



Frontiers

www.boeing.com/frontiers

DECEMBER 2011–JANUARY 2012 / Volume X, Issue VIII



Dream makers

Pride and excitement
run high at Boeing
South Carolina site



SOARING TOGETHER

Every partnership opens up fresh possibilities. Together, Boeing and Mubadala are committed to the advancement of the aviation industry in the UAE. From creating a new global hub for aerospace to the development of technology, manufacturing capabilities, process management, human capital and military services, new frontiers await us.

 **BOEING**

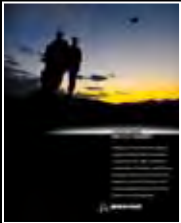
The stories behind the ads in this issue of *Frontiers*.

Inside cover:



This ad highlights Boeing's partnership with Mubadala and the advancement of the aviation industry in the United Arab Emirates. It appeared in local publications such as *Gulf News*, *Al Khaleej*, *The National* and *Khaleej Times*.

Page 6:



This ad celebrates Boeing's long-standing partnership with the United Kingdom and support of the British Military Tournament, which took place earlier this month. The print ad appeared in publications

such as *Defense Focus*, *House Magazine* and *The Times*.

Pages 16–19:



"Enduring Innovation" (shown) and "Enduring Awareness" (pages 18–19) are two ads in a Defense, Space & Security campaign highlighting the capabilities Boeing brings its customers, including advanced technology development and innovative systems, as well as network-based solutions. The ads appear in U.S. print and online business, political and trade publications.

Back cover:



Corporate citizenship refers to the work Boeing does, both as a company and through its employees, to improve the world. This ad reflects Boeing's commitment to organizations that enrich and enlighten the lives of youths.

24 Dream line

After months of training and preparation, final assembly of the first South Carolina–built 787 is well under way. "Every day now, you come in and see something new on it," says one Boeing employee in the huge new Final Assembly building at the North Charleston site. This photo essay captures the pride and excitement of Boeing South Carolina employees who are completing their first Dreamliner.

COVER IMAGE: BOEING MECHANICS LEINYUY LAISIN, LEFT, AND KEENAN NALE WORK ON THE VERTICAL FIN AND EMPENNAGE OF THE FIRST 787 IN FINAL ASSEMBLY AT BOEING SOUTH CAROLINA. BOB FERGUSON/BOEING

PHOTO: THE FIRST 787 IN FINAL ASSEMBLY AT THE BOEING SOUTH CAROLINA SITE IS SCHEDULED FOR ITS HISTORIC ROLLOUT IN 2012. BOB FERGUSON/BOEING



Frontiers

Publisher: Tom Downey
Editorial director: Anne Toulouse

EDITORIAL TEAM

Executive editor:
Paul Proctor: 312-544-2938

Editor:
James Wallace: 312-544-2161

Managing editor:
Vineta Plume: 312-544-2954

Art and design director:
Brandon Luong: 312-544-2118

Graphic designer:
Cass Weaver: 480-216-4539

Photo director:
Bob Ferguson: 312-544-2132

Commercial Airplanes editor:
Don Smith: 206-766-1329

Defense, Space & Security editor:
Diane Stratman: 562-797-1443

Engineering, Operations & Technology editor:
Junu Kim: 312-544-2939

Human Resources and Administration editor:
Geoff Potter: 312-544-2946

Shared Services Group editor:
Beriah Osorio: 425-577-4157

Staff writer:
Eric Fetters-Walp: 425-266-5871

ONLINE PRODUCTION

Web manager:
Wendy Manning: 312-544-2936

Web designer:
Michael Craddock: 312-544-2931

Web developers:
Lynn Hesby: 312-544-2934
Keith Ward: 312-544-2935

Information technology consultant:
Tina Skelley: 312-544-2323

HOW TO CONTACT US:

E-mail:
boeingfrontiers@boeing.com

Mailing address:
Boeing Frontiers
MC: 5003-0983
100 N. Riverside Plaza
Chicago, IL 60606

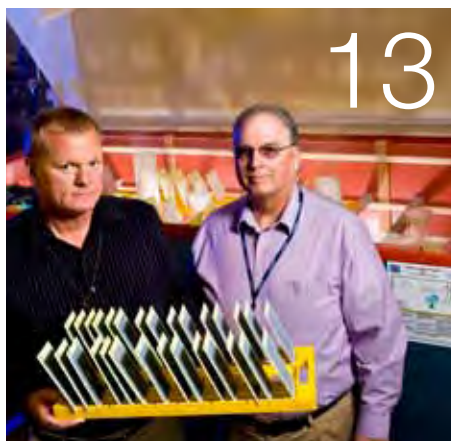
Phone:
312-544-2954

Fax:
312-544-2078

Web address:
www.boeing.com/frontiers
Send all retiree address changes to
Boeing Frontiers, MC 3T-12
P.O. Box 3707
Seattle, WA 98124-2207

Postmaster: Send address corrections to
Boeing Frontiers, MC 3T-12
P.O. Box 3707, Seattle, WA 98124-2207
(Present addressees, include label)

table o



Spreading the word

Boeing's Technical Replication Award winners for 2011 not only had breakthrough ideas that led to significant inventions, but they also helped to spread these important advancements throughout the company. The replication of good ideas and inventions is critical to helping Boeing maintain global technical leadership. PHOTO: RON BOOKOUT/BOEING



