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MARCH 2012 / Volume X, Issue X



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“We really pushed the envelope very hard. And that’s why it’s a game-changing airplane.”

Tom Cogan
Director, Airplane Product Development

787 DREAMLINER

Stories of
innovation
at Boeing



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16 Powering the future

Only five years ago, the idea that fuel made from plants could power military and commercial jets was mostly a dream. Today, it's reality. Although Boeing has no plans to produce aviation biofuels, it's taking a leading role in accelerating their development to help improve the environment worldwide.

COVER IMAGE: A 747-8 INTERCONTINENTAL, WHICH HAS BEEN USED ALONG WITH OTHER BOEING COMMERCIAL AND MILITARY AIRCRAFT FOR BIOFUELS TESTS, IS DEPICTED FLYING ABOVE A FIELD OF RAPESEED, PART OF A PLANT FAMILY CONSIDERED A POSSIBLE BIOFUEL FEEDSTOCK. PHOTO ILLUSTRATION BY BRANDON LUONG/BOEING; 747-8 PHOTO: BOEING; RAPESEED PHOTO: SHUTTERSTOCK

PHOTO: AN ETIHAD 777-300ER (EXTENDED RANGE) IS FILLED WITH A BLEND OF TRADITIONAL JET FUEL AND A BIOFUEL BASED ON RECYCLED VEGETABLE COOKING OIL BEFORE ITS DELIVERY FLIGHT FROM SEATTLE TO THE UNITED ARAB EMIRATES. PHOTO: ED TURNER/BOEING



Ad watch

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

Inside cover:



"787 Dreamliner: Game-changing innovation" is one in a series of videos on innovation at Boeing told by employees such as Tom Cogan. Learn more at www.boeing.com/stories

Page 6:



This ad highlights Boeing's KC-46 Aircrew Training System and its full integration and concurrent development with the new KC-46 Tanker. The ad appears in military trade publications.

Back cover:



In December, FedEx Express announced a firm order for 27 Boeing 767-300 Freighters. This ad celebrates the order, which constitutes a strong vote of confidence in the 767's capabilities and will help ensure continued

production of the jetliner for years to come. The ad appeared in *The Wall Street Journal* on the day of the sale announcement.

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Historical Perspective

The F2H-1 Banshee made its first flight 65 years ago and established McDonnell Aircraft in the jet fighter business. The Banshee would go on to become a mainstay of the U.S. Navy's carrier jet aircraft fleet and was immortalized in James Michener's book *The Bridges at Toko-Ri*. PHOTO: BOEING ARCHIVES



Wings of innovation

By tapping into the best of Boeing, the 737 team created the most advanced wing-box assembly line in the industry. With 737 build rates increasing, this innovative assembly method is speeding production and improving efficiency.

PHOTO: MARIAN LOCKHART/BOEING



Flexible flier

The operational success and unique capabilities of the Bell Boeing V-22 Osprey tilt-rotor, which is performing well on dangerous military missions in Afghanistan and when flying humanitarian support missions around the world, is making a big impression on potential customers.

PHOTO: U.S. MARINE CORPS

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The 787 Dreamliner has been visiting cities around the world to give employees, customers, suppliers and the public a close look at this game-changing new passenger jet. This *Frontiers* photo essay captures the excitement and enthusiasm that greeted the Dreamliner on one segment of the ongoing tour. PHOTO: BOB FERGUSON/BOEING



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Modeling airplane kits

The Boeing 767 is enjoying a strong sales comeback, in part due to significant productivity gains made at its Everett, Wash., assembly line. A 767 Kitting Team is just one example of employee innovation that cuts cost and cycle time—and will keep Boeing building military and commercial 767s for years to come. PHOTO: BOB FERGUSON/BOEING

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Each new generation of products Boeing brings to the market is better for the environment than the one before, notes Kim Smith, vice president of Environment, Health and Safety. Boeing airplanes today have a 70 percent smaller carbon footprint than the jetliners of the 1960s. Smith says that's a tribute to Boeing employees, who continue to innovate ways to make a better environment worldwide.

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CORRECTION

A C-17 Globemaster III cargo aircraft was misidentified in a photo on Page 34 of the February issue of *Frontiers*.



**KC-46
Aircrew
Training**



**KC-46
Aircraft
Development**



SIDE BY SIDE, 100% CONCURRENT.

Boeing's KC-46 Aircrew Training System (ATS) will be fully integrated and 100% concurrent with the aircraft's development. With training teams working side by side with the aircraft program, the expertise and information flow is immediate, in-depth and continual, far beyond a data package. The result is the highest fidelity training and the optimum low-risk solution.



Enduring legacy

Generation after generation, Boeing employees have improved environmental performance

When you ask people about Boeing, they immediately mention our amazing products such as the fuel-efficient 747-8 and 787 Dreamliner.

When I'm asked about Boeing, I talk about the innovation of thousands of mechanics, engineers and other employees who are the heart of our enduring legacy.

The reason today's airplanes have a 70 percent smaller carbon footprint than jetliners that spanned the globe in the 1960s is because Boeing employees continue to innovate. Each new generation of products we bring to the marketplace is cleaner and better for the environment than the one before it.

It is part of our commitment to employees, customers and the communities we serve to continually improve the company's environmental performance across our product lines and operations. Everyone at Boeing can proudly say we're delivering on that promise.

Consider what the people of Boeing accomplished in the past year:

- Entry into service of two new airplanes—the 787 Dreamliner and the 747-8—and the launch of the 737 MAX, setting new industry standards for improved fuel efficiency and smaller carbon and noise footprints.
- Gaining approval for using sustainable biofuels in commercial and military aviation. This issue of *Frontiers* features an in-depth look at Boeing's leadership in accelerating the development of aviation biofuels that have the potential to significantly reduce airplane CO₂ emissions. (See Page 16.)
- Developing the Phantom Eye, an unmanned, high-altitude aircraft powered by clean-burning hydrogen.
- Cleaning up sites affected by past business practices, including a major aquatic habitat restoration of the Lower Duwamish Waterway in Seattle, where a previous generation of employees created airplanes that changed the course of history. This issue of *Frontiers* examines how we reclaimed and recycled the vast majority of the materials from the former Plant 2 site along the Duwamish. (See Page 38.)
- Launching a pilot program enabling employees to recharge their electric vehicles if they work at selected Boeing sites in Arizona, California, Oregon and Washington.



“Boeing employees continue to innovate. Each new generation of products we bring to the marketplace is cleaner and better for the environment than the one before it.”

— *Kim Smith*

*Vice president, Environment, Health and Safety
Boeing Engineering, Operations & Technology*

PHOTO: MARIAN LOCKHART/BOEING

- Installing 10 acres (4 hectares) of solar panels on the roof of the final assembly building at Boeing South Carolina; retrofitting buildings in Philadelphia, Southern California and the Pacific Northwest to be more energy-efficient; and taking other actions to be recognized as a U.S. Environmental Protection Agency ENERGY STAR Partner of the Year.

We've made outstanding environmental progress, yet there are many opportunities ahead of us. It's exciting to come to work and hear from employees who are proud of how their teams are finding new ways to save energy, conserve materials and enhance our environmental performance.

Every one of us makes a difference. It is part of the remarkable Boeing legacy of creativity and innovation that, I believe, makes us well positioned for growth and longevity.

For me, it's personal. I am proud to be part of a team that is helping to create a cleaner future and making the world a better place for future generations. ■



COMMANDER-IN-CHIEF PILOT: U.S. President Barack Obama checks out the 787 flight deck with Mike Sinnett, right, vice president and chief project engineer for the 787, during Obama's visit last month to Boeing's Everett, Wash., plant. After a tour of one of the 787s in final assembly, Obama told more than 2,000 employees and invited guests in the factory that the fuel-efficient Dreamliner is not only the "airplane of the future," but it "looks cool." PHOTO: OFFICIAL WHITE HOUSE PHOTO BY PETE SOUZA

Quotables

"ScanEagle can quickly deploy over a fire scene and remain on station for hours on end."

– Paul McDuffee, head of commercial development at Insitu, the Boeing subsidiary that makes the ScanEagle unmanned airborne system, discussing how firefighters could use unmanned aircraft for reconnaissance in fighting wildfires. In *Boeing News Now*, Feb. 7.

"Down the road, the cyber threat will be the number one threat to the country."

– FBI director Robert Mueller briefing a U.S. congressional committee on how cyberattacks against government agencies and businesses continue to rise and could one day surpass the danger of terrorism. In *Information Week*, Feb. 1.

Fruits of his labor

Dreams in a citrus grove turned into an inspirational journey for this employee

By Diane Stratman

In this *Frontiers* series that profiles employees talking about their jobs, Apache rotorcraft technician Cristobal Garcia recalls how he once dreamed of flying aircraft. But now he helps build them—and that's even better, he says. PHOTO: BOB FERGUSON/BOEING



When I was a kid, the land now occupied by Boeing's rotorcraft factory in Mesa, Ariz., was just desert. No big structures, no factories, but plenty of orange, lemon and grapefruit groves.

