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LEADING EDGE

Innovation and a pioneering spirit define Boeing subsidiary Insitu as a leader in unmanned systems

20
ROOTS OF INNOVATION

Located in the picturesque Pacific Northwest near the Columbia River that separates Washington and Oregon, Insitu, a wholly owned subsidiary of Boeing, is a pioneer in unmanned aircraft systems such as the ScanEagle. Insitu's roots go back to its founding by a small group of employees who designed an unmanned aircraft—to track tuna—that could be launched and retrieved from a fishing boat. Today, Insitu has about 800 employees but has retained its small-company feel and pioneering spirit—and the innovation continues.

COVER: INSITU EMPLOYEES PREPARE SCANEAGLE FOR AN EARLY MORNING FLIGHT NEAR THE COMPANY'S HEADQUARTERS IN BINGEN, WASH. BOB FERGUSON/BOEING

PHOTO: DARIN HOLTZ, FOREGROUND, AIRCRAFT SYSTEMS TECHNICIAN, INSPECTS SCANEAGLE COMPONENTS WHILE JIM MCCLANAHAN, A SENIOR AVIATION TECHNICIAN, REVIEWS AIRCRAFT FILE PROGRAMMING AT THE INSITU PRODUCTION FACILITY. BOB FERGUSON/BOEING

AD WATCH

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

Inside cover:

The "X-51A WaveRider" is one in a series of innovation stories told by Boeing employees such as Joseph Vogel. Learn more at www.boeing.com/stories.

Page 6:

The Boeing Store's Custom Hangar is a select collection of authentic, limited-edition Boeing artifacts, collectibles and apparel designed for true aviation fans. This ad features Custom Hangar, 737 MAX and Boeing logo merchandise for Father's Day gift ideas. Learn more at your local store or at www.boeingstore.com.

Page 52:

This new ad for Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) highlights Boeing's readiness to deliver a complete set of critical capabilities essential to national defense. The ad currently appears in trade publications.

FSC LOGO

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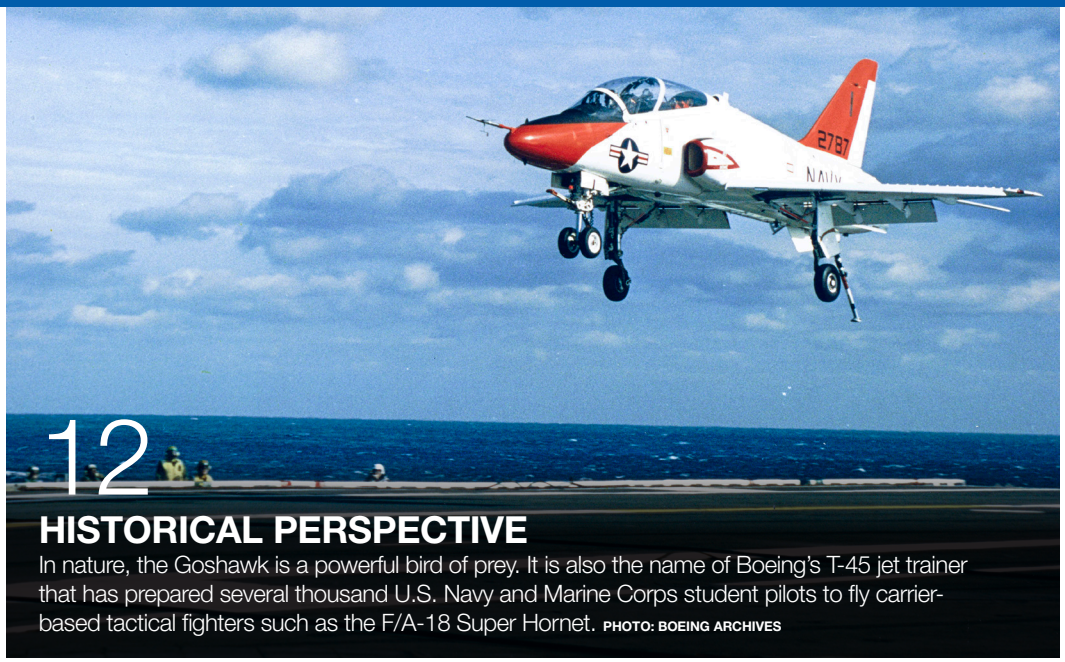

Inside

Father's Day is Sunday, June 16

737-MAX 8
Executive Model

Authentic Boeing Apparel

Timeless collectibles from aviation's most iconic brand.

Introducing the Custom Hangar: authentic, limited-availability Boeing aero artifacts and collectible items for true fans.

Authentic
737 window

View the entire
Custom Hangar line at
boeingstore.com/customhangar

THE BOEING STORE
Authentic merchandise and collectibles

Collaboration enables innovation

On the eve of another Paris Air Show, no other industry has inspired such innovation

Shep Hill
President, Boeing International, and senior vice president, Business Development and Strategy

Innovation is the foundation of Boeing's business success. Reflective of Thomas Edison's admonition, "There's a way to do it better—find it!" Boeing has always been driven by new ideas, methods and breakthrough technologies focused on increasing performance, improving maintainability and ensuring sustainability.

It is fitting therefore that as the world's aerospace community gathers at Le Bourget for the 2013 Paris Air Show, Boeing will again be featuring the innovative products and services that have made it the world's leading aerospace company.

These products and services will also highlight Boeing's global collaborations with customers, industrial partners, academic institutions and technology organizations. Boeing is a more global company today than at any point in its nearly 100-year history, and it could not have happened at a better time. Having a global orientation that embraces partnership and mutual benefit is critical to our long-term business success.

France is one of the best examples of collaboration and mutual benefit. Boeing has increased its partnership with French suppliers and now works with more than 100 local companies. This issue of *Frontiers* features a country profile of France and discusses our growing in-country supplier network. (See Page 30.)

Also featured in *Frontiers* this month are several exciting projects in China, Brazil and Turkey. These countries not only represent important markets for Boeing products but are important examples of collaborations resulting in competitive advantage through innovations. (See Page 17.)

As we approach our centennial, Boeing remains at the forefront of innovation. Yet Boeing's success in this rapidly evolving and highly competitive global business environment is never guaranteed. Much depends on our ability to be collaborative and creative with global customers, suppliers and partners in pursuit of technology, growth and productivity. Given our growing global orientation, the future is bright.

"The 2013 Paris Air Show provides the opportunity once again to appreciate and celebrate our industry and its history—a history of meeting challenges and doing hard things."

The 2013 Paris Air Show provides the opportunity once again to appreciate and celebrate our industry and its history—a history of meeting challenges and doing hard things. As the early French aviation entrepreneur Pierre-Georges Latécoère said, "All the calculations show it can't work. There's only one thing to do: Make it work."

There is no other industry that has done so much to "make it work" in connecting and protecting the world, advancing scientific discovery and, above all, inspiring innovation. ■

PHOTO: BOB FERGUSON/BOEING

Flying through history

When Boeing's fifth flight-test 787 jetliner (ZA005) flew in to Albuquerque, N.M., in April it met up with two vaunted aircraft from Boeing's past—a B-17 Flying Fortress, from left, and a T-28 Trojan. The B-17 is owned by the Experimental Aircraft Association of Oshkosh, Wis., and was on its way to California to perform in air shows. The T-28 was produced by Boeing heritage company North American Aviation in 1955 and served as a U.S. Marine Corps training aircraft. Privately owned, it is operated by the North American Training Command, a T-28 flight school in New Mexico. The 787 later flew to Hawaii as part of ongoing testing of General Electric engine performance enhancements.

PHOTO: BEN BICKLEY

"We kind of went from a telephone in the 1960s … almost to current WiFi era from a technology standpoint."

– *Boeing B-52 Program Manager Scot Oathout, speaking to* Inside the Air Force *about how Boeing's Combat Network Communications Technology, or CONECT, will bring the B-52 bomber into the digital age.* Inside the Air Force, *April 26*

"I've taken countless flights during my career at Boeing. But I can tell you the one I took today may be the most special."

– *Randy Tinseth, Commercial Airplanes vice president for Marketing, who was among the passengers when Ethiopian Airlines became the first airline in the world to return the 787 Dreamliner to service, on a commercial flight from Addis Ababa, Ethiopia, to Nairobi, Kenya. The 787 fleet had been grounded until a battery issue was fixed.* Randy's Journal, *April 27*

"It was a full mission success."

– *Charlie Brink, X-51A program manager for the Air Force Research Laboratory Aerospace Systems Directorate, after Boeing's unmanned hypersonic X-51A WaveRider was deployed from a B-52 bomber and then flew above the Pacific Ocean at more than five times the speed of sound in a historic test flight.* Los Angeles Times, *May 4*

From the heart

Making airplane insulation blankets is a work of art for this employee

By Cecelia Goodnow
Photo by Gail Hanusa

Precision and attention to detail are essential skills at Boeing Fabrication's Emergent Operations. But Vincent Pham, a native of Vietnam who immigrated to the United States in 1984, brings something extra—a sense of poetry and artistic appreciation for his work. In this Frontiers *series that profiles employees talking about their jobs, Pham describes his pursuit of quality in the Blanket Shop in Everett, Wash.*

I enjoy complexity and challenge, so the Blanket Shop is a good place for me to work. We make and repair insulation blankets for every model of Boeing commercial airplane.

Everything I do, I do with quality. So much of this job comes from my heart.

The blankets are Fiberglas batting within a thin skin. They line the interior of the airplane, like insulation in a house, and are used for soundproofing, fireproofing and temperature control in the cabin. They also direct condensation away from passengers. The blankets are stitched together or joined with fireproof tape to match the shape of the airplane, and everything must fit perfectly. It is like a work of art.

During my training, we learned everything, step by step, about how to cut, sew and tape blankets according to the engineers' drawings. I thought, Wow! This is not easy. This is very specialized. It requires great patience.

To begin, I lay out the assigned work and measure, mark, staple and cut to fabricate parts that correspond to the drawing. Every blanket is different because each airplane is different. I use my math skills to establish reference points to check dimensions. Sometimes I get so involved I forget the time. I may not eat. Then I look up and it's time to go home.

To finish the blanket, I sometimes work inside the airplane and join the pieces with tape. Other times I sew them together in the workshop. Sewing was new to me, but I've become a professional.

I am grateful to work at Boeing and create objects of quality. I have worked at Boeing for more than two years. Previously I had worked at several Northwest companies as a machinist. A Boeing job presents new learning experiences and opportunities for career growth. I often write, and this is what I say about my job: "I love to see people succeed and bring new energy into our workplace … If I walk in the Blanket Shop, a flower will bloom under my feet with every step. In fact, the flowers will smile at me and wish me well in my working day." ■

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‘Low fare with care’

With an all-Boeing fleet of 737s, Dutch airline continues to grow

By Dan Mosely

In November 1966, a Dutch dance company, an orchestra and some famous ballet stars boarded a chartered DC-6 and flew from Amsterdam to Naples, Italy.

