representing about half of that figure. To put that in perspective, total U.S. merchandise exports totaled about $1.3 trillion last year.

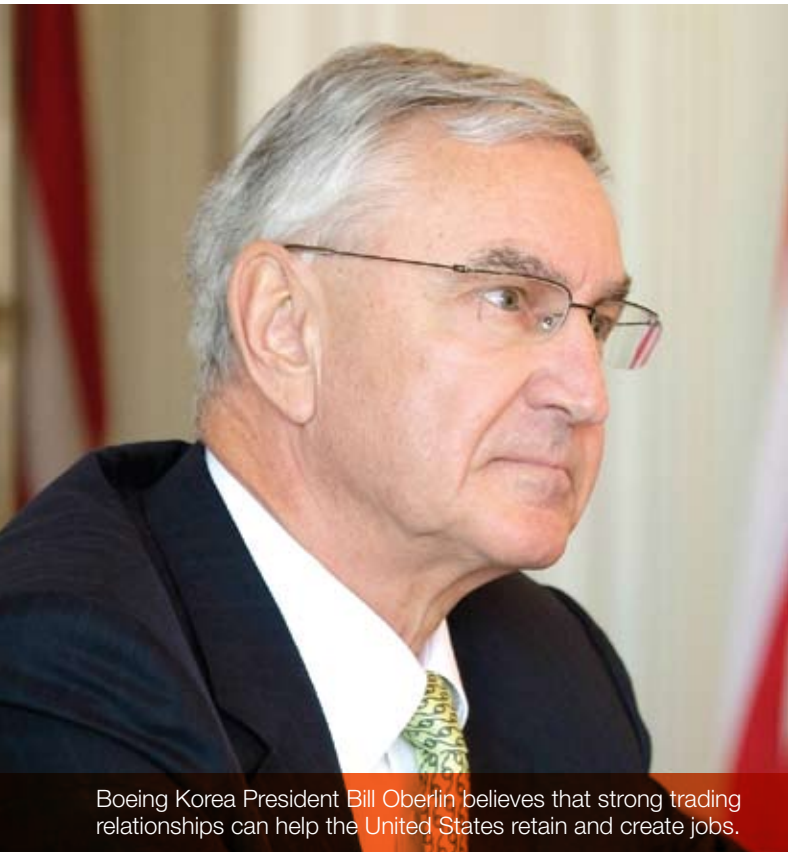
Q: How could protectionist changes in trade policy affect Commercial Airplanes?

A: Protectionist policies, whether in the U.S. or around the world, would harm our long-term business. Growth in trade and economies have been, and will continue to be, crucial drivers of air traffic demand. Simply put, the anti-trade policies associated with protectionism would undermine these drivers of air travel demand. And that would reduce the demand for our products.

—Eric Fetters-Walp

International trade is important to Commercial Airplanes' growth and productivity, says Travis Sullivan, the business unit's managing director of Geopolitical and Policy Analysis. ED TURNER/BOEING

Boeing International's focus: 'Fair trade'



Boeing Korea President Bill Oberlin believes that strong trading relationships can help the United States retain and create jobs.

For many countries, a healthy trade relationship with the United States is critical to the economy. It fuels the engine that enables governments to purchase defense products and services, and air carriers to buy Boeing airplanes.

That's partly why Boeing takes a leadership role in international trade policy matters, said Boeing Korea President Bill Oberlin. The other reason is that a strong trading relationship, particularly when it comes to industrialized nations such as South Korea, benefits the U.S. economy, adding new jobs in the United States and retaining existing jobs, he said.

"Korean companies are now building factories in the U.S., employing local work forces, and in many cases, are buying and keeping open facilities in the U.S. that otherwise would have closed," Oberlin said.

In 2005, Korea and the United States agreed to begin bilateral negotiations on a trade pact. Since then, Boeing has worked closely with several organizations to help negotiators forge the Korea-United States Free Trade Agreement, the most comprehensive trade agreement ever negotiated between two nations.

Oberlin and his team have partnered with American Chamber of Commerce in Korea, the U.S.-Korea Business Council and the U.S. Chamber of Commerce to help encourage the landmark accord. In Washington, D.C., Boeing leads the business coalition formed to support its passage. The KORUS FTA is expected to be considered by the Korean National Assembly in the coming months, and the U.S. Congress may vote on it by the end of 2009.