My friends and I would earn extra money in the fields, harvesting whatever citrus fruit was in season. Often, on breaks, I'd lie on my back, bite into a juicy orange and watch aircraft taking off or coming in for a landing at nearby Falcon Field. Hearing the roar of the engines, I'd dream about flying one of those planes.

Well, I never got to fly a plane. But today, I help build them.

When I started at Boeing in 1995, I got to work on the world's most successful anti-ship missile, the Harpoon. Seeing film footage of the missile achieving bull's-eye test hits made me so proud.

My next assignment was the C-17 transport aircraft. I've never been in Iraq or Afghanistan, but I have played a small role in supporting warfighters in harm's way. I've helped build the aircraft that transport troops in and out of war zones, not to mention the humanitarian missions the C-17 has performed in Chile, Haiti and other disaster zones. When I see on the news the huge amounts

of food, medicine and supplies carried by C-17s to these areas, I can't help but feel good about the role my teammates and I play.

That brings me to the Apache, the primary attack helicopter in the arsenals of the United States and multiple allied nations. Boeing plans to upgrade more than 690 Apaches for the U.S. Army by 2024. My current duty is to help incorporate changes into the airframes to convert them to Block III AH-64 Apaches. One challenge is memorizing exactly where every part is located, its function, and how the part interacts with other parts and with the aircraft as a whole. I get a lot of help from teammates who are just as passionate as I am about taking this aircraft to the next level.

Sometimes, I go out to the airfield and reminisce about those days in the citrus groves where I dreamed of flying. In my off time, I coach kids in softball and basketball. When parents comment on my Apache T-shirts, asking if I work on the aircraft, I answer yes. And, more than once, they have thanked me for the job I do. That expression of gratitude—and knowing that Apaches are helping our men and women in the military every day—beats flying any day! ■

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Rise of the Banshee

The F2H Banshee established McDonnell Aircraft as a jet fighter designer and builder *By Henry T. Brownlee Jr.*



It was named after an entity from the spirit world and immortalized by James Michener in his novel *The Bridges at Toko-Ri*.

And during its day, the powerful two-engine fighter that was affectionately called “Banjo” by pilots was the backbone of the U.S. Navy’s carrier jet aircraft fleet.

First flight of the Banshee came 65 years ago, on Jan. 11, 1947. Only six months earlier, in July 1946, McDonnell had made history when its new FH-1 Phantom became the first American jet fighter to take off and land on an aircraft

carrier. But jet engine technology was expanding rapidly and the U.S. Navy had already requested that McDonnell design and build another prototype fighter, which was to become the Banshee.

Even before the Phantom had made its first flight in January 1945, James S. McDonnell, president of McDonnell Aircraft, had suggested to the Navy an advanced design that would resemble the Phantom, but with more powerful engines. McDonnell received a letter of intent the following March to design, construct and flight-test three prototypes of the proposed jet fighter,

the model XF2D-1, later designated the XF2H-1. The Banshee was to be a larger, faster, carrier-based jet fighter with more range and armament than the Phantom. (To read more about the FH-1 Phantom, see the November 2011 Historical Perspective in *Frontiers*.)

McDonnell believed that a two-engine fighter offered greater reliability over vast stretches of ocean and generally was safer to operate. The Banshee was equipped with two Westinghouse J34-WE-34 turbojets, each producing 3,250 pounds (14.5 kilonewtons) of thrust.

The Banshee was not just a bigger Phantom. There were significant differences between the two jet fighters. The Banshee engines produced twice as much thrust as those on the Phantom and the Banshee carried twice as much fuel, utilizing 200-gallon (760-liter) wingtip fuel tanks and three self-sealing fuel tanks in the fuselage. McDonnell engineers located the engines in expanded wing roots adjacent to the fuselage to reduce aerodynamic drag.

The wings and empennage of the Banshee were considerably thinner than on the Phantom, and the new cockpit and fuselage design provided the pilot with greater visibility and allowed better maintenance access. In addition, the Banshee incorporated electrically powered wing folding and

wheel and flap retraction to avoid excessive use of heavy and vulnerable hydraulic lines. It also had four 20mm cannons.

In 1949, the Banshee set a jet altitude record of 52,000 feet (15,850 meters). The Banshee went into combat in 1951 with the U.S. Navy's 7th Fleet and served for the duration of the Korean conflict.

Among its notable accomplishments, the Banshee was the first jet fighter to be launched with a steam catapult from the deck of an aircraft carrier, the USS *Hancock*, in 1954.

Produced in several variations, including the F2H-1, -2, -2B, -2N, -2P, -3 and -4, the Banshee was a true multi-mission, all-weather jet aircraft capable of operating as a day or night fighter, a bomber and a

photoreconnaissance aircraft. One variant was designed to carry nuclear weapons.

In all, 895 Banshees were produced, with the last delivered to the Navy in October 1953.

After its delivery, Navy Rear Admiral Selden Spangler said in a letter to McDonnell: "The Banshee is the backbone of the carrier jet aircraft, carrying the major load and not complaining about it. While the airplane has already earned its place as having one of the best carrier records of any fighter, jet or reciprocating engine, it is continuing to hold its place in the affections of the air force, Atlantic Fleet, through its ability, versatility and reliability." ■

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PHOTOS: (Far left) An F2H-2 Banshee in flight. **(Above)** The last Banshee, an F2H-4, was delivered to the U.S. Navy in October 1953. **BOEING ARCHIVES**

MORE **BANSHEE** VARIANTS

XF2D-1 Banshee



PHOTO: At a 1947 press conference, a McDonnell test pilot engages the outward-folding landing gear causing the XF2D-1 Banshee to take a bow. **BOEING ARCHIVES**

F2H-1 Banshee



PHOTO: The first production model of the F2H-1 is caddied from McDonnell Aircraft's final assembly area to the flight ramp in St. Louis. **BOEING ARCHIVES**

F2H-3 Banshee



PHOTO: This F2H-3 Banshee was the first jet fighter to launch off the deck of an aircraft carrier, the USS *Hancock*, using a steam catapult. **BOEING ARCHIVES**



'Winging' it

With production rates going up, 737 team develops innovative new process for building wings

By Dawsalee Griffin and photos by Marian Lockhart



PHOTOS: (Far left) On the new 737 Horizontal Build Line, stands adjust to keep the work at the right height for tasks performed by mechanics such as Andy Xayarath. The horizontal wing orientation also allows more mechanics to work on the wing at one time. **(Left)** Barry Lewis, 737 Horizontal Build Line manager.

Take a clean slate. Throw out preconceived notions. Tap into best practices throughout Boeing. Check out cutting-edge technology.

That could have been the checklist the 737 team used to design the new production line for wing-box assembly at the Renton, Wash., factory. They ended up creating the most advanced wing-box assembly line in the industry.

"We knew rate increases were coming and we wanted to create something that could handle the increased production, said Barry Lewis, manager of what's dubbed the 737 Horizontal Build Line.

Everything about the Horizontal Build Line is different, from the orientation of the part to the tools and how the mechanics

work together to build the wing.

"In some ways it was like starting a new program, but we had some advantages because we had existing parts and we had experience assembling wings," explained Gary Laws, one of the mechanics on the team and a 737 Horizontal Build Line machine operator.

Traditionally the aerospace industry uses tools like picture frames that hold wings in a vertical position, allowing mechanics to work on both sides of the wing. They are large, difficult to work on and take up a lot of factory floor space. To meet rate increases using the vertical tools, new tools had to be built, requiring more space. But with the Horizontal Build flow line, wings go through one of two lines (right or left wing) and the

work statement is adjusted to support the rate increases.

The team tapped Boeing assembly automation expert Clayton Munk to help figure out the system. Munk, a Technical Fellow in Boeing Research & Technology, had been studying automation and building large parts in a horizontal, or flat, position for about 10 years before the Renton wing-line project.

Munk noted that Boeing Research & Technology had done several prototypes of horizontal build lines, pulsed flow lines and automation, and Boeing Fabrication's Composite Manufacturing Center at the Frederickson facility uses a horizontal pulsed flow line to build the 787 vertical fin.

The team also benchmarked the 777,



787 and C-17 programs' use of horizontal build and flow lines.

"We took a look at the best practices from Commercial Airplanes and Defense, Space & Security and integrated them into one system," Lewis said.

They also viewed some of the technology being developed in the Automation & Robotics laboratory at California State University, Long Beach.

"It was a challenge because the way the product is built is completely new," Laws said about the horizontal flow line.

In the old system, mechanics moved independently from tool to tool. If they finished their job on one wing, they moved to the next one. On the new line, mechanics all work together to complete

a task before moving to the next task.

"Not only are more people able to work on a wing at a time," Laws said, "but the work itself is more ergonomic, creating a safer workplace for everyone."