Ten years after that first flight, Transavia Holland had 45 percent of the busy Dutch holiday, or vacation charter, market. A decade after that, the airline—by then called Transavia Airlines—began operating scheduled low-cost flights with a fleet of Boeing Classic 737s.

Today, rebranded as transavia.com, the airline has become a respected national institution in the Netherlands. For five consecutive years, the Dutch travel industry has awarded it both the best low-cost and best charter airline operating out of the Netherlands. The airline generates 90 percent of its ticket sales online, and its website gets 1.5 million hits a month.

What has not changed over the years is transavia.com’s reliance on an all-Boeing fleet, which now includes more than 30 Next-Generation 737s. Last year, transavia.com took delivery of its first 737-800 with the Boeing Sky Interior.

The company’s slogan—“low fare with care”—reflects its focus on high-quality customer service coupled with affordable pricing, according to Bram Gräber, chairman of transavia.com. The airline offers low fares to more than 100 summer and winter holiday destinations, from Copenhagen to Casablanca, Morocco. Most flights serve the Mediterranean region and northern Africa, departing from the airline’s three bases—Amsterdam’s Schiphol Airport, Rotterdam The Hague Airport and Eindhoven Airport.

> “What ultimately matters most is the passenger, which is why I am proud that we are adding new 737s with the Boeing Sky Interior to our fleet.”
>
> – Bram Gräber, chairman, transavia.com

Gräber said the fleet of efficient 737s has allowed the airline to expand its range of destinations in tough economic times while offering passengers a better and more enjoyable overall flight experience.

“What ultimately matters most is the passenger,” Gräber said, “which is why I am proud that we are adding new 737s with the Boeing Sky Interior to our fleet.”

As a member of the Air France–KLM Group, transavia.com has also expanded its operations to France through its Paris-based arm, Transavia France (see story on Page 30). Since 2007, French holidaymakers, like their Dutch counterparts, have been able to take advantage of low-cost fares to destinations across Europe, Northern Africa and the Middle East.

Transavia France has expanded rapidly over the past six years. It now operates a fleet of 11 737-800s and plans to increase the fleet by three airplanes in 2014. Gräber said both the Dutch and French sides of the business will take further 737-800 deliveries as transavia.com continues to grow. ■

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PHOTOS: (Top) The latest Next-Generation 737-800 for transavia.com departs Boeing Field in April. JIM ANDERSON/BOEING (Above, from left) Bram Gräber, chairman of transavia.com. TRANSAVIA.COM The airline’s Boeing Sky Interior. JIM ANDERSON/BOEING

TRAINING FLIGHT

U.S. Navy and Marine tactical jet pilots earn their wings in Boeing's Goshawk

By Henry T. Brownlee Jr.

So, you want to fly jet fighters? Well, a jet trainer comes first.

Before they can handle a supersonic fighter such as Boeing's F/A-18 Super Hornet, which can slice through the sky at nearly twice the speed of sound, U.S. Navy and Marine Corps aviators must undergo a rigorous flight training program that prepares them to operate the best fighter aircraft in the world.

And for 25 years, the Navy's system for intermediate and advanced student aviators to transition to jet fighter aircraft has been Boeing's T-45 Training System, or T45TS.

The centerpiece of that system is the T-45 jet trainer, known as the "Goshawk." In nature, a Goshawk is a powerful bird of prey. As a jet, the Goshawk has prepared many a U.S. Navy and Marine Corps aviator for a career as a military jet pilot.

The story of the Goshawk began in 1978 when Douglas Aircraft, a division of McDonnell Douglas, partnered with British Aerospace to enter the U.S. Navy's competition to develop a new training system for jet pilots. The Navy wanted an integrated system to replace both the North American Aviation T-2 Buckeye intermediate jet pilot training program and the Douglas TA-4J Skyhawk advanced jet training program.

Douglas, North American and McDonnell Douglas would later become Boeing heritage companies.

As the basic aircraft for the Navy's jet training system, McDonnell Douglas and British Aerospace chose the Hawk, a proven British-built trainer. The Hawk had been selected by the Royal Air Force in 1970 as its principle jet trainer for basic and advanced training. The proposal to the Navy by McDonnell Douglas and British Aerospace included a carrier-suitable version of the Hawk, simulators and an array of academic and other elements that would prepare student pilots for naval jet aircraft.

The Navy awarded the T45TS contract to the McDonnell Douglas and British Aerospace team in November 1981, with McDonnell as the prime contractor.

McDonnell and British Aerospace collaborated on significant modifications to make the basic Hawk design aircraft carrier suitable as the T-45A, a two-seat, single-engine jet trainer that is approximately 39 feet (12 meters) long, 14 feet (4 meters) high with a wingspan of 30 feet 10 inches (9.4 meters).

PHOTOS: (Clockwise from far left) The T-45A Goshawk jet trainer is at the heart of the T45TS, the U.S. Navy's first totally integrated training system for undergraduate jet flight training; the T-45C's digital cockpit resembles that of a front-line U.S. Navy fighter such as the F/A-18 Super Hornet; the T45TS includes advanced flight simulators. BOEING ARCHIVES

The Navy announced the selection of "Goshawk" as the name for the T-45A in 1985. The name originally was assigned to the Curtis F11C, a U.S. Navy fighter aircraft in 1932.

The aft fuselage and wings of the Goshawk were built by British Aerospace in the United Kingdom; McDonnell Douglas assembled the forward fuselage at its Long Beach, Calif., plant and performed final assembly and production testing in Palmdale, Calif. Final assembly of the first production model of the Goshawk began in December 1988 in Air Force Plant 42 at Palmdale. In 1989, McDonnell Douglas announced it would move production of the T-45 program to its St. Louis, Mo., facility.

First flight of the Goshawk came in April 1988 at Long Beach. Test pilot Fred Hamilton noted the T-45 "handled very much like the Hawk—just as we expected. It's an agile little aircraft."

Production deliveries began in 1992. Two years later, the first students earned their wings as U.S. naval aviators after going through the T-45A training program at Naval Air Station Kingsville in Texas.

In October of 1997, the T-45C, equipped with a digital cockpit that resembles the Navy's front-line fighters, made its first flight. The Navy is continuing to upgrade its T-45A's to T-45C's.

Boeing delivered the 221st and final T-45C Goshawk to the U.S. Navy in 2009. By then, more than 3,600 Navy and Marine Corps student pilots, and student pilots from ally nations, had trained in the Goshawk. Today, these graduates go on to assignments flying the Hornet, Super Hornet, Growler, Harrier and Grumman EA-6B Prowler.

Capt. Andrew Hartigan, Naval Undergraduate Flight Training Systems program manager speaking at the final delivery ceremony, summed up the many contributions of Boeing and its heritage companies: "The equipment of Naval Aviation is truly in the hands of Boeing … that truth demonstrates an extraordinary trust and confidence, trust that has been built for decades and trust we look forward to continuing."

The Navy has said it will utilize the T-45 Training System through 2035. ■

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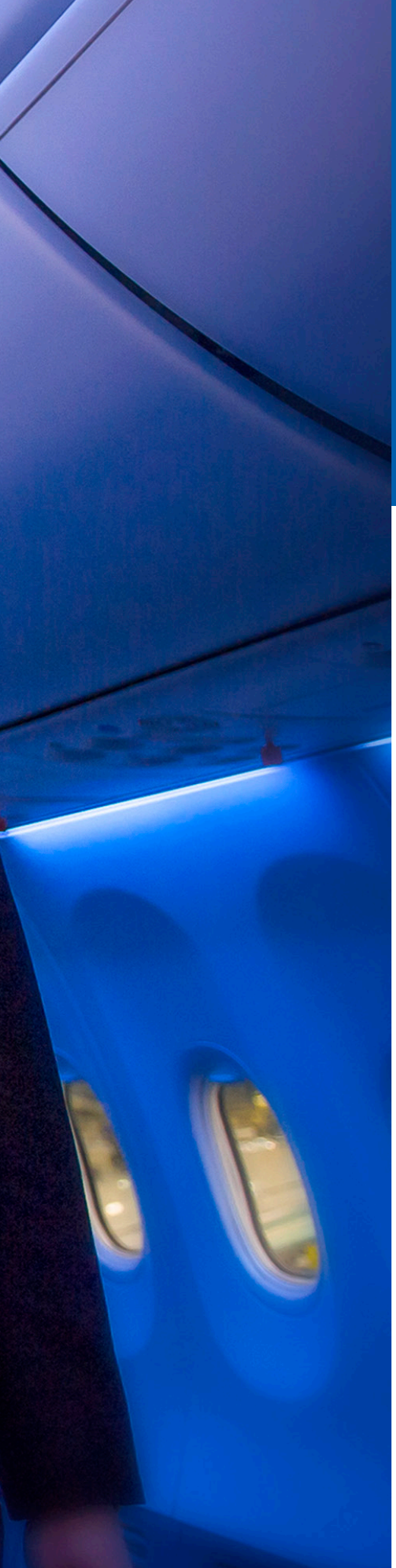
>> *"We have to be the first choice for our customers—that's the only way to guarantee the future of Commercial Airplanes. … We have to have the right people, products and services to do it."*

PHOTO: BOB FERGUSON/BOEING



Game plan for *success* >>

Making Commercial Airplanes the first choice of customers while establishing market-leading products and services for the next 20 to 30 years

Ray Conner joined Boeing in 1977 as a mechanic on the 727 program and proceeded to work his way up, holding many of Commercial Airplanes' key leadership positions. Last June, he took the helm as the commercial division's president and chief executive officer. A year into the job, Conner reflects on his vision for the organization, the challenges ahead and the first big test of his leadership—resolving battery issues on the 787.

What's your vision for Commercial Airplanes?

We work for one of the most iconic companies in the world. When I think about our future, I'd like Boeing to continue its legacy for another 100 years and beyond. I strongly believe that in order to do that, we have to be the first choice for our customers—that's the only way to guarantee the future of Commercial Airplanes. It's not an easy task. We have to have the right people, products and services to do it.

What's your game plan for succeeding in this highly competitive marketplace?

We'll succeed by providing the best value proposition to our customers through the products, services and support we provide. That means executing on our rates and deliveries, driving efficiency throughout the value stream, investing in new products, and growing our people.

What's the biggest challenge you see for Commercial Airplanes?

Competing from a cost standpoint. We have the strongest product lineup in the industry, but unless we increase productivity in the way we design and build airplanes, we will always face a tough challenge in the market. Our competitors have more financial resources and are able to be extremely competitive on price. That's what makes initiatives like Partnering for Success with our key suppliers, Lean+ in our production system, and functional excellence in airplane development so critical.