The pact is critical for the United States—and Boeing—because it opens Korean markets to U.S. businesses. "U.S. markets are open to Korean companies already, so this agreement would level the playing field," said Oberlin, noting that the term "free trade agreement" can be misleading. "Fair trade agreement" is a more accurate term, he said, because the agreements have provisions addressing such issues as government procurement, investment protections, environmental safeguards, labor regulations and intellectual property rights—all of which are critical for Boeing.

Boeing, through Boeing International and the company's Washington, D.C. Operations, works closely with government agencies in the United States and many other nations to help overcome barriers to balanced and fair trade policies. According to Oberlin, that work creates invaluable relationships—which in turn deepens Boeing's presence in international markets with respect to investment, research & development, teaching and community service.

—Conan Kisor

Without trade, jobs might ‘cease to exist’

International business plays a critical part in Integrated Defense Systems’ growth plans. Among the many IDS programs bolstered by international trade is the F-15 program. *Boeing Frontiers* spoke to Bryan Scott, St. Louis-based quality program manager for the F-15 Program Office, about the link between international trade and work on this jet fighter.

Q: Why is international trade important to IDS and the F-15?

A: It’s very key to our growth and productivity goals for IDS and the F-15 program in particular. Trade helps us out domestically; it helps our suppliers and our customers. For the F-15 program right now, all the production F-15 customers we have are overseas, primarily in Korea and Singapore. We support each other between here and those nations with technology, resources and strategies. As we continuously improve our products with our international partners, we create solutions that we can apply to the F-15s that the U.S. Air Force still flies.

Q: How would protectionist trade policies affect the F-15 program?

A: Without trade, the F-15 line would probably cease to exist. But it wouldn’t affect just us in St. Louis. We have over 300 domestic suppliers in 39 states that provide 55,000 jobs and an estimated $9 billion economic impact. Without our trade agreements in place now, all that might cease to exist.

Q: If U.S. trade policies shifted toward protectionism, would that hurt Boeing’s ability to compete in international markets and thus boost competitors?

A: Absolutely. There obviously are other companies and nations that sell jet fighters around the world. That’s not just the case with jet fighters, but with other weapons systems as well.

Q: When the topic of international trade and U.S. jobs comes up in discussions outside work, what do you say to individuals who support protectionist policies?

A: A lot of the time, the prevailing belief is that companies are just shipping jobs overseas. If that’s your whole understanding of international trade, I can see why people would be for trade barriers. But the F-15 program in particular and Boeing overall show how international trade can work. The production and supplier base for the program is overwhelmingly in the U.S. When it’s put into those terms, it’s easier to see the benefits of trade. So once we talk about it in those terms, it’s really an eye-opener for many people.

—Eric Fetters-Walp

Bryan Scott notes how Boeing and the F-15 program demonstrate the benefits of international trade. PETER GEORGE/BOEING

Greater than zero

How a Boeing-developed software application is boosting info security

By Ron Glowen

The word "cipher" means zero, and a Boeing-developed software application called CIPHER is designed to "zero out" information within electronic documents that is hidden from normal viewing.

CIPHER, which stands for Categorize, Identify and Programmatically extract Hidden Entities and Resolve, examines electronic documents, e-mails, attachments and media files for possible incidents of hidden information. If CIPHER finds such data, it provides warning messages and a method for resolution using the software. The application is strengthening measures Boeing and even some external entities are taking to ensure the safeguarding of sensitive information.