The art of aerospace

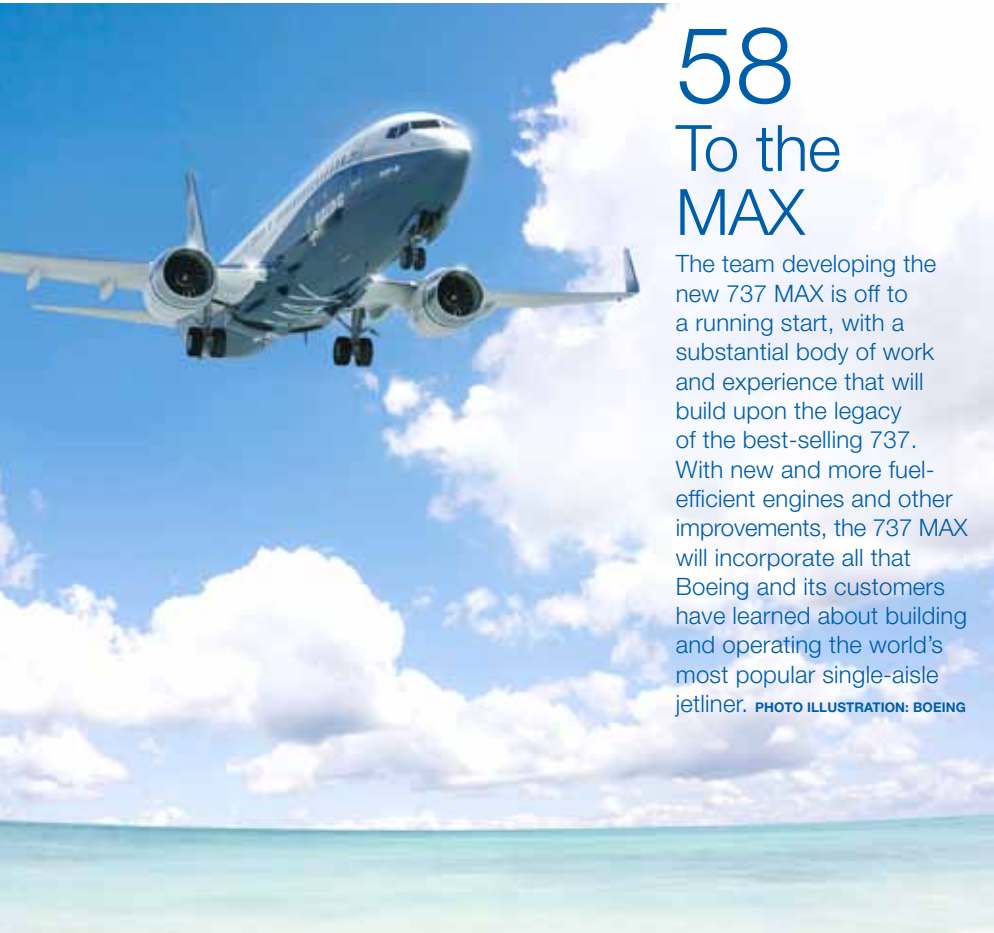
The relationship and collaboration between Boeing and Italy, an extremely important U.S. ally, has grown significantly in recent years, highlighted by the work that Alenia Aermacchi, a Finmeccanica company, does as a critical manufacturing partner on the 787 program. Italy is also a valued customer for Boeing's military and defense products. PHOTO: ED TURNER/BOEING



Photo finish

Boeing photographers took some amazing pictures during 2011, capturing the company's vast array of military and commercial products and the spirit and dedication of its global employees. PHOTO: BOB FERGUSON/BOEING

f contents



58 To the MAX

The team developing the new 737 MAX is off to a running start, with a substantial body of work and experience that will build upon the legacy of the best-selling 737.

With new and more fuel-efficient engines and other improvements, the 737 MAX will incorporate all that Boeing and its customers have learned about building and operating the world's most popular single-aisle jetliner. PHOTO ILLUSTRATION: BOEING

INSIDE

07 Leadership Message

Boeing's ability to innovate and, just as important, the replication of those good ideas and innovations are key to the company remaining a global technology leader, says John Tracy, Boeing chief technology officer and senior vice president of Engineering, Operations & Technology.

08 Snapshot/Quotables

10 Historical Perspective

12 Why We're Here

61 Milestones

66 In Focus



56

Showing the colors

To help commemorate the U.S. Navy's Centennial of Flight celebration this year, aircraft such as this Boeing T-45 were painted in vintage colors and markings representing as many eras as possible during the past 100 years of naval aviation. The idea was the brainchild of a Boeing employee.

PHOTO: GABE PINCELLI



**TOGETHER
WE FLY HIGHER.**

This year, we're honoured once again to support the British Military Tournament; a celebration of the skills, commitment and dedication of the British Armed Forces. Our support reflects our commitment and dedication to the UK, with whom we've shared close partnership for over 70 years.

Discover more at boeing.co.uk



Now that's a great idea

The engine of innovation is fueled by good ideas that can be replicated

Boeing has been built on the great ideas of our talented workforce. For almost 100 years, our employees have applied their knowledge and ingenuity to develop awe-inspiring, cutting-edge products and services that have made us a global technology leader. And being part of this team is what makes Boeing such a special company to work for: We come up with ideas to solve difficult problems, and through the process we make a difference in the world.

So what is it that makes an idea truly valuable? No doubt there's plenty of worth in ideas that solve vexing technical challenges and make the impossible, possible. But what also makes an idea valuable is how widespread it can be replicated, to let others address similar challenges that enable further innovations. In the late 1930s, we built the Boeing 307 Stratoliner, the world's first production plane to have a pressurized cabin. That technology, which helped enable high-altitude flight, was applied to all large Boeing airplanes that followed—including the 787 Dreamliner, which in turn is inspiring replication ideas that will foster our technical leadership for decades to come.

This edition of *Frontiers* features an article on our Technical Replication Awards, which recognize employees who developed a great invention and spread it to other parts of the company. (See Page 13.) This capacity to replicate is an important part of our ability to innovate, because it lets more people benefit from the great ideas we develop. Replication helps us ensure the technical integrity of our products and services and allows us to get these offerings to the market faster. That helps make us more competitive—and supports our business programs—in a challenging marketplace where customers are looking for innovation and affordability from reliable suppliers.

In my mind, this award program demonstrates the value of the “One Boeing” concept: The awards recognize not only the breakthrough ideas our people have created and demonstrated but also the value these ideas have for fellow innovators around the company. These innovators have improved the capability and the quality of the products they and others are supporting, and have done so in a more efficient manner. After all, what better way to show how great an idea is than



“What better way to show how great an idea is than by putting it to use in other places where it can help?”

— John Tracy

*Boeing chief technology officer and senior vice president
Engineering, Operations & Technology*

PHOTO: BOB FERGUSON/BOEING

by putting it to use in other places where it can help?

Our One Boeing strategy calls for all of us to work together—regardless of boundaries such as geography or business unit—and to offer our expertise wherever it's needed. Our 165,000 teammates worldwide make up one of the most diverse, talented and innovative workforces anywhere. And that doesn't even include the talents of the hundreds of thousands of skilled people working for our suppliers across the globe.

So let's get the most out of our collective know-how. Use our various sharing and collaboration tools such as inSite to seek out experts. Reach out to others in your work group and beyond. And if you hear of a call for help needed that relates to your areas of expertise, by all means, offer your assistance when it's appropriate.

Our ability to innovate—and replicate our innovations—will help us remain a global technology leader for the next 100 years. ■

Daydream believers

A new era in commercial aviation began in October when ANA (All Nippon Airways) put its first 787 into revenue service, with a special charter flight from Narita International Airport in Japan to Hong Kong.