You meet with customers quite a bit. Where do they think we can improve? What do they consider our biggest strength?

Our customers would tell us we have the better-value products and services. In addition, they think we do great in a crisis. During the 787 battery situation we communicated constantly with our customers and they appreciated it. We helped show people we were doing the right thing. Where we have an opportunity to improve is in our day-to-day business, in the speed and

>> *"We also are utilizing the full potential of previous research and development investments and driving affordability into our products and services.*

PHOTO: Ray Conner, president and CEO of Boeing Commercial Airplanes, in the 737 factory in Renton, Wash. BOB FERGUSON/BOEING

efficiency of our responses to customers. Our processes also need to get leaner.

What did you learn as a leader during the 787 battery issue?

That it's important to set the tone early, stay engaged, and trust your team to do what's right. Everyone knew that there was nothing more important than getting the airplanes safely back in the air for our customers. We rallied around that. At the end of the day, it's all about people, with our team, customers, suppliers and government officials. I also learned it's important to be involved at the right level with each of them. Let the experts do their job and be there to help with any roadblocks they face along the way.

Commercial Airplanes is pursuing five development programs but also faces cost pressures. How will you address these seemingly contradictory priorities?

First I think these priorities go hand in hand, which is why we changed the structure of Commercial Airplanes to be aligned around three main businesses—production, airplane development, and our services and support business. By coring up all of our development programs together, we are better able to implement lessons learned from 747-8 and 787 across the board. We also are utilizing the full potential of previous research and development investments and driving affordability into our products and services. The other benefit to this structure is the life-cycle view of our products. More than ever before, we are starting earlier in the process to look at how we provide more value to the customer in terms of services and support once the product has entered service.

What value will the 777X and 787-10X provide to our customers?

They are far and away shaping up to be the most efficient machines out there, from both an operating cost and fuel efficiency standpoint. They will provide our customers with unsurpassed economics. The 777X builds off the most popular twin-aisle family and makes it even better. Both the 777X and the 787-10X will make it possible for our customers to prosper in an environment of rising fuel prices and more challenging noise and emission targets. Together, the 787 family and 777X will be a killer combo. No doubt about it.

What legacy do you want to leave as president and CEO of Commercial Airplanes?

When I walk out of here, I want us to be No. 1 in orders and deliveries. More important, my goal is that we have a pristine reputation with our customers, suppliers and communities—that we have the full array of products and services for our future. It's amazing when you think we are establishing the next 20 to 30 years of Commercial Airplanes' products and services right now, in the next five years. I'm proud to be part of that—of ensuring that we are prepared for the future and our customers are taken care of. ■

SUCCESSFUL ENGAGEMENT

International collaboration is critical as Boeing expands in emerging markets

By Jessica Kowal

Late last year, Kimberly Pearson and Joanna Szydlo-Moore of Boeing went to Turkey for a round of corporate networking. The two women, who scout for business opportunities in strategic markets, met with dozens of professors whose research might be relevant to Boeing's future.

Turkey has a young population, an expanding economy and ambitions for aviation. Boeing has commercial and defense customers there and a keen interest in broadening its global activities, especially in emerging markets.

It's the job of Pearson and Szydlo-Moore, who work for Commercial Airplanes' Marketing and Business Development team, to look for projects that benefit Boeing's growth and productivity and countries such as Turkey.

In February, a few months after their visit and discussions with company technology, product development and in-country leaders, Boeing and Istanbul Technical University, the country's leading aerospace engineering institution, announced they will jointly research how nanotechnology can improve air quality in commercial jet cabins.

"We look at the capabilities a country has and where we could potentially develop with them and grow to support our business interests."

– Kimberly Pearson (right), Marketing and Business Development, Commercial Airplanes

Pearson said the company's first research alliance in Turkey is an example of how Boeing is extending its ties in emerging economies, which are the

PHOTOS: (Top) Embraer engineer Fernando Guimarães, left, and Commercial Airplanes engineer Mike Dey with an Embraer E190 passenger jet in Saõ José dos Campos, Brazil. SÉRGIO ZACCHI (Left) Joanna Szydlo-Moore, left, and Kimberly Pearson of Commercial Airplanes' Marketing and Business Development. GAIL HANUSA/BOEING

fastest-growing markets for its products.

"We look at the capabilities a country has and where we could potentially develop with them and grow to support our business interests," Pearson explained.

Much of Boeing's current and future international business is linked to globalization and expanding investment in developing countries. These nations' evolving security needs have broadened opportunities for Boeing to grow international defense sales to 30 percent of revenue. And in Brazil, China, Indonesia, Russia, Turkey, the Middle East and elsewhere, airlines looking to accommodate first-time travelers have helped grow the company's commercial backlog to 4,400 airplanes.

Yet customers in these nations often want more from Boeing than superior airplanes or services, especially when the government has a financial stake in an airline or purchases defense products, according to Shep Hill, president of Boeing International.

"We have to think differently," Hill said. "We need to build win-win relationships in emerging markets to support Boeing's business and strategy. We can no longer simply fly into a country, make a sale and fly out. There is an added expectation that we will contribute to their local economy and help develop their skill base."

Hill's Boeing International team partners with Commercial Airplanes; Defense, Space & Security; and Engineering, Operations & Technology to strengthen the company's global presence to meet these objectives. Boeing's track record shows the company is making progress in this effort.

"We are keeping our promises to put a country's talents to work for Boeing products and industry at large," said Gwen Kopsie, BDS director of International Strategic Partnerships. "Our ability to deliver on our commitments—and to build on existing talent—is exactly why international partners want to work with Boeing."

Kopsie said the Boeing team continues to look for future collaborations in countries such as Brazil, Saudi Arabia and India, among others.

Collaboration is at the heart of the alliance that Boeing and Brazilian airplane manufacturer Embraer announced in April 2012. Every other month since early last year, Commercial Airplanes engineer Mike Dey and his colleagues have traveled to Embraer headquarters in Saõ José dos Campos, Brazil, to brainstorm and test ideas in flight simulators. In intervening months, the Embraer team visits Puget Sound.

These exchanges led to the announcement, last December, that Boeing and Embraer will reduce the risk of runway excursions by offering new pilot training, pilot procedures and flight-deck technology to customers. The companies are also cooperating in two Embraer defense programs, the A-29 Super Tucano and KC-390.

BUILDING RELATIONSHIPS

"Our work with COMAC develops our global resources and leverages unique Chinese research capabilities."

– Dong Yang Wu, managing director of Boeing Research & Technology–China

Dey and Embraer engineer Fernando Guimarães emphasize the value of reaching across company boundaries.

"Our collaboration is marked by respect, professionalism, enthusiasm and hospitality," said Guimarães, Embraer's product development manager. "We feel that we are a single engineering team working to achieve common objectives."

Dey, the manager of flight-deck engineering for Commercial Airplanes product development, agreed. "We have sparks of innovation when we toss ideas back and forth and see something new."

At times, though, collaboration is complicated by competition. China is Boeing's largest market outside the U.S., with anticipated 20-year demand for nearly 5,260 airplanes worth $670 billion, according to Boeing's long-range commercial market forecast. But Commercial Aircraft Corp. of China (COMAC) is building the C919, a competitor to Boeing and Airbus single-aisle aircraft.

Nevertheless, Boeing and COMAC are finding ways to work together. Over the past year, they opened a joint research center in Beijing and began three projects related to aviation biofuel and air-traffic management. They limit research to noncompetitive topics that will support sustainable growth for China's aviation industry and reduce carbon emissions—goals of both companies.

"The Chinese government expects Boeing will broaden its research cooperation in China. And our work with COMAC develops our global resources and leverages unique Chinese research capabilities," said Dong Yang Wu, managing director of Boeing Research & Technology–China, who oversees the Boeing-COMAC research relationship.

In April, Wu and her COMAC counterparts visited a laboratory in Hangzhou, China, to review the progress of research to lower the cost of converting waste cooking oil into aviation biofuel. As the Boeing and COMAC teams inspected lab equipment and heard promising early results, Wu was thinking, Wow, we are really making progress. ■

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Boeing's engagement in emerging markets has produced significant alliances in the past 18 months:

- **Brazil:** Expanded technology partnerships with Brazil's Department of Aerospace Science and Technology and National Institute for Space Research
- **China:** Working with Aviation Industry Corp. of China, or AVIC, to develop its capability to produce seats, galleys and lavatories
- **Indonesia:** Collaborating with government to support commercial aviation safety and efficiency
- **Malaysia:** Partnering on education and vocational training to support the country's future workforce
- **Qatar:** Working with Qatar Computing Research Institute on data analytics research
- **Russia:** Expanded cooperation in commercial services and titanium procurement and development
- **Saudi Arabia:** Hosted business students from Alfaisal University for an Emerging Leaders Program at the Boeing Leadership Center
- **Singapore:** Founding partner of the Advanced Remanufacturing and Technology Center, a collaboration between government, universities and companies
- **United Arab Emirates:** Awarded first direct composites supply contract in the Arab world to Strata Manufacturing, a Mubadala Aerospace facility

– Jessica Kowal

PHOTOS: (Far left) The collaboration between Boeing engineer Mike Dey, left, and Embraer engineer Fernando Guimarães, shown in the cockpit of an Embraer E175 jetliner, is part of a broader agreement by the two companies to work together. SÉRGIO ZACCHI (Above, left) Dong Yang Wu, managing director of Boeing Research & Technology–China. ZHIJIAN LIU (Above) Engineering teams from Boeing and Embraer visit the assembly line of Embraer's E-jets series in Saõ José dos Campos, Brazil. From left: Peter Gunn of Boeing, Todd Oakwood of Embraer, Suzie Ness and Dey of Boeing, Guimarães of Embraer. SÉRGIO ZACCHI

‘The coolest

Unmanned aircraft–maker Insitu has retained its innovative culture, by design

By Diane Stratman and Eric Fetters-Walp

Like many of the men and women who work for Insitu in and around Bingen, Wash., Jerry McWithey loves the recreational opportunities available in an area of the Pacific Northwest that overlooks the picturesque Columbia River Gorge.

With its often-howling winds, the “Gorge” is one of the best places on the planet for windsurfing. Nearby are mountains to hike and bike in summer, or ski and snowboard in winter. Boating and kayaking are popular. People come here to play and never want to leave.