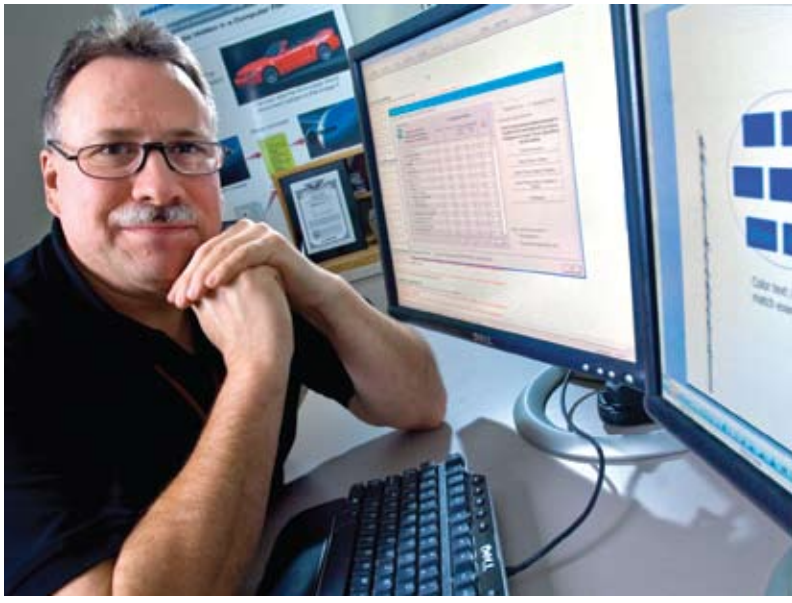
"CIPHER is a phenomenal technical achievement, and has proved to be a valuable tool for protecting International Traffic in Arms Regulations-controlled technical data and embedded classified Boeing information," said Sharon Gilmartin, manager of Export Administration for Integrated Defense Systems' Airborne Early Warning and Control (AEW&C) program.

The application was developed by a team of IT specialists led by Greg Smith, a Boeing Technical Fellow in Information Technology. Their aim: To alleviate serious concerns that proprietary or classified information could be accessed when objects (e.g., Microsoft Office software documents) are copied into another document. That's because these embedded objects may contain multiple worksheets, slides or pages that are hidden from view, or text placed in a location not viewed under normal use. Such entities include document properties, reviewer comments, notes, revisions, and inserted or deleted information.

"CIPHER provides users with the tools they need to ensure that information is not hiding within the documentation they create," said Smith.

The CIPHER tool can be used for a number of important business processes, such as:

- **Trusted Download:** When classified material is downgraded for removal from classified areas.
- **Hidden Information Identification:** For uncovering export-sensitive or personally identifiable information in documents released for dissemination.
- **Seek and Protect:** For identifying inappropriate information stored on a public server share.
- **Third Party Security:** For scanning documents entering the company, such as proposals.



In addition, CIPHER ensures that communications in a network-centric environment do not become a channel for malicious information or subversive activities.

To help keep information assurance a competitive advantage for Boeing, CIPHER is being used to support company policies and procedures for information security. Boeing employees can download it from http://cipherware.web.boeing.com on the Boeing intranet. CIPHER is also offered outside of Boeing and is serving entities from U.S. defense and security agencies to Fortune 500 companies such as Lockheed Martin and Raytheon. As a result, the application is generating significant revenue for Boeing through sales and licensing agreements.

In 2008, CIPHER application received U.S. Patent approval for the application concepts and algorithms, and a European patent approval is pending. CIPHER also received a prestigious InfoWorld 100 Award for being an innovative project that makes the best use of technology in pursuit of business goals.

"CIPHER is a prime example of innovation that enhances Boeing's growth and productivity through technical and functional excellence," said Federico Genoese-Zerbi, Boeing Information Technology vice president of IT Business Partners. "We are proud of Greg Smith and his team's dedication and service, and the recognition they have received on behalf of Boeing." ■

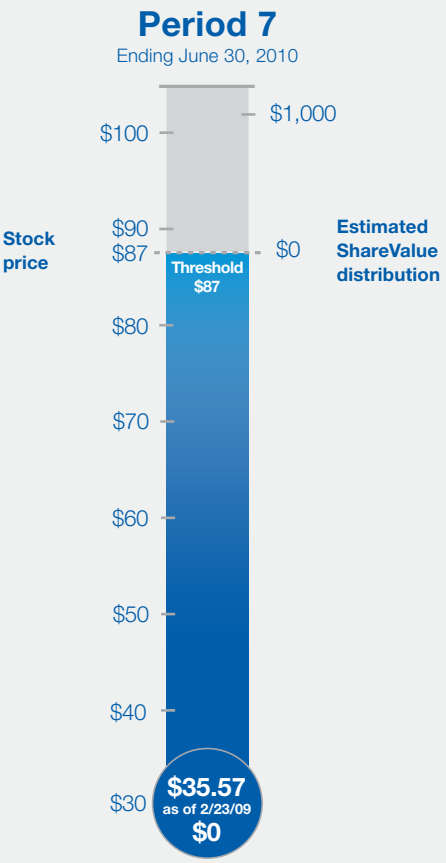
ronald.g.glowen@boeing.com

PHOTO: Greg Smith led a Boeing team that developed CIPHER, a software program that's helping the company and its partners protect sensitive information. **MARIAN LOCKHART/BOEING**

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 graph shows 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.