Tools are counterbalanced and hang from a frame above the wing. Stands can raise and lower the wings to keep everything at waist or eye level, making the work ergonomically easier on the mechanics. As a result, fewer wing build positions are required.

The line is currently producing wings for 31.5 airplanes a month. A second horizontal build line is under construction to help meet future rate increases. By the time production rates hit 42 airplanes a month in 2014, all of the wings will be

built on a horizontal flow line, according to Lewis.

"This was a huge leap forward," Munk said. "It's the first time we've put automation, a flow line and a horizontal build line together to assemble wings. It's the most advanced wing assembly line in the industry."

And the improvements will continue, according to Munk. The Horizontal Build Line will be ready for the new fuel-efficient 737 MAX when the time comes. ■

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"We took a look at the best practices from Commercial Airplanes and Defense, Space & Security and integrated them into one system."

– Barry Lewis, manager of the 737 Horizontal Build Line

PHOTOS: (Left) Teams of mechanics work on 737 wings on the Horizontal Build Line, completing each task before moving on to the next. Tools such as drills hang from counterbalanced overhead fixtures to make it easy for mechanics to use. **(Insets, clockwise from left)** George Wagner clamps the lower 737 wing panel in place; Mike Dworshak, left, and Gary Laws coordinate work; Ryan Little works to complete a task; Alen Ducay prepares the 737 wing for the next step in the build process; mechanics work to finish assembling the upper wing panel; Adam Fobes checks the alignment of a lower wing panel.

Refueling the future

Sustainable, 'drop-in'
aviation biofuel is a reality,
but challenges remain

By *Bill Seil*

PHOTO: Billy Glover, left, vice president of Environment and Aviation Policy, and Darrin Morgan, director of Biofuels Strategy for Commercial Airplanes, examine a fuel sample during a tour of a U.S. biodiesel production facility. BOB FERGUSON/BOEING



Back in 2005, the idea of using biofuels to power commercial and military jets seemed beyond the range of modern science.

While suitable for cars and trucks, biofuels offered little hope they could meet the stringent requirements of commercial airplanes and high-performance jet engines.

But in 2006, Boeing product development professionals became aware of research that challenged the notion that biofuels could not compete with traditional kerosene-based jet fuel in terms of energy content, technical performance, infrastructure requirements and cost. They reached out to others in the industry to determine whether biofuels could help meet the environmental challenges of commercial aviation. And their efforts paid off in a big way.

"It was a dream five years ago, and now it's a reality," said Billy Glover, vice president, Environment and Aviation Policy, Boeing Commercial Airplanes. Biofuels that can be used as a "drop-in" replacement for kerosene are "not only feasible but highly desirable. The next step is to make it commercially viable."

Although Boeing has no plans to produce aviation biofuels, it has taken a leading role in accelerating their development. It's critically important for Boeing, its customers and the aerospace industry to reduce the environmental impact of jet aircraft, as well as to have another option for fuel supply, Glover said.

In 2006, Glover and Dave Daggett, a Technical Fellow with Commercial Airplanes, worked with the Federal Aviation Administration to hold an industry fact-finding meeting on aviation biofuels. This led to the creation of an organization called the Commercial Aviation Alternative Fuels Initiative, which worked to advance the development of aviation biofuels from sustainable, or renewable, sources.

In early 2007, Glover formed a team that set the ambitious goal of conducting the first commercial airplane biofuel test flight within one year. That goal was accomplished in February 2008, when Boeing, Virgin Atlantic and General Electric joined forces to fly a Boeing 747-400 from London to Amsterdam with a 20/80 biofuel-to-jet-fuel blend in one of the four engines. The challenge then became how to develop the next generation of aviation biofuel that would move the industry beyond what was

used to power the Virgin Atlantic flight.

"By the time we completed that flight, we were already on our way to planning three even more ambitious flights to be conducted over the next year," Glover said. "They involved three different airline customers, three different engine manufacturers, three different regions of the world and several different biomass sources." Biomass is the plant (and sometimes animal) material used to produce biofuel.

Considerable progress has been made since the early test flights of 2008 and 2009.

In August, an Aeromexico Boeing 777-200ER (Extended Range) completed the first intercontinental biofuel flight with revenue passengers as it flew from Mexico City to Madrid with more than 250 people on board. It used a 30 percent jatropha-plant-to-kerosene blend.

Later in the year, United Airlines operated the first commercial flight powered with biofuel derived from algae, and Alaska Airlines became the first U.S. carrier to offer regularly scheduled

passenger flights on airplanes powered by biofuels.

Although considerable progress has been made, there is still a long way to go, Glover said.

"We've set ourselves the goal of having 1 percent of all aviation fuel include some biofuel content by the year 2015," he said. "We view that as the hardest 1 percent. After that, the learning curve improves and it becomes easier to get to 5 percent, 10 percent and so on."

Ned Ferguson, director, Environment, Government Operations, said one important



regulatory milestone was the recent approval by ASTM International for the use of up to a 50 percent blend of hydroprocessed (treated with hydrogen), renewable jet fuels and conventional kerosene in jet aircraft. This decision by ASTM, a globally recognized technical standards organization, was supported by the Federal Aviation Administration. Both previously had approved the use of fuels produced with the Fischer-Tropsch process, which makes hydrocarbons by gasifying a diverse variety of materials such as biomass or coal.

The approval of these two processes—hydroprocessing and Fischer-Tropsch—meant for the first time that methods were available for the mass production of aviation biofuels made from plant and animal

matter, and that aviation could fly using fuels from sources other than crude oil. Most recently, the use of hydroprocessing and other new approaches have significantly improved on Fischer-Tropsch by allowing biofuels to be produced using purely renewable sources at much reduced cost with lower carbon dioxide emissions.

But this is just the beginning, according to Glover.

Boeing is working with partners to get approval for other biofuel processes.

"I'd say the key challenge that's in front of us now is making the use of biofuels economical," Ferguson said. "We need to reach the point where these fuels can stand on their own and compete with petroleum." Also, the U.S. Environmental Protection Agency has set ambitious environmental

requirements for biofuels. To meet standards, advanced biofuels must achieve a 50 percent life-cycle reduction in greenhouse gas emissions over current fuels.

But help is coming from many directions. In August 2011, the U.S. Navy, the Department of Energy and the Department of Agriculture announced the agencies were committing \$510 million to advance the production and use of aviation and marine biofuels in the United States. Both the U.S. Air Force and Navy have set goals to have a substantial portion of their domestic fuel sources coming from biofuels by 2016, providing this can be done affordably.

On April 22—Earth Day—in 2010, the Navy demonstrated its biofuel-powered Boeing F/A-18 Super Hornet, dubbed the "Green Hornet." The following January,

PHOTOS: (Left) Converting algae, shown in this sample, to jet fuel has long-term potential for decreasing aviation's fossil fuel dependency. **(Right)** Jim Kinder, left, and Jean-Philippe Belieres, members of the Boeing Commercial Airplanes Fuels and Thermals team, examine algal-based fuel samples during routine lab testing in Seattle. **GAIL HANUSA/BOEING**



Finding the right chemistry

When Jim Kinder was growing up in Phoenix, he didn't own a chemistry set. He preferred other childhood hobbies, including model rocketry.

Kinder gave little thought to science until he went to college and found he felt right at home in a chemistry lab. After earning a doctorate in chemistry from Case Western Reserve University in Cleveland, Kinder went on to pursue a career in research. His resume includes work in private industry, academia and the National Aeronautics and Space Administration.

In 2007, Kinder heard that Boeing Commercial Airplanes was looking for a chemist to work in its Fuels and Thermal Group and applied for the position. He was hired as the company was beginning its program to advance the development of sustainable aviation biofuels for commercial and military jets. Boeing needed a technical expert who could help lead this effort.

"Coming here, for me, was an ideal challenge and an ideal opportunity," Kinder said. "It was right in my area of expertise and a chance to make a difference, both in terms of energy security and the environment. And I knew it could be done. For me, it was perfect timing and a good fit."

Kinder, a Technical Fellow in the Fuels and Thermal Group, now spends more than half his time working on biofuels. His other work involves a range of program needs, including fuel-related equipment, safety issues, fuel cell

development and approving fuels for Boeing products. He works on biofuels development as part of a small but dynamic team, led by Billy Glover, vice president, Environment and Aviation Policy, Commercial Airplanes.

"Jim Kinder has some terrific technical skills," said Glover. "He's also been a huge driver in working with industry groups, fuel providers, jet engine manufacturers, regulatory agencies, the military and others to make sustainable aviation biofuels a reality."

While Kinder is an experienced researcher, over the past few years he has spent more time on airplanes traveling than in laboratories. In addition to technical knowledge, it's a job that requires collaborative skills and diplomacy.

He enjoys working with industry partners around the world and discussing the technical issues surrounding sustainable aviation biofuels development. He also likes to explain the importance and potential of biofuels.