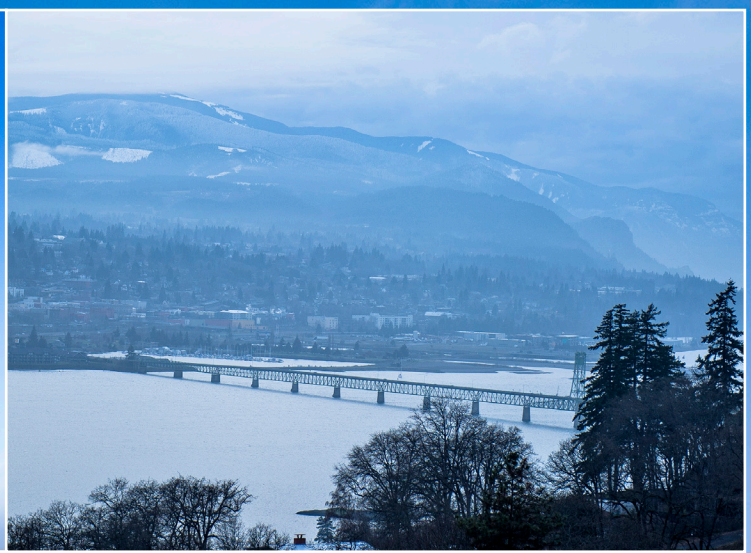
“How can you not love it here?” said McWithey, director of Flight Operations for Insitu. “Being sports enthusiasts, we definitely know how to have a good time.

“But, bottom line, play is play and work is work,” he added. “When it comes to work, we understand how critical our products are to those deployed in the trenches: the Marine, the sailor, the soldier in harm’s way. We want the product that leaves here to be cutting edge, to be the best it can possibly be.”

Insitu is a wholly owned subsidiary of Boeing and a pioneer in unmanned aircraft systems. Insitu’s roots go back to the company’s founder and a handful of windsurfing-loving employees who, in the late 1990s, designed and built a small unmanned aircraft

PHOTOS: (Below) Jennifer Sofinowski, left, and Hannah Rasmussen, both with Insitu Flight Operations, prepare a ScanEagle for flight and place it on a launcher. (Insets, clockwise from top left) Sofinowski holds ScanEagle; the unmanned aircraft’s electro-optic turret; a view of the Columbia River Gorge; Rasmussen, left, and Sofinowski place a propeller guard on the launcher; Sofinowski, from left, Robert Dulka, also with Flight Operations, and Rasmussen position a ScanEagle on a launcher.

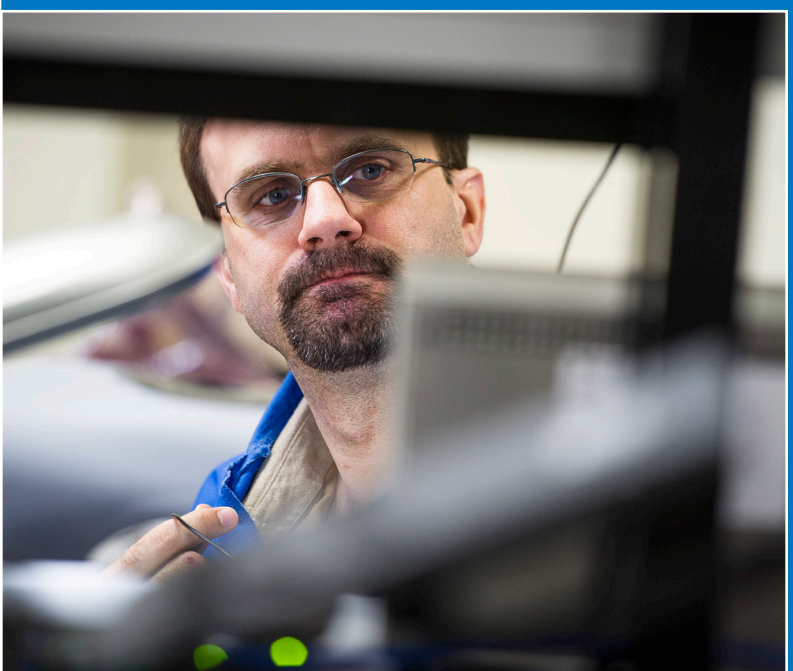
company’



“Because we are still relatively small, we get the opportunity to do a lot of different things, to wear different hats.”

– Kate Pinner, senior instructional design specialist

PHOTOS: (Opposite page, clockwise from top left) ScanEagle unmanned aircraft in production; Justin Pearce, left, Manufacturing test engineer, and Radjesh Azore discuss testing on the unmanned Integrator; Jim McClanahan, left, senior aviation technician and ScanEagle production team lead, and Darin Holtz, aircraft systems technician, run ScanEagle tests. (This page, from top) Darren Lanz, Manufacturing test engineer, evaluates ScanEagle test data; Azore performs testing on an Integrator.



with a high-quality video camera that could be launched and retrieved from a fishing boat to track tuna in the world’s oceans. It was called SeaScan.

Today, Insitu has about 800 employees, including about 200 who are deployed in the field in support of military operations.

“These seasoned professionals, many with multiple deployments, work side by side with the warfighter, continually providing feedback that allows us to fine-tune and adapt to customer needs, wants and desires,” said Steve Morrow, Insitu president and chief executive. “From training to logistics, and from production to operations, we have learned to operate leanly and with tactically significant results, fielding game-changing enhancements.”

Insitu’s headquarters is an unassuming building on the main street of Bingen, population 730, about 60 miles (100 kilometers) east of Portland, Ore. The company is probably best-known for ScanEagle, a small, unmanned aircraft with sophisticated, high-tech optics that can transmit real-time video while being controlled from a ship or mobile ground station, or even by an operator on the other side of the world.

In Iraq and later in Afghanistan, ScanEagle has proved its mettle as an invaluable intelligence, surveillance and reconnaissance vehicle for the U.S. military and its allies. ScanEagle also has been used for a growing variety of nonmilitary purposes, from tracking polar bears to spotting noxious weeds in Australia.

The company has developed a bigger and more capable unmanned aircraft known as the Integrator, and more cutting-edge products are in the works.

“It’s an agile, innovative company and it’s been fun to see a lot of changes,” said Kate Pinner, an instructional training designer who joined Insitu in 2007, one year before it was acquired by Boeing. After her best friend moved to the Gorge, Pinner, who likes to hike and snowboard, visited and fell in love with the area. It turned out that her degree in instructional design was perfect for a job opening with Insitu.

“Because we are still relatively small, we get the opportunity to do a lot of different things, to wear different hats,” Pinner said.

That view is shared by other Insitu employees, who say the company has retained its entrepreneurial culture and not strayed far from its roots.

“We’re always trying to problem-solve for the customer,” said Sam Trevino, an unmanned aircraft flight instructor who has worked at Insitu for six years. “We’re allowed to be creative and bend over backwards to help our customers.”

Creative thinking and problem-solving are part of the founding fabric of Insitu.

The then-fledging company’s first unmanned craft, SeaScan, was developed as a cheaper alternative for the tuna industry, which used expensive helicopters to track schools of the fish. The craft never found a successful market, but Insitu had set the stage for success later with ScanEagle by also developing and perfecting an innovative SkyHook retrieval system. It uses a hook on the end of the craft’s wingtip to catch a rope hanging from a pole. A shock cord reduces stress on the airframe caused by the abrupt stop.

Charlie Guthrie, Insitu senior vice president of advanced programs and engineering, and the company’s chief technology officer, recalled the first time he saw ScanEagle plucked from the sky with a rope.

“I thought this would never work,” he said. “But without this

crazy idea of snagging the aircraft out of midair with a rope, we wouldn't be where we're at today. It's one of the main reasons for ScanEagle's success. We don't need airfields or runways for deployment or landing. We can operate off ships, even off small fishing boats."

With Boeing's help, Insitu developed ScanEagle after the Sept. 11, 2001, terrorist attacks on the U.S. The partnership formally began in 2002, and the first ScanEagles were shipped to Iraq in 2004. In July 2008, Boeing announced an agreement to acquire Insitu as a separate subsidiary. Boeing and Insitu executives said at the time the acquisition was part of an aggressive plan by Boeing to grow its presence in the unmanned systems market.

"This agreement allows us to leverage the breadth and strength of Boeing to get our organization to the next level," Insitu said when the acquisition was announced.

Insitu soon opened a branch office in Queensland, Australia, underscoring the importance of the fast-growing international market for unmanned systems such as ScanEagle.

Although Insitu is a wholly owned subsidiary of Boeing, it has kept its small-company culture. Boeing wanted it that way, so Insitu could retain the unique culture and environment that drives its innovation and entrepreneurial agility.

That culture has been a magnet for those also drawn to the area's way of life and recreational opportunities.

"This is the coolest company to work for," said Caitlin Lynch, who handles events management for Insitu. Lynch started as an intern in 2008 and returned as a full-time employee in 2009 after graduating from college. During her year away, the company nearly doubled its employee head count.

"I like the opportunities the company has given me. I've met so many interesting people and gotten to see lots of things for someone who's only 25 years old," said Lynch, who has met generals and traveled to a number of different countries on Insitu's behalf. She said the small-company atmosphere and its internship program have allowed her to explore and soak up information "like a sponge."

Even though Insitu has grown significantly since the acquisition, employees say they have also learned and benefited from Boeing's decades of development and prototyping experience.

"As a parent company, Boeing has given Insitu better access to a library of standards for leadership and best practices, said Taylor Schwartz, integrated product team lead for ScanEagle ground control station.

Added Chuck Roberts, an engineering technician who works in the Engineering facility in Oregon: "We need Boeing. They can guide us because they've been there."

Trevino, the Insitu flight instructor, noted that Boeing has "provided tremendous opportunities to meet with potential customers, especially internationally."

As Insitu's customer base has grown, so have visits—sometimes by international military officials—to Insitu's modest headquarters. In 2009, about 30 groups visited Insitu. That doubled to 60 in 2010, a level that's stayed about the same since.

Insitu employees work out of several buildings spread across the Columbia River Gorge area of Washington and Oregon. Most of the employees will be brought together when a new complex in Bingen is completed. The current headquarters is on the highway that serves as Bingen's main street, right next to an antique shop and not far from Bingen's lumber mill. The area's landscape is

"I like the opportunities the company has given me. I've ... gotten to see lots of things for someone who's only 25 years old."

– Caitlin Lynch, Insitu events management

PHOTOS: (Above, from left) The business end of a ScanEagle; Kevin Block, aircraft systems technician, works on a ScanEagle payload; Tom Sawyer, aircraft repair technician. (Right) Erika Langhauser, left, and Edward Lee, both software integration engineers, run tests on a sensor.

dominated by the hills and bluffs that rise from either side of the wide Columbia River. The new complex under construction is located in a business and industrial park setting near the river called Bingen Point.