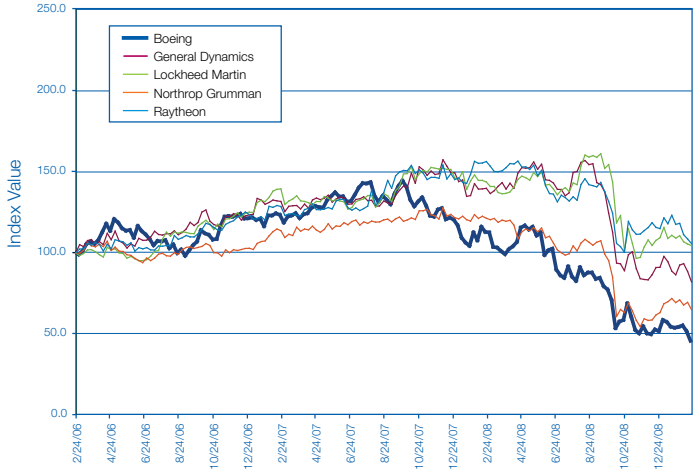
The share price shown is the average of the day's high and low New York Stock Exchange prices. Updates to participant/employment data will be made periodically.

For more information on the ShareValue Trust, visit http://www.boeing.com/share.

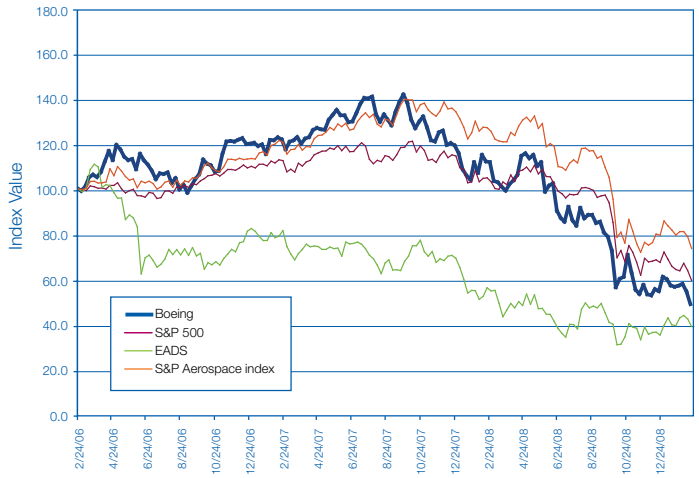
STOCK WATCH

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 Feb. 24, 2006, 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 2/20/09	Four-week comparison		52-week comparison	
		Price/value as of 1/23/09	Percent change	Price/value as of 2/22/08	Percent change
BOEING	**36.31**	**41.98**	**-13.5%**	**83.04**	**-56.3%**
U.S. COMPETITORS					
General Dynamics	50.82	53.32	-4.7%	83.65	-39.2%
Lockheed Martin	77.75	80.98	-4.0%	105.12	-26.0%
Northrop Grumman	44.43	47.11	-5.7%	79.09	-43.8%
Raytheon	45.56	50.38	-9.6%	66.04	-31.0%
INT'L COMPETITORS					
EADS*	12.46	12.60	-1.1%	21.94	-43.3%
U.S. STOCK INDEXES					
S&P 500	770.05	831.95	-7.4%	1353.11	-43.1%
S&P 500 Aerospace and Defense Index	244.13	263.78	-7.4%	420.18	-41.9%

* Price in Euros

IN MEMORIAM:

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

Roger Johnson, materials processor/requirements facilitator; service date April 13, 1970; died Jan. 21
John Judd, systems engineering support analyst; service date June 2, 1988; died Jan. 3
Stephen Kosonen, Lean practitioner; service date Sept. 22, 1986; died Jan. 13
Darcen Krehbiel, procurement agent; service date March 6, 1979; died Jan. 27
Diana Kruis, systems and data analyst; service date Oct. 16, 1972; died Jan. 2
Jerome Lampe, asssembly mechanic; service date Nov. 9, 2007; died Jan. 6
Ellen Mannering, office administrator; service date Nov. 20, 1974; died Jan. 7
Vivian Moore, factory consumables handler; service date Jan. 2, 1985; died Jan. 2
Mark Morimoto, software engineer; service date July 10, 1989; died Feb. 8
David O'Brien, inspector; service date Aug. 30, 1993; died Jan. 5
T.J. O'Brien, system engineer; service date Oct. 11, 1978; died Jan. 12
Gregory Ockfen, numerical controlled skin mill operator; service date Feb. 13, 2000; died Jan. 13
George Pengilley, driver; service date June 10, 1984; died Jan. 9
Leslie Pingel, project engineer; service date July 10, 1967; died Jan. 22
Charles Price, operational support inspector; service date May 4, 1987; died Jan. 18
Mumtaz Qureshi, programmer analyst; service date April 28, 1990; died Jan. 29
Navaal Ramdin, strategy analyst specialist; service date Dec. 2, 1988; died Feb. 19
Donald Seibert, system design and integration specialist; service date Sept. 27, 1981; died Feb. 7
Steven Silverman, staff analyst; service date Aug. 10, 1981; died Feb. 7
Sharon Smeekens, Contracts & Pricing administrator; service date April 29, 1996; died Jan. 30
George Smith, software engineer; service date Nov. 8, 1990; died Jan. 10
Robert Terreberry, materials processor/requirements facilitator; service date Oct. 8, 1997; died Jan. 12
Richard Verrall, electrician; service date Nov. 22, 1981; died Jan. 6
Wade Williams, manufacturing planner; service date Nov. 4, 1985; died Jan. 2
Robert Wood, Program Management specialist; service date Aug. 31, 1982; died Feb. 19
Dave Worley, systems engineer; service date Oct. 15, 1990; died Jan. 5

AROU

747 FLIES ON NEW BIOFUEL

Boeing and Japan Airlines recently demonstrated a new low-carbon-lifecycle biofuel in a 747-300 jetliner.

During the 90-minute flight from Haneda Airport in Tokyo, JAL became the first airline to use the energy crop camelina as fuel. The biofuel blend, which also included jatropha and algae, was tested in the airplane's No. 3 (middle right) engine. No modifications to the airplane or engine were required.

To learn more about Boeing's efforts to drive the development of sustainable biofuels for use by the aviation industry, visit Commercial Airplanes and the Environment on the Internet at www.boeing.com/commercial/environment.

IDS ROUNDTABLE HELPS INDIA GET IDEAS ON ADDRESSING MRO CHALLENGES

Integrated Defense Systems last month continued strengthening its relationships in India, an international market the business unit sees as having tremendous growth potential, by leading a discussion on how to address challenges to the nation's maintenance, repair and overhaul (MRO) business.

The business unit's International Support Systems team led a roundtable at last month's Aero India air show on how the Indian aerospace and aviation market can overcome challenges in public and private partnerships.

The roundtable gave aerospace industry leaders and customers, including members of the Indian Air Force and Ministry of Defense, the opportunity to discuss challenges in the MRO business.

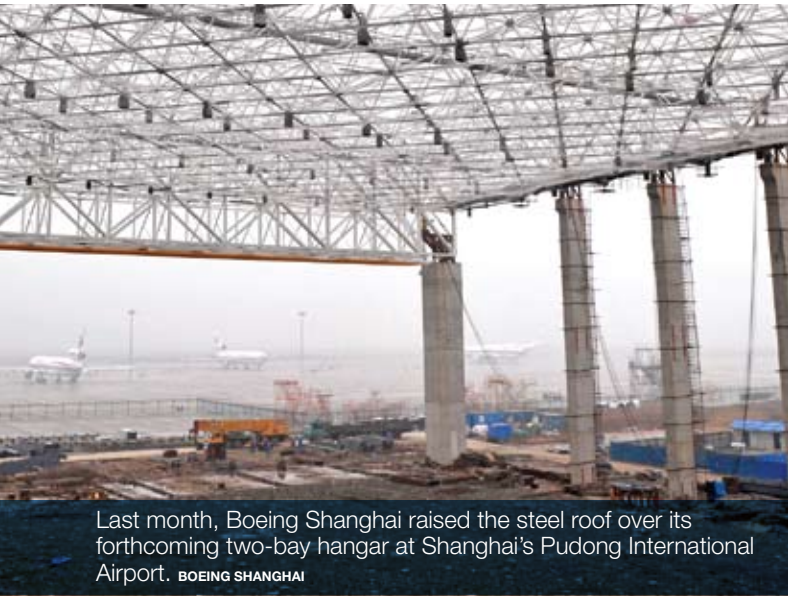
According to George White, ISS director for International Alliances and the panel discussion's leader, representatives from the Indian Air Force, Indian defense industry and global defense companies provided their perspectives on high-interest topics in this field.