"It's exciting working at Boeing, because we're not just thinking two or three years down the road," Kinder said. "We're looking five, 10, 15 years into the future and wondering about the price and availability of fuel to power our products. It's important to have another option for fuel and to lower our environmental impact."

— Bill Seil

the Air Force certified the Boeing C-17 Globemaster III for unlimited use on hydro-processed blended biofuels. The Air Force has also tested and certified biofuel as a 50 percent blend with regular jet fuel in the F-15E Strike Eagle, the A-10 Thunderbolt II and the F-22 Raptor.

And a Boeing AH-64D Apache, flown by the Royal Netherlands Air Force, became the first rotorcraft in the world to fly using biofuels in mid-2010.

While by agreement, Commercial Airplanes has taken the lead in Boeing's biofuels development—it is a company-wide effort.

Tim Vinopal, director, Environment, Health and Safety Engineering for Boeing Defense, Space & Security, said military customers are seeking to improve the

environmental performance of their fleets.

But this is not their only interest in biofuels.

They are interested in “having diversified sources of fuel to supplement fossil fuels,” Vinopal said. “They see biofuels as a way to maintain secure sources of fuel and reduce cost volatility, while supporting their commander in chief’s environmental initiatives.”

Vinopal noted that while the same types of biofuels can be used in both commercial and military airplanes, military products are initially requiring additional testing. This is due, in part, to the wider range of operations performed by military products. There is, however, tremendous synergy and cooperation between the testing programs for various military products and the civilian jet industry, he said.

Boeing’s focus is on the development of “sustainable” aviation biofuels that

don’t compete with Earth’s food, water or land-use resources, said Darrin Morgan, director, Sustainable Aviation Fuels, Commercial Airplanes.

Morgan said the Sustainable Aviation Fuel Users Group, of which Boeing is a founding member, clearly defines the conditions a biofuel must meet to be sustainable.

For example, the biomass materials used to produce the biofuel must be products such as algae or jatropha and camelina plants that are not part of the food supply. Biofuels must also, through their entire life cycle, produce lower greenhouse gas emissions than conventional jet fuel does. This includes the byproducts of growing and processing the plants into fuel in addition to emissions from the airplane itself. For example, the production of any fertilizer for biofuel crops requires energy, which may involve the use of petroleum.

From a sustainability standpoint, biofuels have one big advantage over fossil fuels, Morgan said: Modern biofuels have a lower carbon footprint.

“Oil comes from plants that grew long ago when our atmosphere was much more greenhouse gas-intense,” Morgan said. “When we burn oil it releases carbon into the atmosphere that has been sequestered for hundreds of millions of years.”

Most of today’s biofuel development around the world aims to make use of plants that can be locally grown. In addition to the biofuel’s environmental benefits, production can advance the economic development of countries or regions that have large areas of land and water not suited or developed for the large-scale production of food, but adequate for the production of nonedible biomass. At present, it appears most biofuels will be



used to supplement fossil fuels within the regions where they are “grown.”

Bill Lyons, director, Strategic R&D Partnerships, Boeing Research & Technology, said research programs taking place around the world are exploring multiple processes and biomass sources for the production of sustainable aviation biofuels. However, the company is taking a “One Boeing” approach to ensure that information is shared and there is a combined outcome that provides the best solutions for the aviation industry as a whole.

“One of the challenges right now is to get everybody in the value chain to feel like there’s enough certainty in their piece of the industry so they’re confident in making investment decisions,” Lyons said.

Boeing has, and will continue to play, an important role in making that happen. ■

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PHOTOS: (Below) The Imperium Renewables biodiesel production facility in Grays Harbor, Wash., produced the first aviation biofuel blend used in a commercial jetliner. It was flown in a Virgin Atlantic 747-400 in 2008. **BOB FERGUSON/BOEING (Right)** A KLM Royal Dutch Airlines 747-400 flew Europe’s first commercial passenger flight to be partly powered by biofuels a year later. **KLM**



Proving the potential

In March 2007, Boeing set the aggressive goal of conducting the first biofuel test flight for a commercial airplane within one year. That test flight was conducted with a Virgin Atlantic 747-400 the following February, using General Electric engines. In the months and years that have followed, a different process has been developed to produce biofuels that more closely resemble conventional jet fuel; test flights have been performed by different airline and military customers in different aircraft and using different jet engines. All helped pave the way for future aerospace biofuel use.

Virgin Atlantic

Date: Feb. 24, 2008
Aircraft: Boeing 747-400 jetliner with General Electric engines
Location: London to Amsterdam
Biofuel: 20/80 blend of babassu/coconut oil-based biofuel and conventional jet fuel

Air New Zealand

Date: Dec. 30, 2008
Aircraft: Boeing 747-400 jetliner with Rolls-Royce engines
Location: Auckland, New Zealand
Biofuel: 50/50 blend of jatropha-based biofuel and conventional jet fuel

Continental Airlines

Date: Jan. 7, 2009
Aircraft: Boeing 737-800 jetliner with CFM International engines
Location: Houston
Biofuel: 50/50 blend of algae-/jatropha-based biofuel and conventional jet fuel

Japan Airlines

Date: Jan. 30, 2009
Aircraft: Boeing 747-300 jetliner with Pratt & Whitney engines
Location: Tokyo
Biofuel: 50/50 blend of camelina-/jatropha-/algae-based biofuel and conventional jet fuel

U.S. Navy

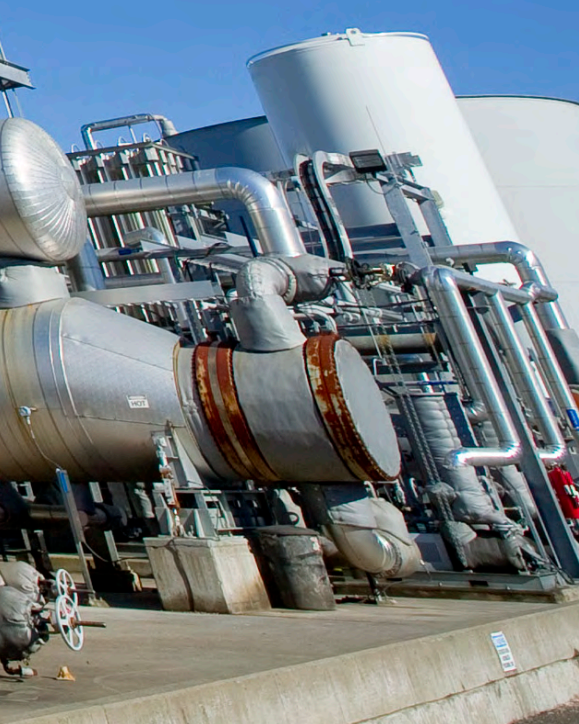
Date: April 22, 2010
Aircraft: Boeing F/A-18 Super Hornet fighter with General Electric engines
Location: Naval Air Station Patuxent River, Md.
Biofuel: 50/50 blend of camelina and conventional jet fuel

Royal Netherlands Air Force

Date: June 16, 2010
Aircraft: Boeing AH-64D Apache helicopter with General Electric engines
Location: Gilze-Rijen Air Base, the Netherlands
Biofuel: 50/50 blend of jet fuel and biofuel derived from algae and used cooking oil

U.S. Air Force

Date: Series of tests concluded Aug. 27, 2010
Aircraft: Boeing C-17 jet transport with Pratt & Whitney engines
Location: Edwards Air Force Base, Calif.
Biofuel: Multiple flights using fuel derived from a variety of sources





Growing new energy

Boeing is supporting organizations and research and development projects throughout the world dedicated to advancing the development of sustainable aviation biofuels.

SAFUG: The Sustainable Aviation Fuel Users Group is a global airline coalition whose members account for approximately 25 percent of annual commercial aviation fuel consumption. Its focus is driving the development of commercial supply chains and supporting the implementation of sustainability standards. Boeing is a founding member of SAFUG.

Australia: Boeing Research & Technology–Australia is actively involved in aviation biofuels research. Boeing initiated and co-funded the Sustainable Aviation Fuels Roadmap project, which was developed in collaboration with the Australasian section of the Sustainable Aviation Fuel Users Group (including airlines Air New Zealand, Qantas and Virgin Blue) and the Australian Defense Science and Technology Organization.

United Arab Emirates: The Sustainable Bioenergy Research Center is a research institution and demonstration project in Abu Dhabi, United Arab Emirates, established by Boeing, the Masdar Institute, Etihad Airways and Honeywell's UOP. The SBRC is using an innovative saltwater agricultural system to support the development of sustainable biomass sources for aviation fuel.

United States: Sustainable Aviation Fuels Northwest conducted the first comprehensive assessment in the United States for creating a regionally sourced, sustainable aviation fuels industry in a four-state region. Boeing initiated and co-funded the project with Alaska Airlines, the Port of Seattle, the Port of Portland, Spokane International Airport and Washington State University.