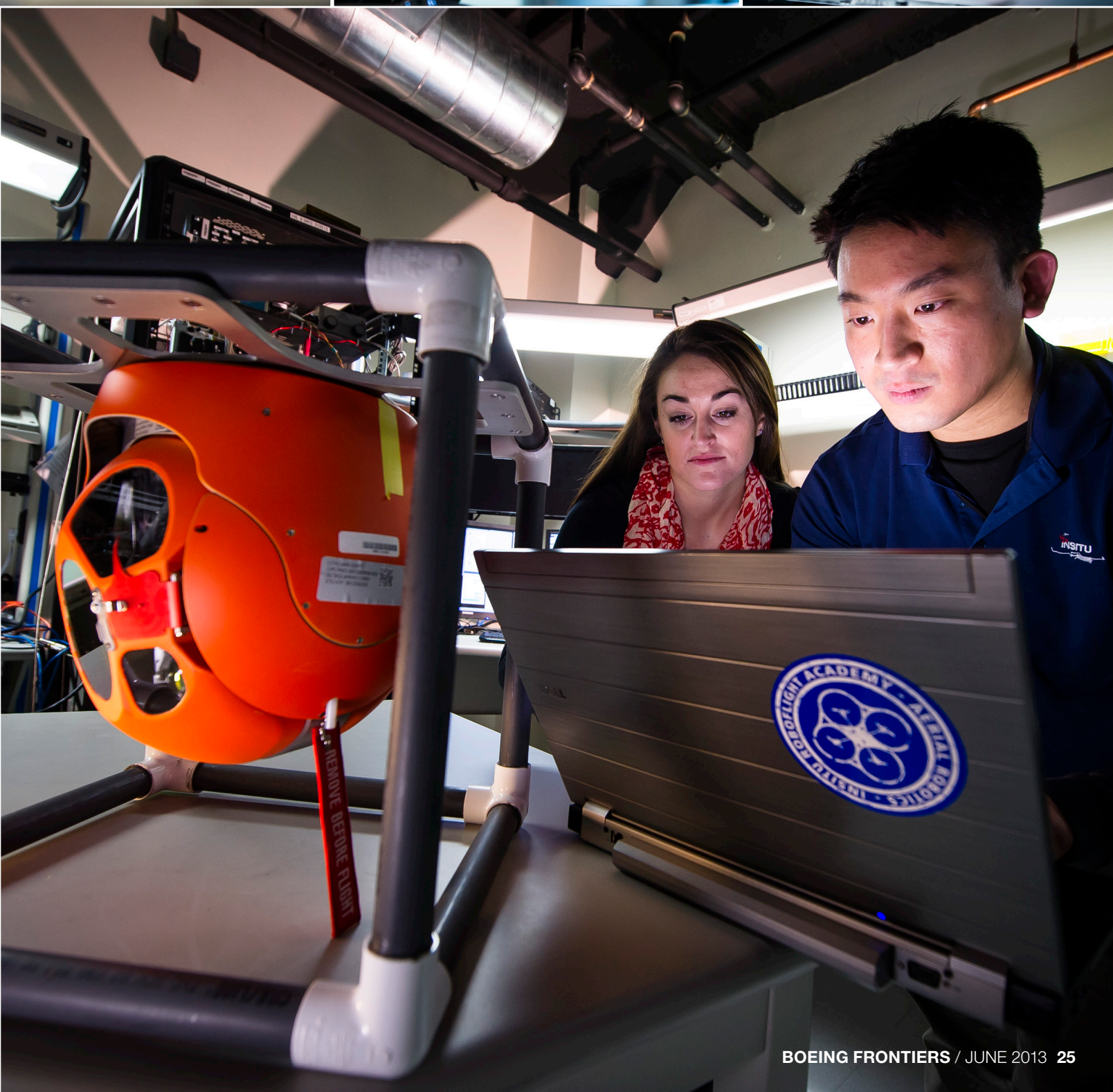
Reflecting the unassuming storefront office building in which the company is now based, Insitu employees dress in "business casual." On some days, employees are welcome to bring their dogs to the office. While employees make clear they work hard, many say they go directly from work to skiing, windsurfing or biking, depending on the season.

"You don't live in the Gorge and come to work in a suit," Schwartz said. While attending Central Washington University in Ellensburg, Wash., Schwartz interned in 2004 for Insitu when it had fewer than 100 employees. He began working there in 2007.

Of course, the Insitu culture is much more than what employees wear to work. Some of the first employees were avid windsurfers who had experience working with the composite materials used in windsurfing and snowboard manufacturing. Lightweight

(Continued on Page 29)


ScanEagle


REMOVE BEFORE FLIGHT
INSITU
INSITU BOEING ACADEMY OF FLIGHT - AVIATION ROBOTICS

Eagle eye

At a recent industry trade show, Caitlin Lynch, who handles events management for Insitu, heard something that gave her goose bumps—and an enormous feeling of pride.

"Two separate men came up to us and told us ScanEagle saved their lives in Afghanistan," she recalled. "To actually hear that firsthand was amazing."

ScanEagle, currently in service with the U.S. Defense Department, the Australian Defence Force and numerous other allied foreign militaries, is just one of the unmanned aircraft systems developed by Insitu, a wholly owned subsidiary of Boeing. Since 2004, coalition forces in Iraq and later in Afghanistan have successfully used ScanEagle for countless missions.

"ScanEagle is there when you need it," said Charlie Guthrie, Insitu senior vice president of advanced programs and engineering, and the company's chief technology officer. "At virtually a moment's notice, ScanEagle can be launched and get to the area where it's needed."

That ease-of-use capability is key to the small unmanned aircraft's success in providing real-time intelligence and reconnaissance, Guthrie pointed out.

Weighing less than 40 pounds (18 kilograms) and with a wingspan of only 10 feet (3 meters), ScanEagle is launched with a pneumatic catapult. For recovery, a hook on the end of the aircraft's wingtip catches a rope hanging from a 50-foot (15-meter) boom. An onboard computer and GPS units mounted on top of the pole guide the aircraft.

The unmanned aircraft can fly for more than 20 hours at up to 16,000 feet (500 meters), where it's still undetectable due to its small size and low noise. Missions can be preprogrammed or controlled in real time from a fully transportable ground station. Imagery from the electro-optical or infrared camera is returned by a downlink.

Besides military reconnaissance, ScanEagle can perform

missions such as border control, coastal monitoring, anti-sniper efforts, search and rescue, disaster relief and other missions that might be monotonous or dangerous for human pilots.

Keeping warfighters safer and helping others with the ScanEagle means a lot to all those who work at Insitu, according to Sam Trevino, one of the company's unmanned aircraft flight instructors.

"It means a whole bunch, almost as much as it did when I was in the Army," Trevino said. "Now I'm the guy who supports warfighters with information, so that when they run through a door in the field, they know what to expect."

In 2009, Trevino took part in a mission to rescue a U.S. cargo ship captain being held hostage by Somali pirates near the Horn of Africa. He was one of several ScanEagle pilots on board a U.S. destroyer that launched one of the unmanned systems to provide video surveillance of the small pirate vessel where the captain was being held. The pirates never knew ScanEagle was watching them high overhead. As a result of the unmanned system providing real-time video intelligence as the hostage situation played out over several days, a U.S. Navy Seal team was able to save the captain.

The critical role played by ScanEagle in that successful rescue mission was extensively reported by the media.

"It was awesome to have the spotlight on the product for that," said Taylor Schwartz, integrated product team lead for the ScanEagle's ground control station. "Sometimes you get so involved with your work here, you forget what the products are doing and how they're helping in the field."

– Diane Stratman

The ScanEagle used in the 2009 mission to rescue the U.S. cargo ship captain from pirates has been donated to the Museum of Flight in Seattle, where it will be put on display.

PHOTOS: (Clockwise from far left) A ScanEagle is launched from a pneumatic catapult from the USS *Comstock*; the unmanned craft in flight during launch and recovery exercises. **U.S. NAVY** A close-up of a ScanEagle used by the U.S. Marine Corps in Afghanistan. **U.S. MARINE CORPS**

“This is just the leading edge that we’re working on. It’s a technology that’s ready to burst open.”

– Gary Holder, a maintenance planner for Integrated Logistics Support

composites are also used in Insitu's unmanned aircraft such as ScanEagle.

"They came here for the lifestyle," Jon Malmberg, a manufacturing engineer at Insitu, said of the company's founders. But they also had a vision for developing unmanned systems. "There's a very deep-seated lifestyle that is mixed with this company's roots."

Malmberg has worked at Insitu since 2010 but has lived in the area on and off for 20 years, attracted first by the windsurfing. Despite having a technology and engineering background working for a variety of large companies, Malmberg lived in a van near the Columbia River to pursue his passion.

Gary Holder, a maintenance planner for Integrated Logistics Support, was one of the first 50 employees hired and has worked at Insitu for more than nine years. The U.S. Coast Guard veteran left his technology job in the Seattle area more than 20 years ago in favor of the Columbia River Gorge's recreation opportunities, at times doing carpentry to support himself.

Holder and other Insitu employees know the future has never been brighter for unmanned aircraft.

"This is just the leading edge that we're working on," Holder said. "It's a technology that's ready to burst open."

In addition to the much bigger and more capable Integrator developed by Insitu, the company also has developed a modified ScanEagle with infrared technology that can see through dark, smoke, fog or haze, bringing daylight-quality imaging to night operations.

"ScanEagle with our mid-wave infrared turret literally opens up the night," said Curtis Chesnutt, senior vice president of ScanEagle programs.

Meanwhile, the bigger Integrator is already in operations. It maintains the same long endurance and small footprint of ScanEagle, but has reconfigurable bays to carry custom payloads.

"Integrator's extended capabilities allow missions to be equipped rapidly with the most advanced payload to suit unique mission objectives," said Ryan Hartman, senior vice president of Integrator Programs. "In operational environments where change is the only constant, this level of versatility can be the key to mission success."

And there is more to come. Insitu is developing an imager that will enable unmanned aircraft to focus on a wide area, or zoom in for a closer look—at the same time.

Chesnutt said the imager does the job of a 2.5-foot-long (0.8-meter) telescope in a device only 6 inches (15 centimeters) long.

"Imager is a game-changer in the industry," he said. "Its continuous optical zoom and picture-in-picture view enable operators, imagery analysts and commanders to simultaneously view a broad area on land or sea while zooming in on a specific object of interest."

This kind of innovation is what makes Insitu such an exciting place to work, said Mason Welp, an electronics technician who joined Insitu five years ago. He grew up in The Dalles along the Oregon side of the Columbia Gorge and served 12 years in the U.S. Navy.

"One of my favorite things about the company is that this technology is still in its infancy," Welp said. "We're like the Wright brothers or the auto industry 100 years ago." ■

diane.l.stratman@boeing.com

For more on Insitu and what Boeing is doing in the fast-growing unmanned systems business, see the July 2009 and July 2010 stories in Frontiers.