"Access to intellectual property, limitation on foreign direct investment in Indian defense companies and Indian tax regimes are three areas that came up," he said. "These are the types of issues we see in many areas of the world and that the ISS business has met head-on, with some very successful solutions."

Insights from the roundtable discussions will be collected in a white paper and delivered to members of India's Air Force and Ministry of Defense, as well as to participating industry leaders.

ND BOEING

Singapore Airlines recently took delivery of its 77th 777 airplane.
TIM STAKE/BOEING



Last month, Boeing Shanghai raised the steel roof over its forthcoming two-bay hangar at Shanghai's Pudong International Airport. BOEING SHANGHAI

SINGAPORE AIRLINES TAKES DELIVERY OF ITS 77TH 777

Boeing and Singapore Airlines reached a historic milestone recently with the delivery of the airline's 77th 777, which also is its 19th 777-300ER (Extended Range).

Singapore Airlines began its relationship with the 777 in December 1995, when the airline ordered 28 of what has become the world's most popular intermediate twin-aisle airplane, with a market share of more than 60 percent.

The delivery brought the Singapore Airlines fleet of Boeing airplanes to 91, with an additional 20 787-9 Dreamliners on order.

747-8 GETS FAA APPROVAL FOR SCHEDULED MAINTENANCE PROGRAM

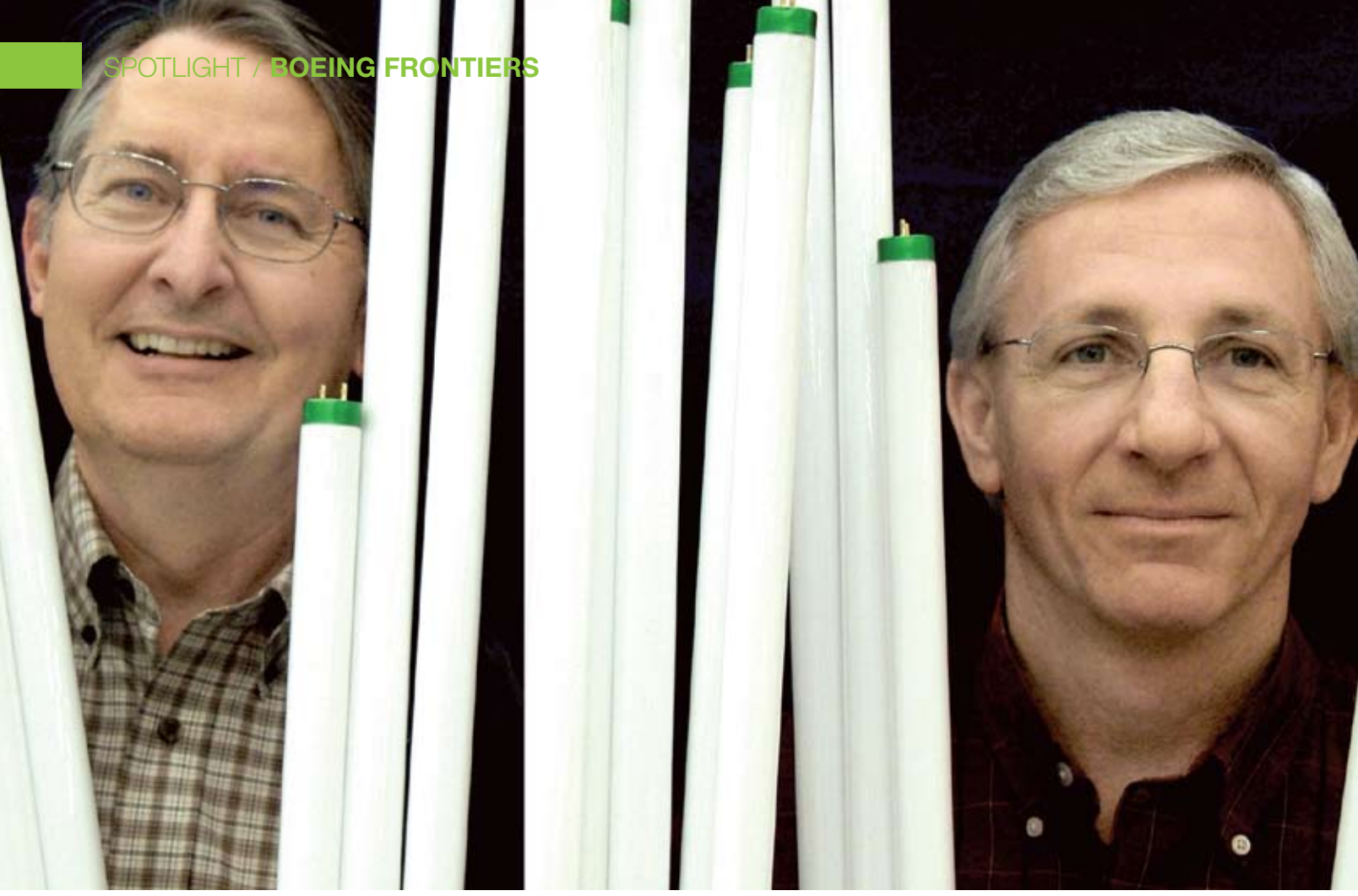
The 747 program reached a milestone last month when the U.S. Federal Aviation Administration approved the Maintenance Review Board Report for the 747-8.