Farm to Fly: Recognizing that commercial aviation is a central contributor to the U.S. economy, the Agriculture Department partnered with Boeing and Airlines for America (formerly the Air Transport Association of America) to create the Farm to Fly rural development plan. It outlines how production of aviation biofuels can create jobs, enhance domestic energy resources and lessen fossil fuel dependency.

China: Boeing and PetroChina are leading the Sustainable Aviation Biofuel Evaluation Study, which focuses on the establishment of a sustainable aviation biofuels industry in China. Other participants include Honeywell's UOP, United Technologies Corp., the Civil Aviation Authority of China, Air China and China's State Forestry Administration. Also, Boeing and the Qingdao Institute of BioEnergy and Bioprocess Technology opened a joint laboratory to accelerate microalgae-based aviation biofuel research.

Mexico: Boeing is working closely with Airports and Auxiliary Services, a Mexican government agency, in guiding the creation of a Mexican biofuels industry. In August 2011, an Aeromexico Boeing 777-200ER (Extended Range) completed the first intercontinental biofuel flight with revenue passengers. It flew from Mexico City to Madrid.

Latin America: Yale University received funding from Boeing to conduct the Latin America Jatropha Sustainability Study, the first sustainability assessment of jatropha, a plant suitable for use in aviation fuel. The results, released in March 2011, were based on field data from actual jatropha farms. Subsequent research initiatives now are under way with Embraer and the Inter-American Development Bank, and with the Sao Paulo State Research Foundation.

PHOTO: Renewable aviation biofuel made from algae, left, has successfully powered commercial and military aircraft. Algae's value comes, in part, from its high oil content, high yield potential and non-competition with food and water resources. GAIL HANUSA/BOEING

Full tilt

Operational success leads to international interest in the V-22 Osprey

By Andy Lee

“Thanks for picking us up when no one else could.”

That expression of gratitude came from a U.S. special operations forces ground commander in Afghanistan after he and 31 of his men had been extracted from an intense firefight near the northern Afghanistan town of Kunduz.

Bell Boeing V-22 Ospreys were used that June day in 2010 to perform a rescue mission that other aircraft could not.

The unit's helicopter had been disabled and the soldiers came under fire as they radioed for alternative means of transport. Other helicopters and fixed-wing aircraft were dispatched to the area, but none

was able to make the rescue in the rugged mountain terrain.

In Kandahar, 400 miles (650 kilometers) to the southwest, two Air Force Special Operations Command CV-22 Ospreys were launched.

Once on the scene, the Ospreys transitioned from high-speed airplane-mode flight, tilting their rotors and landing vertically amid the uneven terrain. Then, once all 32 troops were on board, the Ospreys rapidly ascended in helicopter mode before transitioning to fixed-wing, high-altitude flight—and out of harm's way—for the direct trip back to base.

The 800-mile (1,300-kilometer)

round-trip mission was accomplished in under four hours.

This unclassified mission vignette, which has made its way through the halls of Congress and the Pentagon, is but one of a growing number of examples of the game-changing capability of the Osprey for military, civilian and humanitarian missions. And it's why there is growing interest in this unique tilt-rotor aircraft from potential new customers.

“Safety, survivability and cost efficiency are becoming trademarks of the operational fleet,” said John Rader, vice president, Bell Boeing V-22 program office.

During a November appearance at





PHOTOS: (From left) U.S. Marines simulate casualty rescue; Marines seated in an MV-22B Osprey during a training drill.
U.S. MARINE CORPS A CV-22 Osprey flies in airplane mode over New Mexico. **U.S. AIR FORCE**

the Dubai Airshow in the United Arab Emirates, there was high international interest in the aircraft, according to program officials.

U.S. Marine Corps Col. Greg Masiello, V-22 joint program manager at the Naval Air Systems Command, said the Osprey's success in the field is making a big impression.

"The level of the conversations that we are having today with potential users, we've never had with the V-22 before," Masiello said. "Quite frankly, it's because it's real and it's in the field performing—what we have now is proven performance."

The speed, range and versatility of the Osprey make it an ideal platform for a variety of missions, said Marco Di Gabriele, Boeing V-22 business development lead.

"Troop and cargo transport, humanitarian support, executive transport, medical and casualty evacuation, combat rescue and delivering cargo to ships are just some of the roles the V-22 is well-suited to play for international customers," Di Gabriele said.

The performance of the operational fleet and increased international interest has not gone unnoticed at the Boeing Philadelphia factory where

the Osprey's fuselage is assembled.

"The team is excited—they see a real future here with possible international orders on top of the current program of record," said John Schwartz, a 25-year Boeing employee who serves as a lead final inspector for structures on the V-22 line.

"For all of us in the factory," he added, "it's important that we stay focused on building a quality product for our current customers—that's how we can make our contribution to the international sales effort." ■

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PHOTO: The V-22 Osprey flies past the Burj Al Arab Hotel along the Dubai coastline, United Arab Emirates, following its debut at the Dubai Airshow in November. **BELL BOEING**

Dream *destination*

Ongoing 787 world tour is an opportunity for many to see the Dreamliner up close

By John Flick and photos by Bob Ferguson

From the heartland of America to the shores of the Irish Sea, from air shows at Dubai and Singapore to the tarmac of customers in Beijing, Qatar and Addis Ababa, the 787 Dreamliner is being greeted worldwide with enthusiasm and smiles from customers, employees, suppliers and aviation professionals.

A continuing Dream Tour, which began in Beijing in December, has covered parts of Asia, Africa and the Middle East and made more than a dozen stops before the advanced jetliner's arrival at the Singapore Airshow last month.

On the following pages are photos from the second segment of the Dream Tour, one of at least five world tours planned for the 787. This 12-day adventure gave Boeing employees, along with suppliers and financiers, a chance to see the new airplane and included stops in Wichita, Kan., Rockford, Ill., Huntsville, Ala., St. Louis and even Ireland.

In Wichita, the first stop after the 787 left Boeing Field in Seattle, workers for Spirit AeroSystems, who assemble the forward fuselage as well as make the pylons that attach to the wings and hold the engines in place, had an opportunity to tour the plane.

"I'm getting goose bumps just talking about it," Danny McFadden, a quality inspector for Spirit AeroSystems, said after his Dreamliner visit.

From Wichita it was on to Rockford, where employees at Hamilton Sundstrand work with Boeing to make nine electrical systems that generate power on the





WICHITA, KAN.



PHOTOS: (Left) The sun's rays reflect off the Dreamliner's carbon fiber-wound fuselage during its visit to Wichita, Kan. **(Insets)** Employees from Boeing Wichita and supplier Spirit AeroSystems toured the 787. It was a first chance for them to see the airplane they help build.

plane and control airflow through the cabin. These systems save hundreds of pounds of weight, leading to a lighter, more fuel-efficient plane.

Next stop was Ireland, to allow lenders and leasing companies attending an aircraft finance conference in Dublin to see the finished product. Ten years ago, Boeing did something unprecedented—it reached out to financial institutions for ideas on how to design the Dreamliner. The input: Build a plane that will be easily interchangeable between carriers as leases change over or ownership switches.

“Boeing delivered on those design promises,” said Citigroup Managing Director Tom Hollahan, who was attending the finance conference in Dublin and got to see the plane.

From Dublin, the 787 flew across the Atlantic to Huntsville, Ala., where it was a homecoming for Dreamliner pilot Mike Bryan. He’s from Huntsville and was greeted by family and friends.

“I’m just so proud of him, I can barely stand it,” said Ardith Bryan, Mike’s mom. Employees from PPG Aerospace also beamed with pride. They help design the large passenger windows for the 787 cabin that dim at the press of a button.

The second Dream Tour concluded in St. Louis. Over two days, 50 local Boeing engineers toured the airplane they helped design, as well as more than 800 other employees. They marveled at the interior’s high ceilings and aerodynamics of the curved wings.

“It’s amazing,” said Linda Coleman, who works in flight operations. “It’s the future.” ■

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ROCKFORD, ILL.

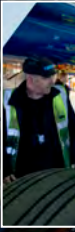




PHOTOS: (Above) Inside the 787 on the way from Rockford, Ill., to Dublin. **(Insets)** Employees from supplier Hamilton Sundstrand, which makes electrical systems that run throughout the Dreamliner, toured the airplane in Rockford; Boeing employees worked in the comfort of business-class seating.



DUBLIN

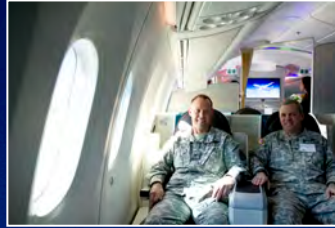


PHOTOS: (Below) Old met new in Dublin as the Dreamliner shared a hangar with a de Havilland DH.84 Dragon biplane. **(Insets)** Members of the global finance community viewed the airplane in Dublin—inspecting features such as its arched entryway, versatile LED lighting system and business-class cabin. Airport-crew also got an up-close view.