PHOTOS: (Clockwise from far top left) Robert Dulka, left, Flight Operations fleet maintenance technician, and Nereida Ford, field service technician, place a ScanEagle on a launcher; Mike Daly, left, director of software, and Mason Welp, engineer, inspect a ScanEagle turret; Hannah Rasmussen, foreground, and Jennifer Sofinowski plot the navigation path for a ScanEagle flight in the ground control station; engineer Doug Miller, left, and electrical engineer Chris Erickson, both with Radio Frequency Communications, run tests on the Integrator.

a rich heritage

Boeing and France have enjoyed a long and close relationship

By Bill Seil

The Los Angeles International Air Meet, held in 1910, featured some of the day's pioneering aviators, including Glenn Curtiss of the United States and France's Louis Paulhan. Among those attending the show was 29-year-old Bill Boeing. Impressed by Paulhan and his Farman biplane, Boeing tried to get a ride with the French aviator. That didn't happen, but Boeing left the show with a newfound passion—airplanes. Six years later, he founded the company that bears his name.

Today, The Boeing Company enjoys a special relationship with France, one that at first glance might seem odd given that Boeing's main competitor in commercial aviation, Airbus, is based in France. This makes the French aerospace market challenging for foreign companies. Yet, Boeing has been very successful in selling commercial airplanes to French airlines and forming partnerships with French companies.

"France is often referred to as the home of our primary commercial competitor, but in truth it's a country that is the home to some great Boeing industrial partners and longtime customers," said Shep Hill, president, Boeing International, and senior

PHOTOS: (Far left) A view of Paris from above the Eiffel Tower looking across the Seine River. ALAIN ERNOULT (Above) Pilot Louis Paulhan is carried on the shoulders of supporters at the 1910 Los Angeles International Air Meet, where his flights impressed Boeing founder Bill Boeing. MUSEUM OF FLIGHT COLLECTION (Left) A period poster publicizing the 1910 Los Angeles International Air Meet. SEAVER CENTER FOR WESTERN HISTORY RESEARCH, LOS ANGELES COUNTY MUSEUM OF NATURAL HISTORY

vice president, Business Development and Strategy.

"We've always found France to be very open and friendly to The Boeing Company," Hill added, pointing out that Boeing and French airlines have been close allies since the dawn of the jet age. Air France has been an important contributor to planning requirements for new commercial airplanes, and French industry has been a key supplier to commercial airplane programs.

Boeing jetliners have been successful in the competitive French market since 1955, when Air France became the first airline outside the United States to acquire a Boeing 707. Boeing has had a particularly strong connection with Air France, which, in 2004, merged with KLM Royal Dutch Airlines to form the Air France–KLM Group. Air France was the launch customer for the 777-300ER (Extended Range), the best-selling long-haul twin-aisle airplane in the world. It was also the launch customer for the 777 Freighter and 747-400ER Freighter.

Boeing has provided equipment to the French military for more than 50 years and is currently under contract to perform an extensive upgrade of France's E-3F Airborne Warning and Control System (AWACS) aircraft.

France has significant industrial and technological capabilities that Boeing is able to leverage into many of its programs, Hill said. For example, eight French suppliers support the 787 program.

More than 40 Boeing employees work in France, mostly in and around Paris. They are involved in supplier management, technical assistance, sales and managing operations.

Yves Galland, president, Boeing France, said the quality of Boeing's products and the relationships it has built with customers give it a strong competitive advantage.

"Here in France we are surrounded by competitors, but we have remained strong in the commercial airplane market by offering outstanding products and listening to our customers," Galland said. "We're also working constantly to take the initiative and surprise the industry with innovative strategies."

One such strategy was the creation of the Boeing French Team, a group of key suppliers gathered by Galland in 2005. The team, which now includes the chief executive officers of 15 French suppliers,

"Here in France we are surrounded by competitors, but we have remained strong in the commercial airplane market by offering outstanding products and listening to our customers."

– Yves Galland, president, Boeing France

PHOTO: ALAIN ERNOULT

PHOTOS AND ILLUSTRATION: (Center) Crowds in Paris tour Air France's first Boeing 707 in 1959. BOEING ARCHIVES (Far right) This 737-300 QC (Quick Change) is part of Europe Airpost's fleet of 19 Boeing 737s. EUROPE AIRPOST (Above) An artist's concept of the 787 Dreamliner in Air France livery. Air France–KLM has 25 787-9s on order, with options for 25 more. BOEING

Airlines in France that operate Boeing jetliners

AIRFRANCE

Headquarters: Paris–Charles de Gaulle Airport

74 Boeing airplanes in service

Passenger fleet: Seven 747-400s, 25 777-200ERs (Extended Range) and 37 777-300ERs

Cargo fleet: Three 747-400 Freighters, two 777-200Fs

(*Note:* The data above refer to Air France only—not the full Air France–KLM fleet.)

Air France has four 777s on order, and the Air France–KLM Group has 25 787-9s on order.

EUROPE AIRPOST

Headquarters: Paris–Charles de Gaulle Airport

Fleet: 19 Boeing airplanes in service, including 13 737-300QCs (Quick Change), two 737-300Fs, two 737-400Fs and two 737-700s

transavia.com

Transavia France (60 percent owned by Air France, 40 percent by Transavia Airlines in the Netherlands)

Headquarters: Paris–Orly Airport

Fleet: 11 Boeing 737-800s in service

(*Note:* The airline plans to expand its fleet with three Next-Generation 737-800s by 2014. See Page 11.)

CORSAIR

Corsair International (owned by TUI)

Headquarters: Rungis, France, with main base at Paris–Orly Airport

Fleet: Three 747-400s in service

XL Airways France

Headquarters: Paris–Charles de Gaulle Airport

Fleet: Three 737-800s in service

Air Méditerranée

Headquarters: Juillan, France–Tarbes-Lourdes-Pyrenees Airport

Fleet: One 737-500 in service

open skies BRITISH AIRWAYS

Open Skies (a French subsidiary of British Airways)

Headquarters: Rungis, France, with main base at Paris–Orly Airport

Fleet: Three 757-200s in service

meets as needed to plan initiatives and events that highlight and encourage the participation of French industry in Boeing programs—both commercial and military.

For example, nearly 300 partners, customers and journalists attended an event in Paris in 2010 to showcase Boeing's partnership with French suppliers on the 787 Dreamliner. Attendees were given briefings and toured an exhibit displaying parts for the 787 built by French suppliers.

"We called it 24 Hours of the Dreamliner," Galland said. "Here in our office we displayed all of the parts produced by French industry that are used on the Dreamliner—everything from sections of the passenger door by Latécoère to elements of the electrical brake system by Messier-Bugatti-Dowty. It was very successful in highlighting the strength of French industry in Boeing products."

The Boeing French Team has traveled to Seattle a few times to meet with leaders from Boeing Supplier Management. And in 2012 they met in Paris for a wide-ranging discussion with Hill, Galland and Jim McNerney, Boeing's chairman, president and chief executive officer.

Galland said Boeing's supplier network in France contributes to approximately 25,000 jobs in France. Overall, the partnership between Boeing and the French aerospace industry is valued at $4.5 billion per year ($3.25 billion through direct sales to Boeing airplane programs; $1.25 billion paid by airlines and others for spare parts and systems to maintain Boeing airplanes). Boeing's economic contribution to France continues to grow as the company ramps up production in the 787 and 737 programs.

Overall, there are more than 100 French companies involved in Boeing programs, including Snecma, a subsidiary of the Safran Group. In partnership with General Electric, Snecma has delivered thousands of engines to power Boeing commercial and military airplanes, including the 737. The fuel-efficient 737 MAX now in development will be powered by their new CFM LEAP-X1B engine. Snecma also partners with General Electric in manufacturing engines for the Boeing 767 and 777.

The French market for the sale of military products is limited for companies based outside of France. Still, Boeing remains engaged with the French military and is constantly pursuing new opportunities, Galland said. In the fall of 2012, a Boeing Unmanned Little Bird H-6U helicopter operated from the French naval frigate *Guépratte* in the Mediterranean Sea, off the southern coast of France, and successfully demonstrated its ability to conduct autonomous landings and takeoffs from a moving ship.

France is the largest NATO country that does not currently operate heavy-lift helicopters, so there might be future opportunities for the sale of Boeing Chinooks to France, Galland said. France owns and operates 14 Boeing KC-135 refueling aircraft, as well as four AWACS aerial surveillance airplanes.

Chad Hammond is Boeing's in-country project manager for the French AWACS Mid-Life Upgrade program, which began this spring when the first of the four aircraft arrived at Air France Industries Le Bourget Airport facility near Paris. Air France Industries, a unit of Air France, is performing the upgrade under Boeing supervision. The first of the four French AWACS aircraft is scheduled to be returned to the French military in July 2014. Work on all four of the airplanes will be completed by the summer of 2016.

The upgrade replaces technology that was developed in the 1970s and early 1980s with modern Windows-based technology. France is the first to receive the upgrade outside the United States.

"The upgrade will enable the French Air Force, one of America's closest NATO allies, to remain both nimble and effective, through the year 2035 and beyond," Hammond said. "It will allow the French AWACS to process more data and be fully interoperable with the U.S. AWACS fleet. Hammond said Boeing has a strong working relationship with Air France Industries, which performs maintenance, repair

PHOTOS: (Above, from left) French supplier Latécoère manufactures composite passenger doors for the 787. LATÉCOÈRE Boeing is under contract to perform an extensive upgrade of France's E-3F Airborne Warning and Control System, or AWACS, aircraft. ALAIN ERNOULT (Right) Visual inspection of a CFM56-7B engine at the Snecma customer delivery center in Melun Villaroche, France. SNECMA/SAFRAN

Working together to help

Boeing, its French suppliers and a French nonprofit organization have joined forces to train promising unemployed candidates for careers in aerospace and related industries.

Since 2005, Boeing France has supported Les Restos du Coeur (Restaurants of the Heart), the most popular French nonprofit organization that addresses hunger, unemployment and homelessness.

"We're now focusing on what has become a serious problem in France, which is unemployment among disadvantaged people," said Yves Galland, president, Boeing France.

Initially, Boeing provided funding to support the organization's winter campaign program, which delivers food to the needy during the cold winter months. Over the years, Boeing has worked with Les Restos du Coeur on programs related to infant support, housing, and social and professional rehabilitation.

The next level in the partnership is now represented by the Solidarity in Aerospace program, which involves Boeing industrial partners in France.

In 2011, Boeing and Les Restos du Coeur launched Solidarity in Aerospace—"Aéronautique Solidaire"—an initiative designed to provide aerospace training and industry job placement assistance to disadvantaged individuals in France.

"The program uses a very dynamic sector of the French economy, the aerospace industry, to provide training," Galland explained. "Boeing, with its supplier base, has a fantastic network. We are all working together to help these people find jobs."

Each program session begins when Les Restos du Coeur selects a group of 15 individuals to participate in the training. They attend a two-week training session at the Châteauroux airport in the center of France. This is followed by a three-week training period at the facilities of Boeing partners throughout France.