"If it performs as promised, it's the iPod of the aircraft world," Richard Aboulafia, an industry analyst with the Teal Group, told an Associated Press reporter writing about the 787 flight.

Judging by the comments from passen-

gers on ANA flight 7871, the Dreamliner will be a big hit with air travelers. They spoke glowingly about the many new features that make the 787 flying experience more pleasant and comfortable, such as bigger windows with electronic shading and higher cabin humidity.

At one point during the four-hour flight, the 787's mood lighting splashed the cabin with disco-like colors, creating an appropriate atmosphere for the

celebration that was taking place on a flight into the history books.

The flight came on the 53rd anniversary of the 707's first commercial flight by Pan Am, Oct. 26, 1958. ■

PHOTO: All Nippon Airways staff and spectators wave at an ANA 787 as it receives a water cannon salute at Narita International Airport in Japan shortly before taking off on the first commercial passenger flight. ASSOCIATED PRESS





“I have seen the future and it’s flying. That’s worth clapping.”

– Peter Hughes, the *Telegraph* (United Kingdom), Oct. 26

“The windows are absolutely amazing. You’re not confined.
You’ve got the outside inside.”

– Passenger Stephanie Wood of Davie, Fla., who was on the flight with her husband, Dean,
as reported by the Associated Press

“It’s really comfortable, and my ears don’t hurt.
It would be great if I could do all my business trips on 787s.”

– Passenger Yohei Konishi, a systems engineer who said he flies most weeks, as reported by
the *Seattle Times*

“For an aviation enthusiast, this is as high as it gets. It’s like
going to a movie on opening day.”

– Passenger Thomas Lee of Los Angeles, who was 17 years old in 1970 when his parents took him
on the inaugural flight of Boeing’s 747, as reported by the Associated Press

The art of war

R.G. Smith turned a job at Douglas Aircraft into a career as a famed aviation artist *By Pat McGinnis*

His paintings and drawings depicting naval aviation and combat have been displayed from the Pentagon to the wardrooms of warships, in private collections and the Smithsonian National Air and Space Museum. They have even been used on U.S. Navy recruiting posters.

But had it not been for a speeding ticket, who knows what career road R.G. Smith, considered the dean of naval aviation artists, might have taken.

The traffic citation had been issued to Roy Brown, chief draftsman for Northrop, by a Los Angeles police officer who was acquainted with the Smith family and knew that R.G. was interested in a career in aviation. Brown agreed to meet with Smith—and the ticket was torn up.

It was 1936. Smith was hired at \$18 per week as a blueprint trimmer at the Northrop operation in El Segundo, Calif., which later became the Douglas El Segundo Division.

For Smith, working at airplane-maker Douglas was a childhood dream come true.

Born in Los Angeles but growing up in Oakland, Robert Grant Smith's love of aviation began at age 13 when he was inspired by Charles Lindbergh's solo flight across the Atlantic.

That daring and pioneering flight by Lindbergh in the *Spirit of St. Louis* in 1927 "ignited in me an immediate ... and unending interest in aviation, I just had to get into the flying world," Smith would later write in his autobiography, *The Man and His Art: R.G. Smith*.

But unlike many other boys of the day who were interested in flying and wanted to be pilots, Smith wanted to design and build airplanes.

Following high school, he studied mechanical engineering and took aeronautical engineering classes, graduating in two years from the Polytechnic College of Engineering in Oakland, Calif.

At age 20, he set out to find a job in the aircraft business. No jobs existed

in that field in the San Francisco area, so he accepted a job with the Works Progress Administration. He left after three days for a job in the mining industry making \$1 a day.

It was a couple of years later, after he went to work at Douglas, that his artistic talents took root. Smith quickly progressed from blueprint trimmer to producing detailed component drawings. Later, he was a configuration engineer. He was part of the conceptual phases of every military aircraft built by Douglas at the El Segundo Division, including Smith's favorite, the A-4D Skyhawk.

Although much of his artwork depicts aircraft in combat, Smith never served in the military. When World War II began, he was told he was too vital to the war effort and could not enlist.

Years later in his autobiography, Smith would write: "If given the opportunity to rewrite the course of my life, I would change but one pathway. I would have liked to serve my country on the front lines. I believe this is one of the reasons serving the Navy as a combat artist means so very much to me."

Throughout his career, Smith had opportunities to witness Navy operations firsthand. Among the highlights were two trips, when he was in his 50s, to Southeast Asia during the Vietnam War.

Famous for his images of Navy fighters, signature clouds and sky, Smith's body of work spanned more than five decades and comprised some 2,000 pieces. In addition to naval aviation, he produced many paintings and drawings of Native Americans.

He died in Rancho Mirage, Calif., in 2001, at age 87.

"As I enter the final chapters of my life," Smith wrote in his autobiography, "I feel a twinge of guilt for having had so much fun." ■

patricia.m.mcginis@boeing.com





“I feel a twinge
of guilt for
having had
so much fun.”

– R.G. Smith



PHOTOS: (Clockwise from top left) R.G. Smith; Douglas SBDs attack Japanese carrier *Akagi* during the Battle of Midway; a C-17 taking off; paratroopers jump out of Douglas C-47s over Europe during World War II; an F-4 Phantom is shown ready to launch from a carrier as A-4 Skyhawks return from a mission during the Vietnam War; Douglas AD Skyraiders from the USS *Princeton* attack the Hwachon Reservoir Dam during the Korean War; the U.S. Navy’s Blue Angels; and C-54s at Tempelhof Airport, Berlin. BOEING ARCHIVES

Treasure hunt

Boeing archives are a growing repository of a fascinating history

By Diane Stratman



As an archivist for Boeing in Southern California, Pat McGinnis helps find and safeguard the company's historical treasures. In this *Frontiers* series that profiles employees talking about their job, McGinnis shares what it's like to have a front-row seat to the fascinating legacy of Boeing and its heritage companies. PHOTO: BOEING

I have one of the most intriguing jobs at Boeing. I collect and catalog historical records. Specifically, I maintain the Boeing Historical Archives, a repository for selected company records that have particular historical significance.

Records of interest include printed and electronic files of engineering documents, correspondence, technical papers, maps, photographs and negatives, films and video advertising.

One of the most interesting items I've located is the boyhood journal of Donald W. Douglas Sr. The journal revealed that Douglas, at age 16, convinced his mother to let him attend a Wright brothers' demo flight in 1908. The journal had clippings from aviation magazines from that time, as well as handwritten sketches and notes for designs Douglas later created.

Many view this journal as the beginning of the Douglas Aircraft Company! It has been preserved and is now on display at the Boeing Corporate Offices in Chicago.