HUNTSVILLE, ALA.

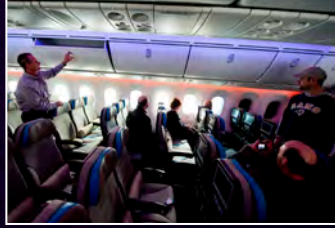
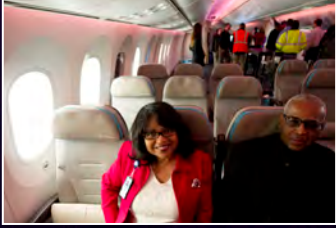
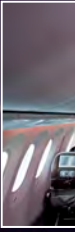


PHOTOS: (Below) A Huntsville, Ala., employee showed his pride in the role he played in building the Dreamliner. **(Insets)** Employees from PPG Aerospace were among those who toured the airplane in Huntsville. They make the large cabin windows that dim at the press of a button.



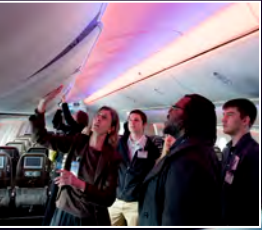


ST. LOUIS



PHOTOS: (Below) Set against the silhouette of the control tower at St. Louis International Airport, the Dreamliner was a striking sight. **(Insets)** More than 800 Boeing St. Louis employees toured the 787 over two days.





A pivotal year for BDS

Shrinking defense budgets mean Boeing Defense, Space & Security must look for new opportunities and execute on existing contracts

By David Sidman

Boeing Defense, Space & Security faces a challenging environment. The U.S. Department of Defense budget is going to shrink by at least \$487 billion over the next 10 years, with additional significant cuts possible. The international marketplace has opportunities, but competition for them is greater than ever. In this interview with *Frontiers*, Chris Raymond, BDS vice president of Business Development & Strategy, says 2012 will be pivotal.

How will U.S. defense budget cuts impact BDS?

Reducing the Defense Department budget can lead to outright cancellations or reductions in funding. Boeing has seen this already happen to a number of our programs including the Brigade Combat Team Modernization and Joint Tactical Radio System, Ground Mobile Radios programs. The other things it can do is slow existing programs or delay the start of new ones. On the opportunity side, we have a great base of products. This is a time to be adding capability to those products and increase their value to our customers. Further, we see increased funding for capabilities that BDS has invested in such as cybersecurity, C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance) and unmanned systems. This is not a time to hunker down. We have to stay focused on the opportunity side of this environment—not just the risk side.

How can BDS keep growing?

Aside from keeping our programs healthy and viable, when you're in a declining market like the one we're in, you really have to seek to take market share from others. So we need to protect the business we have, to the degree that we can, and then we need to look for those opportunities where our capabilities can provide the customer with better value than what our competitors provide.

What about the competition?

Boeing isn't alone. Certainly the Lockheeds, the Northrops, the L-3s—everybody in the industry faces pressure from the budget. We're different in the sense that BDS exists inside a larger aerospace company that has a large commercial business. They're focused purely on defense, so we have to stay mindful that they will be aggressive about how they maintain their portfolios, where they can take share, and how they can differentiate themselves.

How can BDS reach its goal to increase international sales to 25–30 percent of revenue?

International is one of the easiest places to see "One Boeing." Often, Boeing Commercial Airplanes has been in a particular country for a long time because of the airline relationships. So we're able to leverage Commercial Airplanes' global footprint and the relationships they have.

Long term, while export product sales

will always be a huge part of what we do, we have to find some other ways to partner for new product creation, new market access and, ultimately, find a way to drive more revenue back to Boeing in between significant sales of our products.

Industrial participation also is critical to our long-term international growth. Through Global Corporate Citizenship, Boeing Research & Technology and other groups across the enterprise, we can help a country not only with its product acquisition but with other aspirations it might have such as education and employment. For instance, Brazil's president established that country's Science Without Borders program, which has a goal to educate Brazilian students in science, technology, engineering and math, or STEM. Boeing is funding scholarships for 14 Brazilian students in the United States this year as part of that effort.

What can employees do?

No matter your job or function, execute. One of the great things about our portfolio right now is we have a lot of great programs that are doing just that. Boeing has six out of the 11 best-performing programs in the Defense Department. That ability to execute is one of the best factors when it comes to customer satisfaction. It shows up in our award fees, and it also shows up in our relationships—and it helps us talk about the next things they're going to need, even in a budget-constrained environment. ■