"The program has been a real success," Galland said. "It's another example of how Boeing, working with its suppliers, can achieve success—not just in business, but in helping the communities we serve."

The program thus far has found jobs or further professional training for about half the participants. Many of the jobs are offered by Boeing suppliers. The program's impact has been significant—and gratifying. As one of the participants wrote to Galland after she finished the program and found a job: "At 46, I will at last be able to breathe and not to live in fear for my son and myself."

– Bill Seil

and overhauls on both commercial and military airplanes.

Having excellent relationships with customers and suppliers is vital to Boeing's competitive strength in France, according to Todd Nelp, vice president, European Sales, Boeing Commercial Airplanes. "Our success in France begins with our products," Nelp said. "We have the best twin-aisle, long-haul airplanes in the world and our French airline customers recognize that. It's also about people and relationships. We're always working to earn the trust of our customers and maintain the solid relationships we've built over the years."

Nelp said France has historically been a strong market for Boeing products, with the 777 serving as the backbone of the Air France long-haul fleet. In the single-aisle market, the 737-800 has had strong sales. In late 2011, the Air France–KLM Group signed an order for 25 787-9 Dreamliners, with options for 25 more.

Working with Air France and the other French airlines has been an excellent experience at both a personal and professional level, according to Nelp.

"They know what they're doing, they're professional and they're good business people," Nelp said. "They appreciate honesty, and appreciate the fact that we meet our commitments. And I don't sense any bias toward one manufacturer over another. They're looking for the best answers for their airlines when it comes to products and services."

Jean Thouin, a Boeing Commercial Airplanes sales director for Europe, is in charge of the Air France–KLM account and the French market. Thouin said French airlines fill different market niches, but Air France is by far the country's predominant airline.

"Air France for the longest time has been involved in the development of new Boeing airplanes," Thouin said. "It wants to be involved in the design of the airplane's performance and capabilities—basically what it will look like and what it will do."

This participation has been very beneficial to Boeing because Air France is a very representative airline with a great deal of expertise, he explained. Its passenger and cargo operations are well integrated and it has an extensive route system throughout the region and the world.

In late 2011, the Air France–KLM Group signed an order for 25 787-9 Dreamliners, with options for 25 more.

Its product needs are representative of many airlines around the world. Air France offers European and domestic service within France, but the TGV high-speed rail system is a serious competitor that connects cities within France and neighboring European countries. Thouin said travelers tend to prefer the train for trips of three hours or less.

Transavia France, a subsidiary of the Air France–KLM Group, operates a fleet of Next-Generation 737s. It offers French travelers low-cost fares to leisure destinations outside the country, such as North Africa and the Mediterranean region.

Several other French airlines fly Boeing airplanes. Europe Airpost, for example, operates Boeing 737-QCs (Quick Change), as well as 737-700s. The Quick Change models carry passengers during the day and are changed to cargo configuration at night to transport mail.

Tony Simpson, managing director for Europe, Boeing Capital Corporation, noted that France's commercial banks are among the industry leaders in financing the purchase of Boeing airplanes.

"French banks have deep and very experienced teams that are able to structure aircraft financing in every part of the globe," Simpson said. "Their loan structuring capabilities help make financing our aircraft low-risk with lucrative returns."

Air transportation plays an important role in French tourism; France is the No. 1 tourist destination in the world.

"France remains a fascinating country," Galland said. "Around 70 million people visit France each year. There's marvelous sightseeing everywhere—from Paris to the mountains to the seas. France has a rich heritage, and Boeing is proud of its continuing role in this important and dynamic country." ■

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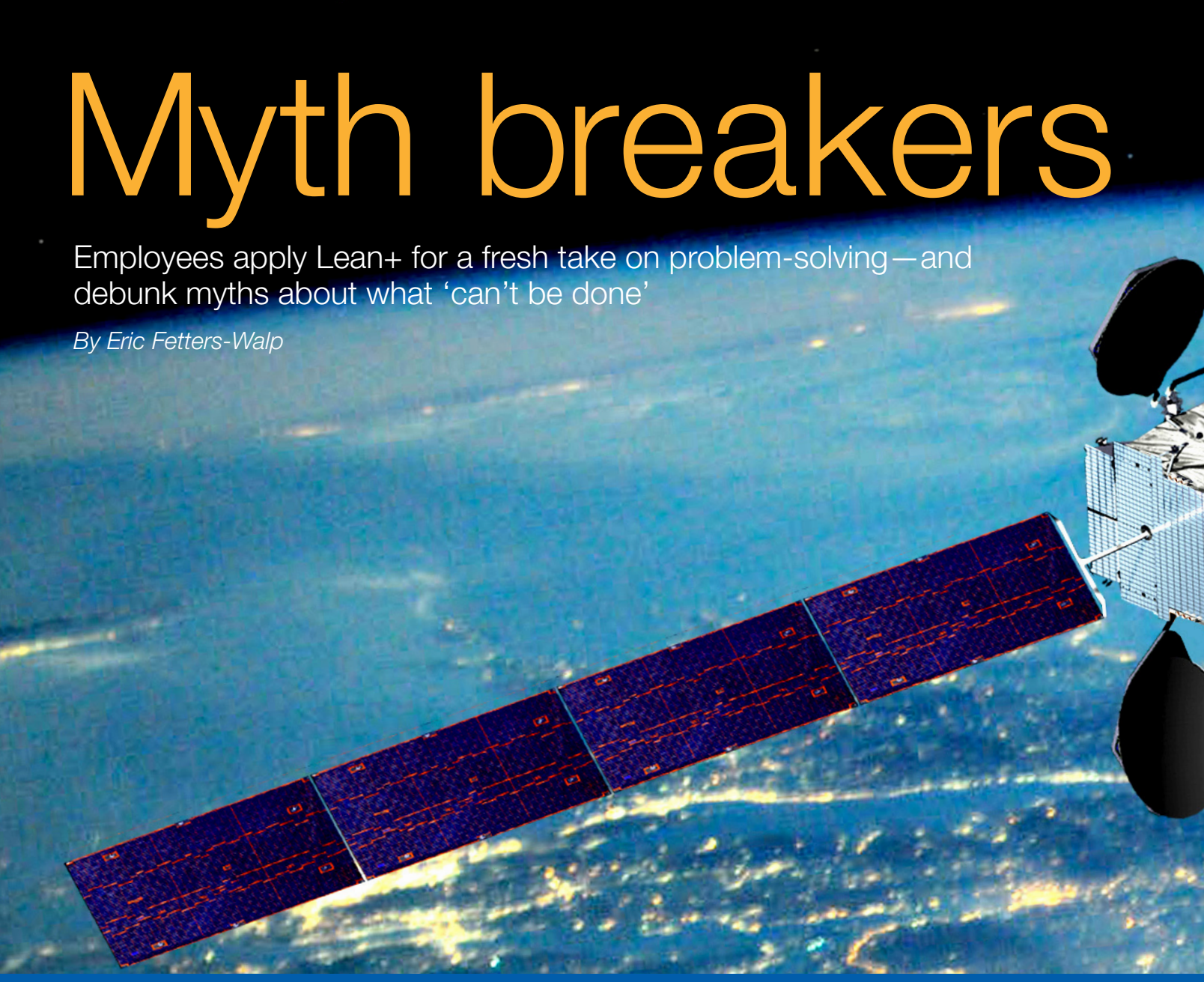
PHOTOS: (Far left) An employee of Zodiac Seats, left, trains a Solidarity in Aerospace program participant. L'IMAGE PRO PHOTOLOUIS (Above) Boeing 787 landing gear are assembled at the Messier-Bugatti-Dowty final assembly facility in Everett, Wash. GAIL HANUSA/BOEING

Myth breakers

Employees apply Lean+ for a fresh take on problem-solving—and debunk myths about what 'can't be done'

By Eric Fetters-Walp



Preventing satellite quality issues, completing quarterly financial reports on time and accelerating 777 production are challenges that might appear to have little in common.

Yet employees trying to address these challenges found that applying Lean+ was effective in each case. But first, they had to overcome certain myths about what can and cannot be accomplished.

"Lean+ is about solving problems and realizing opportunities," said Dayde McLaughlin, director of the company's Lean+ initiative. Although employees are putting Lean+ into action more often across the entire enterprise, she noted, "even with our best efforts now we know that 40 percent of hidden opportunity is left on the table."

Capturing that lost value requires doing more than tackling obvious opportunities to increase efficiency. It requires taking a fresh look at long-standing processes across the company, said Bill Schnettgoecke, vice president of Supply and Operations Chain, Boeing Defense, Space & Security, and Lean+ initiative leader.

> "If we're going to reinvent the way we do things, we need to break some of the myths and norms we have today."
>
> *– Bill Schnettgoecke, vice president of Supply and Operations Chain, Boeing Defense, Space & Security, and Lean+ initiative leader*

"If we're going to reinvent the way we do things, we need to break some of the myths and norms we have today, Schnettgoecke said. "And we need to devote resources to permanently solving the right problems. We are being challenged to adopt a myth-breaking mindset to increase productivity, improve safety, develop new products more efficiently—and more."

Myths about what can—and cannot—be accomplished abound in a company of Boeing's size. Often problems are fixed without adequately addressing all their

root causes, and the fixes become the new "standard" process, which can lead to other issues down the road—and perpetuate the myth the problem may never be completely solved, according to Schnettgoecke.

That's what a team at the Satellite Development Center in El Segundo, Calif., discovered as it worked to reduce small but costly problems cropping up in the satellite factory. Through the implementation of Lean+, the team was able to find underlying causes of these problems and then develop and install permanent solutions.

The Satellite Development Center developed a process years ago to help spot and fix potential defects that could prevent a satellite assembly from being unfolded in space. This process relies on inspection, verification measurements and deployment testing during the satellite build and test phases, explained Karen DeWeese, Engineering "Capturing the Value of Quality" project lead for Space and Intelligence Systems.

DeWeese found that many employees believed it was not practical to introduce design process changes to eliminate the problem, due to the complexity of the satellites they build. A myth had developed that further improving the design process would be too difficult or prohibitively expensive.

"We needed a culture shift from addressing these problems as they arose, to preventing them at the start," said Mike Littleton, the Root Cause Analysis subject-matter expert who worked with the team.

To tackle these challenges, DeWeese and Bob Morita, senior manager of Space and Intelligence Systems Mechanical System Architecture, led a team of employees with different areas of technical expertise to dig down and discover the problem's root causes. The team found discrepancies in computer-aided designs; tasks that didn't have a specific person held responsible for their completion; and insufficient design standards.