I've also located original photo negatives of one of Marilyn Monroe's earliest modeling shoots, in a Douglas DC-6, as well as an original negative of one of the leading ladies from Hollywood of

the 1930s—Olivia de Havilland—in a C-53 aircraft, a military version of the DC-3. And in a crate in Downey, Calif., I found a hatch from an Apollo test spacecraft.

My career as an archivist began in the mid-1990s. I worked in the Marketing department at McDonnell Douglas. As time allowed, I developed an avid interest in the archive files. I was fascinated—sometimes until 10 or 11 at night—by the endless documents and photos that told a great story about a great company. My curiosity gradually evolved into a part-time component of my job.

Following the merger with Boeing in 1997, part time turned into full time. Gradually, the archives grew to include not only Douglas Aircraft but North American Rockwell's space activities, Hughes and the McDonnell Douglas space activities in Southern California.

From the start of my career, the size of the archives has doubled—and so has my passion for not only preserving and protecting the fascinating history of Boeing but for making information and objects of historical significance available for business, legal and educational use. ■

patricia.m.mcginis@boeing.com

The multiplier effect

When it comes to achieving innovation, replication is just as important as invention

By Bill Seil



A decade ago, a team of Boeing rotorcraft employees in Philadelphia noticed how employees in Wichita, Kan., had revolutionized the way they worked with their suppliers.

Wichita's Min/Max system set inventory ranges for parts and allowed suppliers

.....
PHOTO: John DeAntoni, left, and Craig Scott were part of a team that shared a 2011 Technical Replication Award for developing non-chromated exterior decorative primers for aircraft.

RON BOOKOUT/BOEING



to actively monitor the overall supply.

Understanding how significantly inventory control can affect the company's bottom line, the Philadelphia team grasped Wichita's idea and combined it with the user-friendly interface of its own Consumption-Based Ordering tool, which increased the system's visibility—and value.

Today, the enhanced Min/Max inventory control system is being used by programs at 15 sites across the company, and it is being accessed by approximately 1,725 Boeing suppliers, used to access roughly 42,000 different parts. Min/Max has also become an industry standard, having been adopted by other corporations.

"I can't imagine that our Wichita employees, a decade ago, realized how widely Min/Max would spread," said Angela McLaughlin, now a procurement analyst in Boeing Defense, Space & Security. She was among the Supplier Management employees who saw the companywide potential of Min/Max all those years ago.

"For those of us in Supplier Management," McLaughlin said, "it's become a cornerstone of the way we do business. It's been quite a journey, but well worth the effort."

Min/Max was one of four innovation success stories recognized by a Boeing Technical Replication Award in 2011. McLaughlin was recognized for her involvement in the program, along with Brian Laughlin, the original developer of

the system. Two other Min/Max leaders were also named.

The Technical Replication Award recognizes how important problems are solved by creatively leveraging proven, good ideas.

"These awards recognize employees who have taken an existing capability and applied it to other Boeing programs, spreading important advancements throughout the enterprise," said Allen Adler, vice president of Boeing's Enterprise Technology Strategy.

Boeing's long-standing practice of honoring innovators with an annual invention award was recently broadened to include technical replication efforts. The reason is simple, Adler explained: In the broad scheme of technology, replication is just as important as invention to achieving innovation.

"Even most inventions are built upon the prior art, or original idea, of someone else," he said. "The natural progression of human technology depends on the widespread use and copying of good

ideas and best practices."

This year's Technical Replication Award winners included key individuals involved in the expanded use of Min/Max; methods for the development of non-chromated exterior decorative primer, used on both commercial and military aircraft; Common Open Mission Management Command and Control, a software toolkit for developing unmanned air vehicle ground stations; and the Boeing Agile Software Process, which incorporates Lean+ principles in software development methodology.

Laughlin, now a Boeing Technical Fellow, first thought of the Min/Max idea when he was a process engineering analyst on the shop floor in the late 1990s. The 737 program was having serious problems getting parts in a timely manner. Laughlin and his manager decided to look for alternatives to standard supply chain procedures.

"We found that we were artificially bogging ourselves down in a nightmare of purchase order and change order maintenance," Laughlin recalled.



PHOTO: Randy Jahren, who shared a Technical Replication Award for developing non-chromated exterior decorative primers for aircraft, has worked mainly on paints for commercial airplanes. JIM COLEY//BOEING

"The natural progression of human technology depends on the widespread use and copying of good ideas and best practices."

Allen Adler, vice president of Boeing's Enterprise Technology Strategy



PHOTO: Dale Lauer, left, of the F-15 program and Technical Fellow Brian Laughlin discuss aspects of Min/Max, an inventory control system Boeing uses with suppliers. Laughlin developed Min/Max, which is now in use in other parts of the company.

RON BOOKOUT/BOEING

They found that vendors were delaying deliveries until they could supply the exact quantity listed in the purchase order. As a result, there were often shortages on the shop floor. If extra units inadvertently came in, this would have to be addressed by a change order.

The proposed solution was based on relationships with suppliers—not transactions—that gave suppliers visibility to inventory information.

The team experienced resistance from some in management, who back then had little confidence in their proposed use of the Internet to build the system. Since then, Min/Max has won two Boeing Special Invention awards and, in 2010, was awarded a U.S. patent.

“The neat thing about the Technical Replication Awards is that they recognize growth in the use of new technologies,” Laughlin said. “It shows how you can leverage and spread good ideas across the enterprise.”

When it comes to the art of replication, “use,” “leverage” and “spread” are operative words.

Consider, for example, another of this year’s Technical Replication Award winners.

The aerospace industry has a long history of using chrome-based primers on the outside of aircraft to inhibit corrosion. Unfortunately, those chemicals also pose health hazards when being applied. Boeing takes extensive precautions, at much expense, to protect both workers and the public from compounds such as hexavalent chromium.

For the past 15 years, both military and commercial airplane programs have been working to develop non-chromated exterior decorative primers for aircraft. This is no easy task, since different aircraft require primers that are specific to their needs.

Randy Jahren, a Technical Fellow in the Paints & Coatings Group of Boeing Research & Technology, is among nine researchers across the enterprise who are sharing a 2011 Technical Replication Award for succeeding in this challenge. Jahren has devoted most of his efforts to paints for commercial airplanes.

“Military aircraft have very specific requirements,” Jahren said. “In a commer-

cial airplane, we don’t really care about the infrared signature. But in our military programs, we’re very concerned about things like that.”