The report documents the scheduled maintenance program, defining the maintenance tasks and intervals for operators. This approval is one of many requirements needed for the airplane's certification. The 747-8 Freighter will make its first flight later this year.

BOEING SHANGHAI REACHES CONSTRUCTION MILESTONE

Boeing Shanghai Aviation Services Co. Ltd. (Boeing Shanghai) completed a major milestone last month by safely raising the 1,936-ton (1,756,309-kilogram) steel roof over its forthcoming two-bay hangar at Shanghai's Pudong International Airport. When complete, the hangar will measure about 538,000 square feet (50,000 square meters) and will accommodate several Boeing airplane models, including 737s, 747s, 767s and 777s.

Boeing Shanghai, a joint venture of Boeing, Shanghai Airport Authorities and Shanghai Airlines, will provide modification, maintenance, repair and overhaul services primarily to regional and international airlines as well as domestic Chinese carriers.



Huntsville **'Green Team'**

Here in Alabama, our Huntsville "Green Team" began as a partnership between Environment, Health and Safety and Shared Services Group to identify projects and events that benefit the site, the environment and the community. The team achieved big results and was recognized by winning the City of Huntsville 2008 Air Pollution Control Achievement Award in two categories: Energy Conservation and Employee Education.

We began by installing more efficient lighting, motion sensors and timers. These simple but effective measures caught the city's attention when we were able to show that the new fluorescent bulbs use about 50 percent less energy to produce the same amount of light as the old bulbs. The new bulbs also contain less mercury and reduce the region's carbon dioxide emissions.