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Internal Corporate Server 2

```
/usr/local/src/unclutter  
[25] vroot.h  
Makefile patchlevel,h  
/usr/local/src/unclutter  
/usr/local/bin/  
/usr/local/src [26]> ls/  
/usr/local/bin/unclutter*  
*****  
*****
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Gateway

“We have to stay focused on the opportunity side of this environment— not just the risk side.”

– Chris Raymond, vice president of Business Development & Strategy for Boeing Defense, Space & Security

PHOTO ILLUSTRATION: CASS WEAVER/BOEING; RAYMOND PHOTO: FRED TROILO/BOEING; BACKGROUND PHOTO: BOEING

Something old,



For Seattle's Plant 2, history 'recycles' itself

By Kathleen Spicer and
Cindy Naucner Glickert

The former Boeing production facility in Seattle known as Plant 2 leaves a legacy beyond the famous Boeing airplanes built there, such as the B-17 and B-52 bombers.

From the start of World War II to its demolition late last year, Plant 2's rich history also was testament to the value of recycling and reusing materials.

When the United States entered World War II, the need for metal was critical. To support the war effort, many

in the United States began collecting scrap metal so the recycled material could be used for military purposes.

To support the Allied war effort, Plant 2—officially known as U.S. Air Force Plant 17—produced the B-17 Flying Fortress bomber and turned out more than 300 a month during peak production. To conceal the structure from possible enemy air attack, the U.S. Army Corps of Engineers constructed a fake neighborhood on the building's rooftop, complete with canvas houses and chicken-wire trees.

When the camouflage was removed from Plant 2 in 1946, that material, along with 555 tons (500 metric tons) of steel, was recycled.

"More than 1.5 million square feet

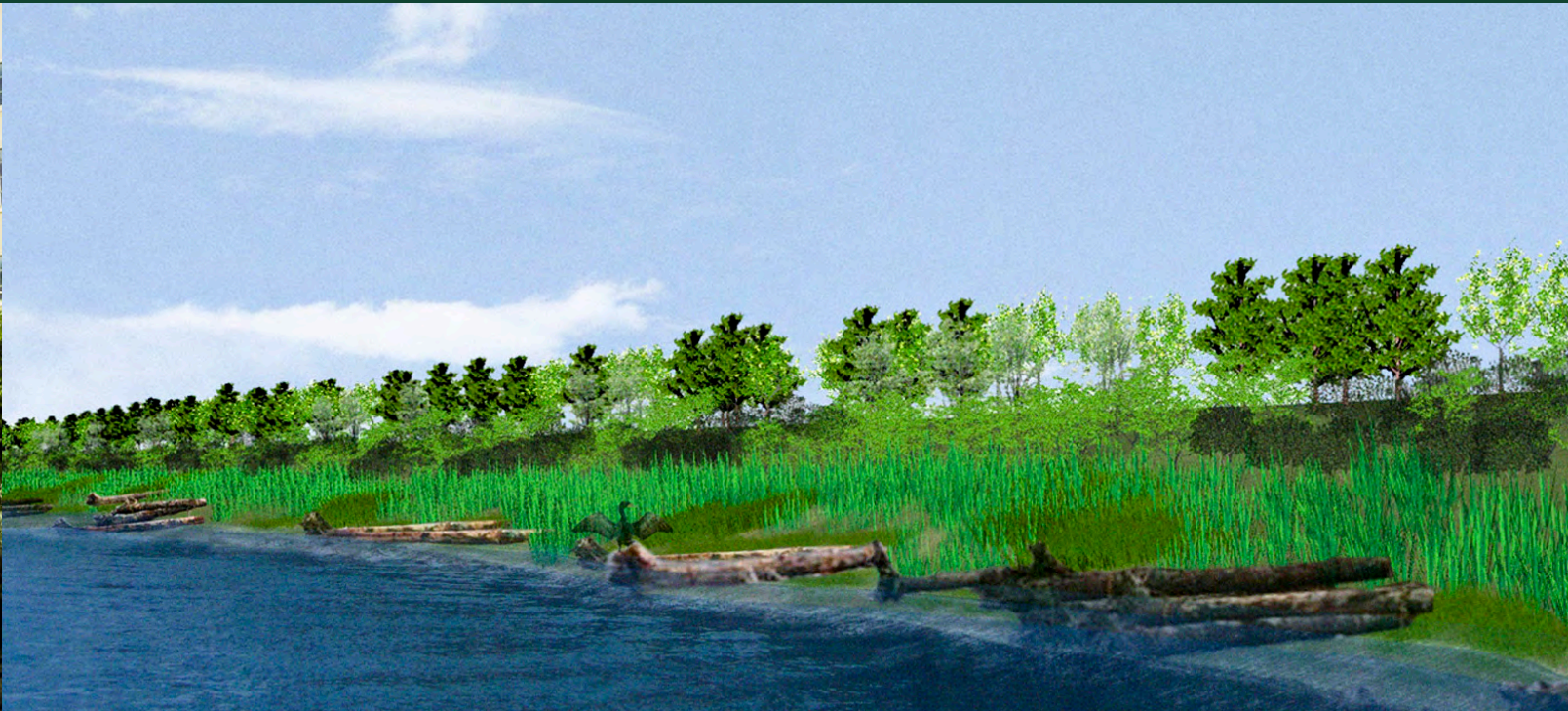
(140,000 square meters) of chicken wire was given away to employees, and 1 million linear feet (305,000 meters) of lumber, in varying sizes, was made available for sale," said Boeing historian Mike Lombardi.

But the reuse of Plant 2 materials did not end there. History would repeat itself.

With the recent demolition of the aging Plant 2 structure, which made room for a salmon habitat restoration project along the Duwamish Waterway, more than 86 percent of the plant's building materials have been recycled, according to Kent Peterson, Boeing Shared Services Group program manager.

Boeing has worked with suppliers to recycle or reuse approximately 13,000 tons (11,800 metric tons) of struc-

something new



tural steel and other metals; 100,000 tons (91,000 metric tons) of concrete; and 900 tons (800 metric tons) of high-value, old-growth timber. These substances will be transformed into modern materials and structures—and, in a unique way, preserved as a part of Plant 2's legacy. ■

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Recycled/reused materials



PHOTOS: (Top, from left) The former Boeing facility known as Plant 2; an artist's concept of the future habitat restoration. **BOEING (Insets left)** The first production B-52 rolls out of Plant 2 in March 1954; the wartime camouflage of Plant 2 included a pattern of gray, green and light brown paint; a brand-new B-17G rolls out of Plant 2 in March 1944. **BOEING ARCHIVES (Insets above)** Taking apart the structure piece by piece was critical to maximize recyclable material; concrete from the buildings was reused as fill for the original tunnel structure of the Plant 2 site; the last steel structures were taken down in September 2011. **MARIAN LOCKHART/BOEING**



You gotta be kitting

Employee focus on productivity and lower costs is paying off

By Leslie Hazzard and photos by Bob Ferguson





Once forecast to be eclipsed by the new 787 Dreamliner, the 767 is experiencing a strong resurgence on the back of the U.S. Air Force Tanker contract that Boeing won in 2011.

That award and other major sales, including a large freighter order from FedEx Express, demonstrate that the program's focus on improving productivity and efficiency is paying off.

And the pace of progress is accelerating throughout the 767 factory in Everett, Wash. One of the most visible examples—the team that creates the kits that keep mechanics doing what they do best, working on the airplane, instead of searching for parts. A foam-lined parts kit now is crafted for jobs required to

PHOTO: Dan Altomare, foreground left and Samantha Schneider verify the completeness of a parts kit crafted for a mechanic to install on a 767 at the Everett, Wash., plant.

assemble a 767 with the goal of helping reduce the time and cost required to produce each airplane.

“We took some very motivated people and brought them together to start the kitting team,” said Cathy Scanes, who manages the 767 Lean Kitting team. “Now people seek us out and want to be part of our team because we’re affecting the future of our program.”

The kitting team employs several of the nine tactics of Lean manufacturing, which they use to eliminate waste and achieve an efficient manufacturing system. An especially effective tool called a pacer system allows the team

to pick and deliver parts according to each day of flow, or work, in the assembly process.

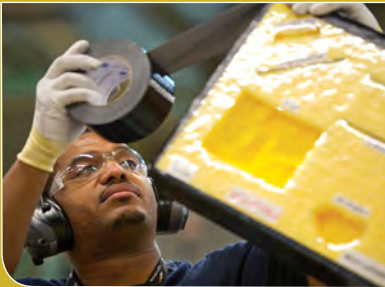
“As a mechanic you get your parts when you are ready to build, and they are not pushed on you all at one time,” said Deanna Baker, 767 Boeing Production System/Parts Control Organization manager. The change means just-in-time delivery of parts instead of multiple days’ worth arriving on the same day, resulting in inventory sitting on the factory floor.

The team surpassed the 1,000-kit mark earlier this year and is on schedule to produce 5,000 parts kits in 2012. Supplier kits and other types of kits will follow.

In addition to the KC-46 Tanker, the program expects to continue building commercial airplanes for several more years. For tankers, two more procurement phases could follow to replace more than 400 Boeing-built KC-135 tankers, some still flying after 50 years in service.

“When we’re successful,” said Fred Richards, senior manager for the 767 Kitting Team, “it’s entirely possible that our children and grandchildren will build the 767.” ■

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IN THE SHOP

PHOTOS (Clockwise from top left): Mison Baker Sr., James Nice and Jeff Westfall create custom foam forms for parts kits that are to be delivered to airplane mechanics on the 767 production line.

The kitting team employs several of the nine tactics of Lean manufacturing, which they use to eliminate waste and achieve an efficient manufacturing system.

ON THE FLOOR

PHOTO: Vinnie Composano, left, and Marcus Border review an installation plan to identify the components required for a 767 parts kit. More than 1,000 kits have already been assembled; the 2012 goal is 5,000 kits.



IN THE PLANE

PHOTO: Andrey Movchan uses a parts kit to finish installing interiors on a 767-300ER (Extended Range) passenger airplane.





Vision for the future

Biman's modern, efficient Boeing jetliners help Bangladesh unlock economic growth

By Anne Gose

Biman Bangladesh Airlines is celebrating its 40th anniversary this year by revitalizing not only its vision and brand but also its aging fleet.

Bangladesh's flag carrier took delivery of two 777-300ERs (Extended Range) late last year for new long-haul routes as part of the airline's fleet replacement and modernization program. Biman currently flies to 18 international destinations in Asia, Europe and the Middle East. The airline is scheduled to take delivery of two more 777-300ERs, four 787 Dreamliners and two Next-Generation 737-800s between now and 2019, two years before Bangladesh marks its 50th year of independence.

The new Biman brand is focused on reliability and safety, a professional team, a culture of hospitality, outstanding cuisine and the celebration of everything unique and beautiful about the Bangladeshi people.

"These pillars will guide our strategic decisions as we grow," said Managing Director Air Commodore Zakiul Islam. "Just as Biman is embracing new opportunities, so too is our country witnessing remarkable progress in economic growth on the world stage."

The airline was founded in 1972 with DC-3 aircraft from the Bangladesh Air Force. Today, tourism and a strong textile industry are fueling demand for new nonstop routes in and out of the nation's capital of Dhaka. With the acquisition of new Boeing airplanes, Biman will help meet this need and also substantially reduce its imbalance of trade with the United States, one of Bangladesh's largest textile trading partners.