After these matters were addressed, programs were able to identify and often

ILLUSTRATION AND PHOTO: Boeing's satellites team used Lean+ to find ways to improve manufacturing efficiency, as well as the quality of products such as the 702MP (medium power) satellite (illustration) and the Wideband Global SATCOM, or WGS, satellite (inset photo).
ILLUSTRATION: BOEING; PHOTO: JONATHAN DAVINO/BOEING

eliminate any potential interferences—and prevent costly rework and repair problems, DeWeese said.

Getting past the belief that "it just isn't possible" was something that 777 employees had to do last year as they prepared to increase production, said Brook Alongi, a 777 Tooling manager.

One of the biggest concerns at the Everett, Wash., factory was the speed of the line move. Employees needed to consistently cycle aircraft fast enough to hit a 2 a.m. "saddle-on" time—when all the body sections have been loaded into the final join position and the saddle that supports mechanics is lowered into position.

"One of the greatest contributors to increasing our efficiency was the formation of a cross-functional Employee Involvement team," Alongi said, adding that the program also improved processes and technology to reduce some of the line's major bottlenecks. "After every line move, the cross-functional team meets and we discuss any issues that came up, even if they were a five-minute delay, and we talk about how we can prevent them in the future."

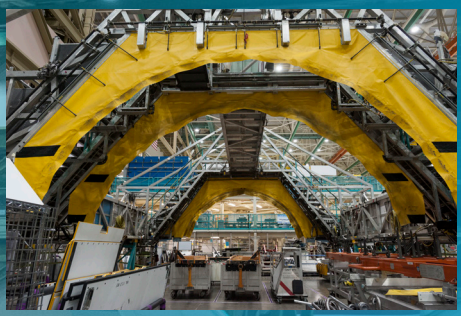
> "Lean+ is about solving problems and realizing opportunities."
>
> *– Dayde McLaughlin, director of the company's Lean+ initiative*

After hitting the 2 a.m. saddle-on goal every two-and-a-half days, the program set and met an aggressive 1 a.m. goal by last summer.

"Since then, we've been able to achieve the saddle-on within 10 to 15 minutes of the 1 a.m. goal on a regular basis," Alongi said.

The Corporate Finance office also used Lean+ to meet a daunting goal: In order to produce and file quarterly financial statements on time, the team had to reduce its 15- to 20-day protocol for closing the books to just five days.

"The biggest myth around the five-day close was that it couldn't be done due to the inherent complexity of our processes in the company," said Karen Archiable of Corporate Finance. "So we first looked at



the things that were the biggest drivers and that took the longest time in our process, and we attacked those first. And then we looked at all of the other areas and we used a lot of Lean+ workshops and process improvements to help us reduce our cycle time and improve our efficiencies."

McLaughlin, the Lean+ initiative director, said it's important to remember that Lean+ is about simplifying processes to improve them, but that's different from taking shortcuts. "It's not about ignoring the complexity of a problem, but distilling it, understanding it," she said.

Archiable acknowledged she was a skeptic about Lean+ when her team began using it, but achieving its goal has changed that. "The biggest thing I would tell people is to keep an open mind, to look at their biases, their assumptions and the myths that they hold."

Once employees and teams try using Lean+, they often have a similar experience to Archiable's, according to Schnettgoecke. The emphasis continues to be on moving Lean+ from Boeing's production areas—where there have been countless successes—further into the company's offices, he said.

"We look at all the successes we've had at the factory level by applying Lean+ tools. Most of our people don't work in factories—just think of all the value we still could realize," Schnettgoecke said. "The opportunity there is huge."

In a time of reduced military budgets, new international competition and customers facing their own cost pressures, taking advantage of that opportunity can help win contracts, DeWeese noted.

"Anything we can do to make the cost of our products more competitive and help to increase customer satisfaction pays dividends in multiple dimensions," she said. ■

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PHOTOS: (Above, left) To support a higher production rate, the 777 program used Lean+ to ensure steps in the assembly process—including lowering the "saddle" used by mechanics to connect body sections in the final join position—could be done faster and more effectively. (Insets, from top) A close-up of the saddle; Cara Nielsen, body join mechanic, attaches a systems bracket in the wheel well of the 777; Tony Collins, left, and Simon Atkins, 777 lower body join mechanics, consult during the overnight third shift in Everett, Wash. PAUL GORDON/BOEING

More than a paycheck

Boeing's total compensation package sets it apart from other companies

By Ron Taylor and JoAnn Houlihan

Even as a child, Brian Eisenbeis had a passion for things that fly. He studied aerospace engineering at Texas A&M, deep in the heart of NASA territory, and figured he'd get hired by the space agency or another local aerospace company.

Then Eisenbeis discovered Boeing at a career fair.

In 2006, he applied for and was selected for a Boeing internship. As a young engineering intern, decades away from retirement, Eisenbeis signed up for Boeing's Voluntary Investment Plan, or VIP, a 401(k) plan, which enables employees to save for retirement on a pretax and after-tax basis.

When it came time to consider permanent employment, Eisenbeis said, he studied Boeing's offer and compared it with those he received from other companies.

"I'm an engineer and pretty analytical," he said. "I looked at everything—health care, pension, VIP. It wasn't just about salary."

Today, Eisenbeis is an aerodynamics engineer with Product Development in Boeing Commercial Airplanes. He still has that childhood passion for things that fly.

> "I'm an engineer and pretty analytical. I looked at everything—health care, pension, VIP. It wasn't just about salary."
>
> *– Brian Eisenbeis*

And he's still contributing to the VIP, and taking advantage of other benefits from Boeing's total compensation package.

Last year, the company invested $23.6 billion in total compensation for employees including pay, incentives, benefits and well-being programs, according to Boeing financial data. Total compensation at Boeing generally falls into those four major categories. (Employees can learn more about their total compensation next month when their Total Compensation Profiles are refreshed on TotalAccess.)

"We've designed our total compensation package to set us apart as an employer of choice," said Tony Parasida, senior vice president of Human Resources and Administration. "And we work to keep near the top of our peer group so we can attract, develop and retain the top talent that will support our global growth."

In addition to getting the company match to his VIP, Eisenbeis participates in the new Advantage+ health plan and contributes to a Health Savings Account.

"The Health Savings Account is a great way for someone healthy to stack up a nest egg of savings for future potential health care expenses," he said.

Boeing offers a comprehensive, market-leading benefits program that adds significant value to the total compensation package, Parasida explained. These benefits include medical, dental, vision and prescription drug coverage, life and accident insurance, short- and long-term disability plans, and retirement benefits.

Parasida noted that even with recent changes, Boeing employees pay, on average, 8 percent of the cost of company health care plans through payroll contributions, and with the "no paycheck" cost plan option, some pay nothing at all. Employees at many other aerospace companies pay up to 25 percent of the cost.

Doug Clauson, an 11-year Boeing veteran who works in Experimentation at the Virtual Warfare Center in St. Louis, recently experienced a life-changing event that has helped him appreciate the benefits he has—he and his wife, also a Boeing employee, had a baby daughter.

"The health care coverage for her birth was phenomenal," Clauson said. "I've compared it with the coverage my siblings have through their jobs and we have it better."

Katie Lashua, a disability management representative in Everett, Wash., and six-year Boeing veteran, also has a young daughter. Like a growing number of Boeing

> "The health care coverage for her birth was phenomenal. I've compared it with the coverage my siblings have through their jobs and we have it better."
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> *– Doug Clauson*

PHOTOS: (Far left) Brian Eisenbeis at the Bomarc building in Everett, Wash. GAIL HANUSA/BOEING (Left) Boeing St. Louis employees Doug and Linda Clauson with their daughter Emily. RON BOOKOUT/BOEING

employees, she participates in Boeing's Well Being programs, another key element of the company's total compensation.

She got involved in Boeing on the Move last year after returning from maternity leave.

"Having the pedometer and online tools were the key to my success with losing the extra pounds I gained during pregnancy," Lashua said. She and her husband have made walking with their daughter a habit.

Her team also incorporates walking into their routine, she said, choosing from time to time to have what she called "walking meetings."

"Instead of parking in a conference room, we meet by walking through the factory, tunnels or outside," Lashua said. "It's nice to get away from your desk, get the heart rate going and get your brain in a new environment."

Boeing Well Being offers a number of services, including Family Care Resources, the Employee Assistance Program, Health Screening and Assessment, Boeing on the Move, and financial planning services.

It's also important for Boeing to help employees see that their contributions are valued and to understand the role they have in Boeing's overall success, Parasida said. The company's incentive programs are designed to do just that.

Boeing offers employees annual performance-based incentive programs such as EIP, as well as other individual forms of recognition such as Pride@Boeing and the Cash Awards Program.

Boeing benchmarks its total compensation package against those of other top-performing companies, Parasida said, and makes changes to ensure the Boeing package remains competitive in the marketplace.

"When designing or making changes, we always keep in mind the guiding principles for our total compensation package," Parasida said. "It must be competitive with those offered by our peers in aerospace and high technology. It must be affordable to support our business plans and flexible to meet our business needs, and it must be highly valued by our employees." ■

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"Having the pedometer and online tools were the key to my … losing the extra pounds I gained during pregnancy."

– Katie Lashua

PHOTO: Katie Lashua, center, participates in a walking meeting in Everett, Wash., with Everett Disability Management team members Janna Giles, left, and Roseanne Fortner. **ED TURNER/BOEING**

THE PAY AND BENEFITS PROFILE is getting a new name. When it is relaunched late next month on TotalAccess, it will be called Total Compensation Profile, a name that more accurately reflects all of the programs, services and benefits that Boeing provides to employees.

The profile is a comprehensive snapshot of the value of each employee's total compensation package, along with several interactive tools to help employees plan for their future financial and retirement goals. It's an easy-to-use tool to share with family members or a financial adviser.

At work, employees can access their profile through TotalAccess by clicking "My Pay & Incentives" and then "Total Compensation Profile," or at home through TotalAccess Express at http://www.boeing.com/express.

RELIABLE SOURCE

The first of 12 V-22 Ospreys assigned to the U.S. Marine Corps Helicopter Squadron 1, which is responsible for transporting the president of the United States and his staff, is introduced last month at Marine Corps Base Quantico, Va. Built by Boeing and partner Bell Helicopter, the V-22s will be used to carry support staff and news media who travel with the president, but not the commander in chief. The Osprey's unique tilt-rotor design allows it to cruise like a fixed-wing aircraft and take off and land vertically like a helicopter. It has seen extensive duty in Afghanistan with the Marines and Air Force Special Operations Command and has played vital roles in humanitarian missions. **PHOTO: U.S. MARINE CORPS**


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FULL FAB-T CAPABILITY. NEEDED AND READY NOW.

The Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) is essential to our nation's defense, providing critical communications for our nuclear-equipped bomber fleet and command and control infrastructure. Boeing is the only company ready now to deliver a fully integrated FAB-T solution of both Airborne Wideband (AWT) and Command Post Terminals (CPT). A total solution that's needed and ready, now.

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