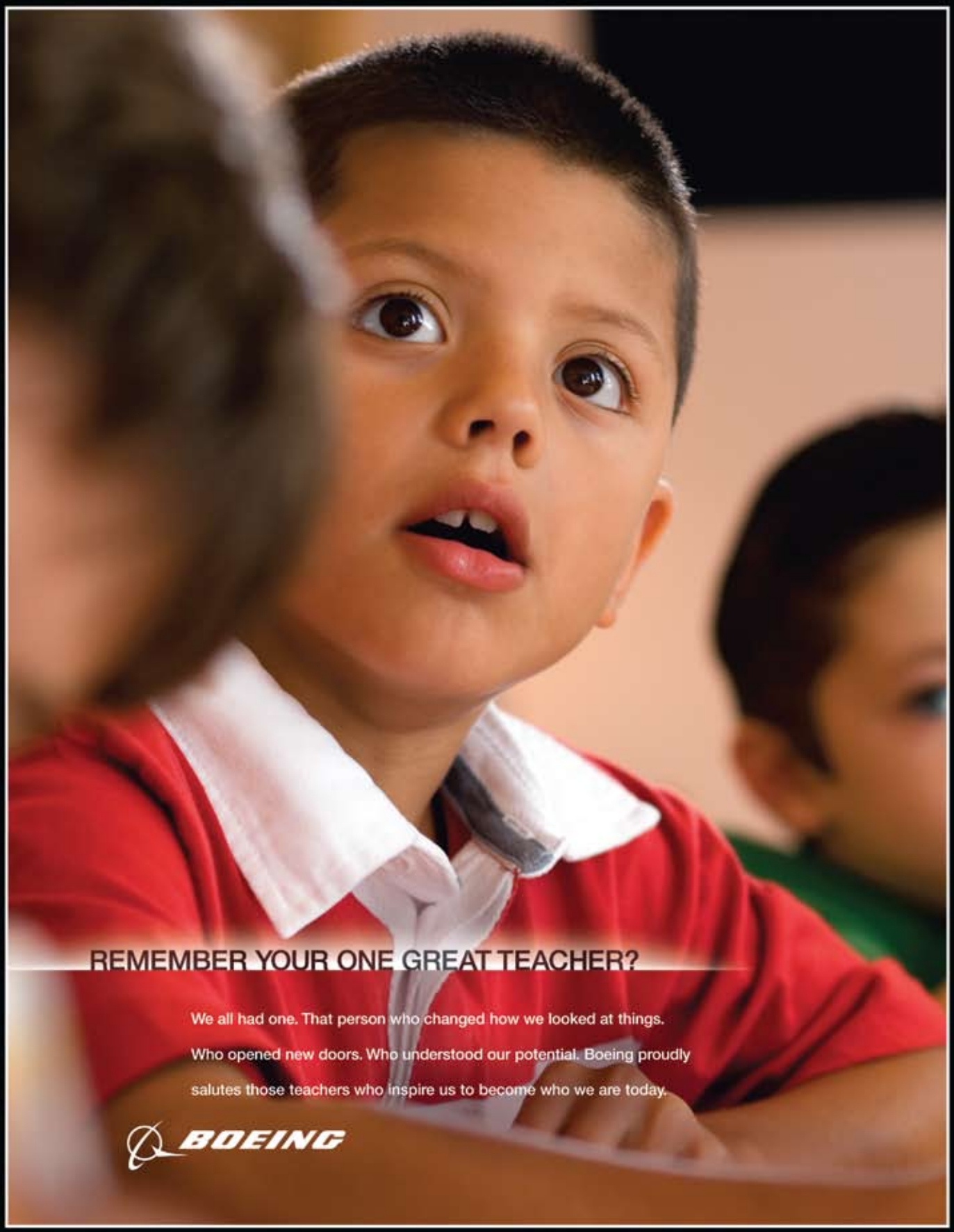
We increased employee environmental awareness through conservation tips and the distribution of energy efficient compact fluorescent bulbs, to remind them that saving energy can be as simple as turning off a light bulb or adjusting a thermostat.

The team also takes satisfaction from being active in our community. Our Earth Day events in 2008 included assisting a local Boys and Girls Club with landscaping around its building. We participated in the Panoply Arts Festival where children decorated reusable grocery bags to take home. The team also participated in the Madison County Drinking Water Festival and hosted a household hazardous waste turn-in.

We're delighted to receive the award, but we're not resting on our green laurels. The objectives and targets stated in our ISO 14001 environmental quality certification emphasize conservation, so we're examining how we can further capitalize on our success.

Huntsville 'Green Team' members:

Patti Adams
Jeb Bartram
Danny Bradford
Trish Gregg
Alan Griffin (above, left)
Greg Lanier
Randy Miller (above, right)
Kay Rains
Christina Reich
Suzanne Riney
Tony Soto



Global corporate citizenship refers to the work Boeing does—both as a company and through its employees—to improve the world. This ad emphasizes Boeing's commitment to the development of quality learning environments, providing youths with the skills to succeed in school and life.

This Integrated Defense Systems print ad supports the efforts of Boeing Defence Australia. The ad reinforces the commitment and contribution of BDA and its employees to Australia's military and economy. The ad is scheduled to run in a number of publications in Australia.