So although the company does not have a unified enterprise-wide research program for the development of non-chromated primers, the programs talk with one another and share their research methodologies.

Technical replication is even in his group’s scorecard, said John DeAntoni, a St. Louis-based BR&T engineer who developed new coatings for military jet fighters.

“This is not an end game; we’ve got a ways to go,” DeAntoni said, explaining that the replication must continue across many Boeing teams until all chrome is eliminated from paint on the outside and inside of all products.

Said Adler about replication team efforts: “It definitely takes both coming up with a good idea and leading a larger team by charting the course to success—and that is not frequently easy to do.” ■

william.j.seil@boeing.com

4840

ENDURING INNOVATION





Advanced Experimentation

.....
Technology Development

.....
Rapid Prototyping

.....
Next-Generation Systems

.....
www.boeing.com/innovation

TODAY TOMORROW BEYOND



ENDURING AWARENESS

Mortar Sec. C Co

Mortar Platoon

+0 Btry

1002021617

5-4

requested

Fire requested

Support requested





Intelligence, Surveillance & Reconnaissance

Network Systems

Secure Communications

Command & Control

www.boeing.com/C4ISR

TODAY TOMORROW **BEYOND**

 **BOEING**



The gathering swarm

Boeing is applying swarm technology to unmanned vehicles

By Diane Stratman

There is strength—and wisdom—in numbers. Swarming bees know this. So do birds that fly in flocks and fish that swim in schools. They all know instinctively that many coordinated individual actions produce far better results—for nest building, food gathering or defense against predators—than even the best solitary effort.

Autonomous unmanned aircraft could one day work together in a similar manner, thanks to technology being tested by Boeing Phantom Works with support from Boeing Research & Technology.

In flight trials conducted in July and September, Boeing tested swarm network technology developed by Johns Hopkins University's Applied Physics Laboratory (APL). It enables disparate unmanned aerial vehicles to work together as an intelligent group toward a common mission.

For the July tests, Boeing dispatched two different types of unmanned aerial vehicles, or UAVs, on a simulated reconnaissance mission over rugged terrain in Oregon. Two Insitu ScanEagles worked together with a Procerus Unicorn from APL to search a test area. The vehicles successfully mapped terrain, autonomously

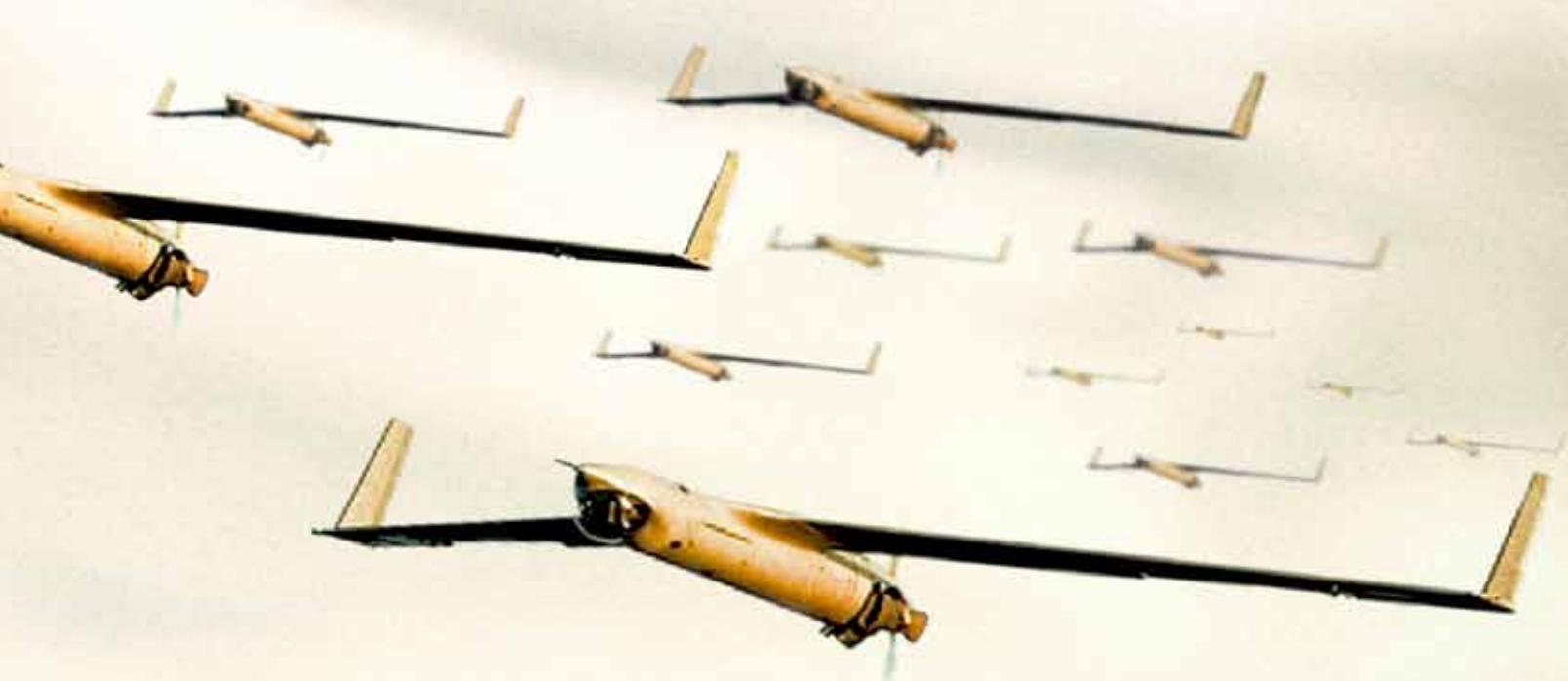
generated their own waypoints and sent data to ground teams.

"The tests were a critical milestone in UAV flight ... and proved that unmanned aircraft can autonomously collaborate to perform a mission," said Gabriel Santander, Boeing Advanced Autonomous Networks program director.

It was the first time that fielded, battle-tested UAVs were autonomously swarmed in actual flight, he explained. Previously, swarming demos were limited to indoor labs using test vehicles or using a centralized controller. Also, this was the first time dissimilar UAVs were autonomously swarmed while working together with one another.

In September, using the same technology, Boeing and APL demonstrated a holistic intelligence, surveillance and reconnaissance "cloud" at Webster Field, Md., using a variety of unmanned platforms: seven unmanned aerial vehicles (including three ScanEagles), two unmanned surface vehicles, an unmanned underwater vehicle, an unmanned ground vehicle and an unattended ground sensor.

The objective was to task the cloud with no user effort beyond the assignment of general mission objectives.