"The relationship we share with Boeing has reflected the strong economic ties between Bangladesh and the U.S.," said retired Air Marshal Jamal Uddin Ahmed, chairman of the airline. "Together we made history by completing the largest capital goods deal in Bangladesh history when we ordered 20 of Boeing's newest airplanes, including the 787 Dreamliner."

Bangladesh is the world's seventh-most-populous country. Seventy-five percent of its 160 million people are under the age of 40. A democratic country, it recently received a United Nations award for progress in achieving its own Millennium Development Goals, which seek to address poverty and boost health and education. Late last year, Biman and Boeing teamed with SpaandanB, a nonprofit organization, and Bangladeshi Boeing employees to deliver nearly 8,500 pounds (3,900 kilograms) of humanitarian aid for impoverished areas in the country on board Biman's second 777-300ER.

"A modernized fleet helps the airline tackle several critical challenges, including the high maintenance and fuel costs associated with aging airplanes," said



J. Miguel Santos, director of International Sales at Boeing Commercial Airplanes. "Boeing will continue to work in partnership with Biman as it offers the Bangladeshi people and those traveling to the country on business and tourism a safe, efficient and comfortable way to travel."

Despite immense challenges—high population density, a subtropical monsoonal climate and natural disasters—Bangladesh is cited by global experts as having the potential to be among the world's largest economies in the 21st century.

Biman has laid plans to be a major contributor to that economic development. ■

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PHOTO ILLUSTRATION: From top, a 787 Dreamliner, 777-300ER (Extended Range) and Next-Generation 737-800 in Biman Bangladesh livery. **BRANDON LUONG/BOEING; AIRPLANE GRAPHICS: BOEING; SKY PHOTO: SHUTTERSTOCK**

PHOTO: (Inset) Biman Bangladesh received its second 777-300ER (Extended Range), shown, in November. On the delivery flight, Boeing and Biman partnered to carry humanitarian aid supplies for impoverished areas of Bangladesh. **JOHN CROZIER/BOEING**

SERVICE AWARDS:

Boeing recognizes the following employees in March for their years of service:

55 years

John Boundy
Bruce Pilkington
Robert Potthoff

50 years

Corinne Burrell
Seya Sakurai
Irving Wheeler

45 years

Monroe Blackmon
Susan Broadus
Patrick Carroll
James Dahn
Roger Griffin
Ronald Hardy
Ata Mansoor
Robert Park
Anthony Scanalato
Michael Spray

40 years

William Atwell
James Bell
Teddy Bowman
Eugene Chase
Jerry Denver
Brian Dorge
David Garrett
Dennis Hollander
Emi Isomoto
Wayne Miller
Stephen Ormiston
Ronald Owens
Frank Piasecki
Walter Tomlinson

35 years

John Baker
Harold Bales
Thomas Ballantyne
Rosalind Banks
Alan Blackstock
Paul Boughner
Irene Byrers
Kenneth Caley
Louis Carpinelli
Bill Garner
Michael Chapman
Kim Conder
Joseph Corce
Marcia Croft
Jean Daniels
Terry Deegan
Duane DeComber
Dennis Denno
Robert Dickerson
Ralph Dickey
Becky Dobbert
Roger Donnelly
John Dudash
Randy Embry
James Evans

Michael Ewing
Thomas Farrar
Debbie Felderman
Robert Ferguson
David Foisy
John Forchione
Kevin Fox
Thomasina Freeman
Craig Fukuma
Philip Gablehouse
Gary Geldseth
Toni Gore
Gary Gray
Michael Hammock
Michael Haney
Richard Herdel
Russell Hensley
Raymond Hirano
Ariene Hulin
Daniel Hungerford
James Johnson
Robert Johnson
Steven Johnson
Robert Jordan
Russell Jordan
David King
Wesley Kosal
Debra Kruszona
Kathy Lamkin
Brian Leighton
Frank Leo
Bruce Lord
Anthony Loville
Robert Lyell
Marc Manning
Bruce Markham
Jerry Marsh
Mary McAllister
Kevin McRae
Larry Mills
Susan Moretti
Gordon Mueller
Anthony Natalie
Christine Niebrugge
Scott Nishimoto
Wayne Noel
Frederick Olsen
Gordon Patterson
Gary Pflitzner
Mark Pittenger
Michael Prestegard
Dale Reinke
Connie Richards
Alan Risbey
Ronald Ruegg
David Sanders
Mark Sanders
Cassy Shearar
Fred Shields
Laurence Simonds
Ronald Smith
Lee Sorenson
Jeffrey Stone
Kenneth String
Victor Stuhr
Julie Sumner

Fernando Teran
Mark Vaughn
Brian Weitzel
Susan Wan
Scott Weatherford
Yvonne Webb
Allan Weber
James Wells
Rodney Wheeler
Gary Wilson
Randy Witt
Lawrence Wong
Sidney Workman
Daryl Yochum
Merita Young
William Zane

30 years

Doris Altmann
Karl Anderson
Gerald Andre
Diane Ankney
Rodney Amhold
Janet Aubuchon
Emmanuel Balucanag
Dale Baniak
Arthur Barnett
Geronimo Bautista
Kenneth Bayless
Michael Bensing
John Benson
John Bergeron
Gerald Berumen
Daniel Biddle
Benjamin Bigford
Robert Bjornstad
Eric Bloemker
Donald Bohn
Henry Boterenbrood
Jackie Brannon
Gerald Bray
David Breece
Michael Brenner
William Brock
Charles Crockett
Boyd Brown
Bradford Brown
Nancy Brown
Steven Brown
Lisa Brubaker
William Bucher
Randall Burch
Mario Bustamante
Dean Cameron
Gary Campbell
Joseph Caracci
Denise Carter
Kerry Carver
Takashi Chacon
Stephen Chan
Wayne Chan
Randy Chinn
John Clardy
Paul Clear
Demetris Coachman

Danny Cobb
Mark Colan
Ross Corley
Marcellous Connor
Richard Conwell
Audrey Cooper
Bridges
Yvonne Copeland
Christine Corn
Steven Cornish
Michael Corullon
Herbert Cossano
Richard Craig
Stuart Craig
David Cray
Timothy Cross
William Crutsinger
Kenneth Gurry
Roberta Dagand
Gerlach
Vincent Dalessandro
David Daugherty
John Davies
John De Bellis
John Dean
Elmer Dancker
Brian Denson
Steven Dent
Robin Depaul
Robert Devinney
Barton Dias
Art Diaz
Martha Dionne-Romeo
David Dixon
Robert Donohoe
Lori Downs
Michael Doyle
Paula Duer
Susan Duran
Philip Elena
Jerome Elisha
Kathryn Embly
Gary Eubank
Malcolm Faimington
Michael Farrow
Kim Finch
Douglas Flora
Raymond Fredette
Jeffrey Frericks
Tyrone Friar
James Fuller
Jacqueline Gallatin
Chet Gartner
Karen Geiger
Reza Ghodrati
Tracy Gillespie
Michael Glaser
John Graaler
Debra Graham
Raymond Graham
Judy Graun
Jeanette Gruppetta-
Duke
Dennis Gunderson
Rick Gunselman
Gail Hahn

Mark Hamp
Bary Hanson
Frederick Harper
James Harold
Patricia Harvard
Linda Hascall
Mark Hayakawa
Steven Haynes
Steve Hernandez
Denise Hidano
John Hines
John Hodges
Thomas Hoeffken
Ernest Hoover
Nicholas Hopkins
Warner Hoskins
Lynda Hounsell
Akira Hunt
Ariene Hurt
Charles Hynes
Steven Irwin
Robin Iwarylo
Greg Jeffery
Anita Jensen
Paul Jernigan
Dwyane Johnson
Paul Johnson
Victoria Johnson
Thomas Jones
Yunetta Jones
Mary Jordan
Rick Jordan
William Kalanic
Joseph Kenney
Steve Kessler
William King
David Koening
Ronald Kordick
Michael Koura
Gary Krueger
Gary Kunemund
Saulius Labutis
Yu Lam
Douglas Lamoureux
Robert Langston
William Larsen
David Lawrence
Jane Lawrence
Roy Lawson
Paula Leuelien
Bill Lile
Michael Long
Yolande Lubeski
Theodore Lumpkin
John Lutz
Kevin Lynch
Gary Maasen
Pamala Machado
Francis Malawey
Leif Matson
Steve Mattai
Kathleen Mazzanti
Gregory McCain
Gary McDonald
Darwin McIvor
Duncan McLellan

Jeffrey McVey
Michael Megee
Michael Merrifield
Denise Moore
Michael Moore
Georgianna Morgan
Danny Moser
Abdelkrim Moubarki
Dean Mulder
Stuart Murakami
Mark Nakamoto
Norbert Naylor
Randall Neal
Teri Neuharth
Lawrence Ng
Hoan Nguyen
Rachel Norwood
Douglas Oleson
Raul Ortiz
Grazyna Ostrom
Antonio Owiedo
Bruce Palmer
Kimberly Park
Edward Parleman
Marco Perez
Michael Perez
Randy Pfau
Robert Phillips
Roger Phillips
Sally Poole
Andrew Pritchard
Jeanette Raboteau
Jacques Ragsdale
Robin Redmond
Kevin Reimer
Robert Reimer
John Remigio
Bettye Richmond
Ronald Ridderbos
Gregory Rinehart
Steven Ritter
Frank Roesch
John Ruth
Jose Ruvalcaba
Chris Sadowsky
Timothy Samsel
Raymond Sarchet
James Schaffer
Michael Schendel
Randall Schimon
Susan Schneider
David Seeley
Gregory Serba
Steven Shelum
Donald Sheppherd
Orest Shepson
Dennis Sherman
Charles Shure
Robert Simms
Melinda Sly
Earnest Smith
Robert Snyder
Penelope Soda
David Sohn
Bary Sommerfeld
Mark Sorce

FLAKES ON A PLANE

A 747-8 Freighter awaiting delivery at Boeing's Everett, Wash., factory is a vision in white in this photo, shot after a major snowstorm hit the Puget Sound region in January.

PHOTO: BOB FERGUSON/BOEING







WE'RE READY TO DELIVER FOR FEDEX EXPRESS.

FEDEX EXPRESS PLACES MAJOR ORDER FOR 767 FREIGHTERS.

We're proud to announce that FedEx Express has ordered 27 new Boeing 767-300 Freighters, strengthening a world-class fleet that already includes 757 and 777 Freighters. These new freighter airplanes will provide enhanced capability, greater fuel efficiency, flexibility and reliability. The total package to help FedEx Express deliver more solutions to their customers and the world.