Two significant demonstrations were conducted. The first was a simulated search for mine-like objects in the Potomac River. The unmanned underwater vehicle searched for and identified several and relayed that information to the unmanned surface vehicle, which then relayed it to a ScanEagle. The ScanEagle relayed it to the control station. In the second demonstration, a ScanEagle collaborated with both the unmanned ground vehicle and an unattended ground sensor, all searching a territory and sharing sensor data.

The key in these tests, Santander said, wasn't getting similar vehicles to work together. It was getting disparate vehicles to work together.

This is critical, as there's a growing likelihood that unmanned aerial vehicles will play a primary reconnaissance role in disaster and war zones for search-and-rescue missions or early identification of threats, Santander said. As disparate unmanned platforms are dispatched for missions, it's likely they will have very little in common, particularly hardware. But, they will have to work together, so a common communications system will be necessary.

That's the role of swarm technology.

"Interoperability is one of the greatest challenges—and brightest opportunities—in the unmanned systems industry," said Debbie Rub, vice president and general manager of Missiles and Unmanned Airborne Systems. "Through innovative approaches, such as the swarm exercise, Boeing is taking that challenge head-on, leading us closer to an infinite range of possibilities for unmanned platforms."

Prior to this project, the technology had never been tested on military-grade platforms, only on research-grade ones.

In the July test, three UAVs were deployed. In September, 12 unmanned platforms were deployed. Ultimately, in a real-world reconnaissance mission, according to Santander, a more robust system comprising scores of unmanned vehicles could be launched and will have to communicate and work together.

"The technology has worked surprisingly well," said ScanEagle operator Adam Stock. "The autonomous behavior of the platforms has been smooth, predictable and intelligent."

Tests in 2012 will showcase the technology to potential customers. ■

diane.l.stratman@boeing.com

PHOTO ILLUSTRATION: BRANDON LUONG/BOEING;
SCANEAGLE PHOTOS: INSITU





The next frontier

Former shuttle employees shift expertise to new programs

By Ed Memi

Letting go was a challenge for Joel Dodds, who spent 21 years on Boeing space programs. When NASA's effort to return to the moon by 2020 was canceled, however, he seized the opportunity to expand his experience by becoming a 787 engineer for Commercial Airplanes.

The opportunity came 18 months ago when Dodds volunteered for a 90-day special assignment working on system integration in Everett, Wash. That temporary position evolved into permanent work.

"Some aspects of the job are completely different from my work with NASA, which was a services contract requiring daily contact with our customer," Dodds said. "While direct customer interface is no longer part of my daily routine, I continue to use the basic engineering and integration processes I learned in Boeing Defense, Space & Security."

Dodds is one of about 1,600 Space Exploration employees in 2009 who sought new opportunities within Boeing resulting from the conclusion of the shuttle program, which was announced in 2004.

"We've been working for some time to help employees find employment within the company," said Ludwig Campos, a Space Exploration Human Resources manager. "A significant number of shuttle employees found positions elsewhere in the company. Others were retained for space programs, including the commercial crew program."

Campos said employees need to consider all possible options when faced with downsizing and be flexible enough to translate their skill sets to new job challenges.

"Everyone benefits when highly skilled employees are retained within the company," he said. "It's a win-win, as employees build new work experience and growing programs gain employees familiar with Boeing processes and tools. And, in our case, the unique skill set related to space remains accessible for future pursuits."

Dodds advises employees who are in a program that's winding down to work with their managers. "They can help craft your resume and make you more attractive to other business units and programs. Also, seize opportunities. Don't be afraid to take temporary positions in other parts of the company."

Like Dodds, Neal VanScyoc is a longtime Boeing employee who spent the majority of his career on the shuttle program. Before transferring to the 787 program last February, VanScyoc supported payload processing for space shuttle flights, working on more than 100 launches. Today, he's a Manufacturing Engineer manager on 787 Mid Body and Aft Body fuselages in North Charleston, S.C.

The transition presented a few challenges, VanScyoc said. "NASA spacecraft are typically highly specialized. We often developed processes and equipment designed to achieve one-time technical objectives. In commercial aircraft, we emphasize repeatability and standardization over multiple line units, getting better each time we do it."

VanScyoc agreed that employees need to be open to new opportunities. "I've learned to develop new skills, such as using Boeing's production systems and applying principles of manufacturing," he said. "That was not my comfort zone, but I've come out the other side a much more informed and qualified individual."

Before joining the Tanker KC-46A team last December, Doug Cline was the vehicle manager for Space Shuttle *Endeavour*. He's now the equipment manager for the aerial tanker's center-line drogue.

The adjustment has gone smoothly, Cline said.

"There's a lot of similarity of working for the U.S. Air Force versus NASA," he said. "Workwise, it is very similar, and you deal with a lot of the same types of issues such as vibration loads, aerodynamics, hazardous fluids, contamination, and writing requirements for performance and verification."

Cline's advice to employees facing downsizing situations: "Keep looking forward. This is an aerospace company, not just a space, commercial or military aircraft company. There are lots of different things to do." ■

susan.h.wells@boeing.com

PHOTOS: (Clockwise from top left) Neal VanScyoc, left, discusses 787 Aft Body tooling requirements with tooling engineer Rob Rader. ALAN MARTS/BOEING Joel Dodds, from left, reviews 787-8 certification planning with Dale Catlett and Mark Stanton. GAIL HANUSA/BOEING Doug Cline stands by the 767 International Tanker on the flight line in Wichita, Kan. BEVERLY NOWAK/BOEING

It's coming together

First 787 moves down the line at new North Charleston plant *By Eric Fetters-Walp and Rob Gross*

On the Boeing South Carolina final assembly production floor, the shiny white 787 fuselage with its newly joined wings marks the beginning of Boeing's newest commercial airplane assembly line.

After fabricating, assembling and integrating 787 Dreamliner midbody and aft-body fuselage sections since the program's start, Boeing's site in North Charleston has started final assembly on its first complete airplane.

The facility is just the third in the world where twin-aisle commercial jetliners are assembled and delivered.

"It's starting to look like an airplane," said Iris Malin, a mechanical technician working at the line's "Position 0," where all the major pieces of the 787 are



staged before they are joined together. “Every day now, you come in and see something new on it.”

The South Carolina employees have good reason for excitement and pride. It took less than two years for the site’s Final Assembly building to be built and readied to assemble the world’s most-advanced jetliner. Jeff Kerby, team lead on the production line’s Position 1 wing join, said the building is near-perfect for its purpose.

“Our tooling is state-of-the-art, along with the size and scope of the 1.2-million-square-foot (112,000-square-meter) building. It was built with everything and everyone in mind, both the customers and employees,” Kerby

said while on the mezzanine overlooking the factory floor.

The balconies and adjoining office areas on either side of the factory floor are designed to offer open views of the airplanes being assembled. Large windows on the factory doors let in natural light in the often-sunny location. Lessons learned from decades of Commercial Airplanes operations in the Puget Sound area and best practices from across the Boeing enterprise have been integrated into this green-field site.

“We’ve drawn on the best practices from across the enterprise, both in Commercial Airplanes and Boeing Defense, Space & Security, to stand up Final Assembly operations here,” said

Marco Cavazzoni, Boeing South Carolina vice president and general manager of Final Assembly & Delivery.

He noted that Lean+ and other initiatives were part of this “best of Boeing” approach.

The start of final assembly on the first South Carolina-built 787 began over the summer, but months of training and preparation came first.

In late June, the airplane’s first major structural component—the horizontal stabilizer—arrived via Dreamlifter, the

PHOTO: The first completed 787 fuselage and wing-to-body integration is shown at Position 1 inside the Final Assembly facility in North Charleston, S.C. BOB FERGUSON/BOEING





modified 747 freighter that is needed to transport large sections of the 787. Less than two weeks later, the first vertical fin and first set of 787 wings arrived, followed shortly thereafter by the first Section 41 (the nose and flight deck) from Spirit Aerosystems in Wichita.

August marked the most poignant and celebrated component arrivals, as the first midbody and aft-body sections were delivered from the Mid Body and Aft Body operations buildings across the street, accompanied by the men and women responsible for fabricating and assembling those fuselage sections. Those deliveries were filled with emotion for employees as the Final Assembly



factory rang with music, cheers, laughter and even some tears of joy.

Despite the great strides made to date, expectations are high and there are many challenges to meet between now and the day when the first 787 customer takes delivery in South Carolina.

"We have been able to attract, hire and further train some of the best people in the industry," said Jim Davis, director of Final Assembly operations. "Even with our significant investment in many months of training, this is our first airplane and we are coming down the improvement curve. Aggressive improvement is expected of us, and something we expect of ourselves."

Jack Jones, Boeing South Carolina's vice president and general manager, added that the customers who have visited the site like what they've seen.

"The customer representatives we've hosted have commented favorably on our business plan, our commitment to safety, quality and FOD (foreign object debris) control, and the amount of progress we've made in a relatively short time," Jones said. "I think what really leaps out at them the most is the enthusiasm, professionalism and pride of our workforce. Our people are great ambassadors for Boeing."

Boeing South Carolina Final Assembly will assemble and deliver three 787 jetliners a month at full production rate, with

the first Dreamliner fully assembled there scheduled to roll out in 2012. That will be an overwhelming moment for the site, Kerby said.

"You're going to see some big boys cry," he said. "It will bring a tear to the eye." ■

eric.c.fetters-walp@boeing.com
robert.g.gross2@boeing.com

PHOTOS: (Below) Teammates take in the view of the expansive Final Assembly production line at North Charleston, S.C. **(Inset)** The vertical fin and rudder are attached to the aft fuselage. **BOB FERGUSON/BOEING**



With 1.2 million square feet (112,000 square meters) of usable space, the Final Assembly building's footprint covers an area equal to 10½ U.S. football fields. The building boasts the largest open distance between support columns found in any Boeing factory: 464 feet (141.4 meters).

PHOTOS: (Below) Production crews meet with their lead to go over the day's work. Safety, quality, foreign object debris and tool control are stressed as part of teams' daily work routines. **(Insets)** From left, business operations, shipside support and state-of-the-art training facilities are all convenient to the production floor. **BOB FERGUSON/BOEING**





The Boeing South Carolina site in North Charleston now employs more than 5,000 people. That includes employees in Final Assembly, Aft Body and Mid Body Operations, the Delivery Center and other support functions.

PHOTOS: (Below) Boeing mechanics Leinyuy Laisin, left, and Keenan Nale work on the aft fuselage where the vertical fin is joined during final assembly. **(Insets)** From left: Louis Laughon and Arnie Gilliard; Crystal Matthews; and Nicholas Menchaca and Kevin Devaney. BOB FERGUSON/BOEING





The HUB, a new Employee Service Center, is home to a full-service cafeteria and a Boeing Store, and it features amenities including a health clinic and a place where employees can purchase sundries.

PHOTOS: (Below) Boeing South Carolina's cafeteria is the visual centerpiece of the HUB, the site's Employee Service Center. The HUB's many services help provide work-life balance for teammates. **(Insets)** From left, the Boeing Store at Boeing South Carolina and outdoor and indoor seating at the on-site cafeteria. **BOB FERGUSON/BOEING; ALAN MARTS/BOEING**





Boeing South Carolina will assemble and deliver three 787 jetliners a month at full production rate, with the site's first completed Dreamliner scheduled to roll out in 2012.

PHOTOS: (Below) The first 787 to be assembled at the Boeing South Carolina Final Assembly facility. **(Insets)** From left: James McLaughlin and David Lam; Duriel Oree and Buton Tran; and Noli Sanchez and Majid Soltani. **BOB FERGUSON/BOEING**

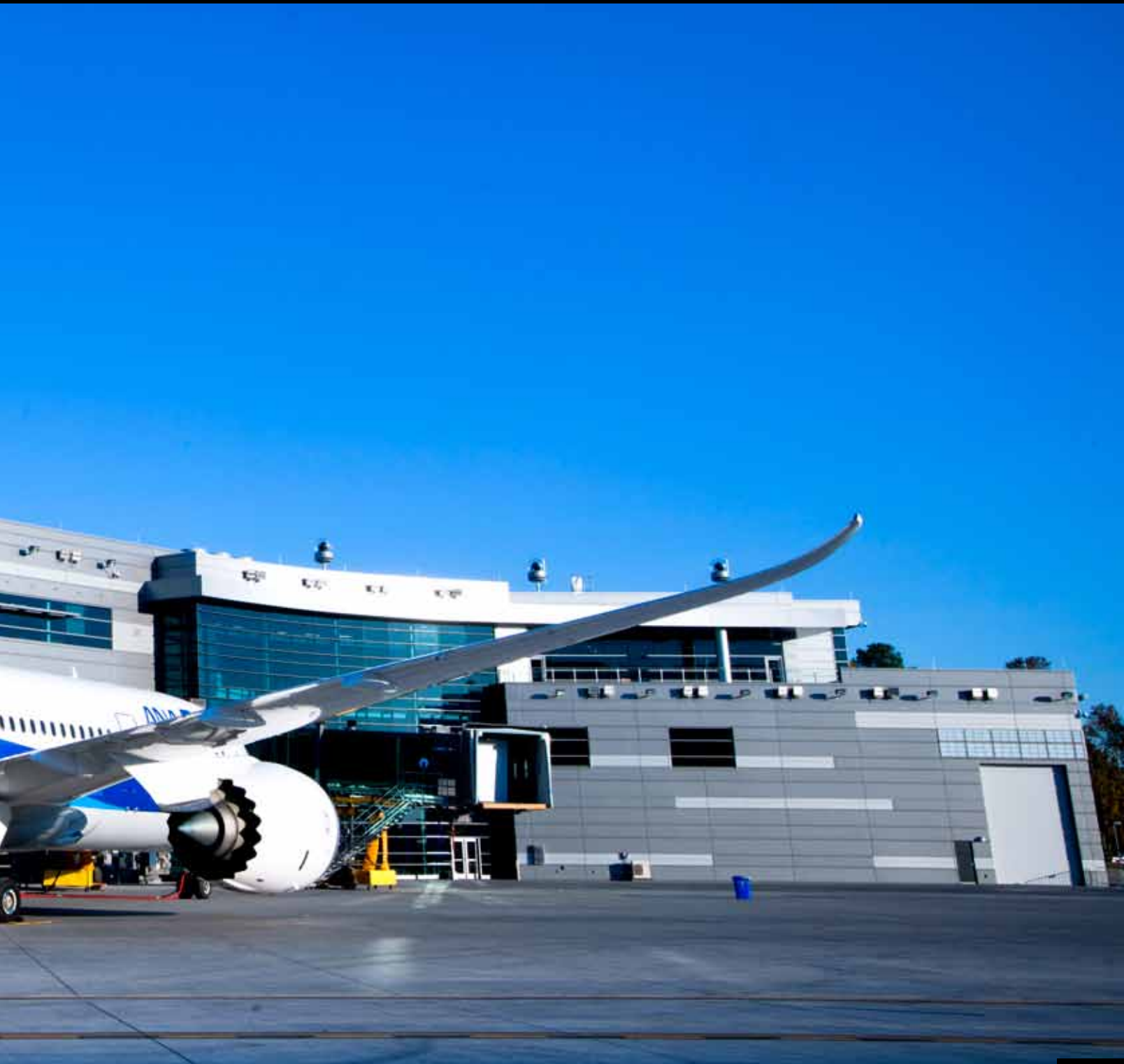
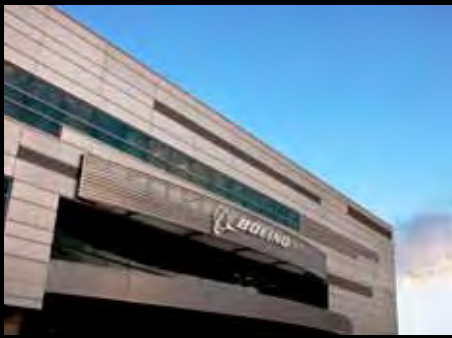




The South Carolina Delivery Center, which opened in November, features two passenger boarding bridges to provide covered airplane access for customers. They are the first passenger bridges to be used at a Boeing delivery center.

PHOTOS: (Below) Test airplane ZA002 spent nearly two months at Boeing South Carolina's new Delivery Center this fall, allowing the Delivery Operations team to practice for the site's first delivery in 2012. **(Insets)** The Delivery Center recalls aspects of Boeing facilities in Puget Sound, with modern architectural touches and hints of South Carolina Lowcountry culture. Center: Kelsey Dunn. ALAN MARTS/BOEING





Safety in numbers

Employee involvement teams improve workplace safety—and production

By Marcy Woodhull

The team that installs aft bulkheads in the 787 Dreamliner at Boeing's North Charleston, S.C., factory recently faced a dilemma: How could they install the bulkhead's heavy crown frame, while staying on schedule?

Using Lean+ techniques, the team focused on the manual lifting of heavy parts, a time-consuming and physically challenging process. The solution was to use four mechanical jacks to do the lifting, which meant safer, faster installation.

This group's ability to identify ways to improve their processes shows how employee involvement teams, or work groups that are empowered to identify better ways of performing their tasks, can improve workplace safety across Boeing.

"Employee involvement teams are an outstanding way for mechanics to recognize problems and come up with solutions," said Jerry Robertson, who leads a production work group in Charleston.

At Boeing, the adage "there is safety in numbers" takes on new meaning when the subject is employee involvement teams.

"Being engaged and involved through teams is one of the best ways to prevent injuries," said Stephen Johnson, Associate Technical Fellow for Environment, Health and Safety. "Empowered, engaged employees can make an enormous difference in keeping our workforce safe, keeping costs down, staying on schedule and continuously improving Boeing products."

A four-level empowerment process,

part of Boeing's Lean+ and Safety Now efforts, guides teams as they develop the knowledge and skills needed to improve safety for themselves and others.

Cohesion, communication and collaboration mark the most successful teams, Robertson said, adding: "The biggest key to success is that everyone has a stake in it."

Employee involvement teams not only identify and address problems but work to prevent issues before they arise.

Members of a Shared Services Group employee involvement team in St. Louis are responsible for keeping manufacturing equipment and facilities in good condition for the production of military aircraft and systems. Using ultrasound and thermal-imaging, the team prioritizes maintenance of equipment that could stop production if it broke down.

"When jobs are in the planning stages, we look at all the equipment in advance and we don't wait until something breaks to fix it," said team leader Kevin Creech, noting that this team's work is grounded in Lean principles.

Keeping equipment in good working order not only paves the way for smoother production but also enhances safety.

"When a pumping process in one of our buildings had mechanical problems, our team was called in to assess the situation," Creech said. The assessment uncovered faulty pump components that could affect safety, and the team promptly alerted management.

The employee involvement team and managers worked with others to quickly resolve the concern.

"Everybody on this team steps up, is willing to work to accomplish what needs to be done and cares about getting our products safely out the door," Creech said.

Another team used Lean+ principles to renovate their machine shop at Kennedy Space Center, Fla., resulting in safer and more efficient work flow.

"Work areas were improved to provide adequate space for our employees to complete tasks, safely do their jobs and maintain the equipment," said team leader Mike Wilson. "We added safety features such as grinder exhaust ducting to improve overall cleanliness and reduce the potential for inhaling dust, and down-draft tables for welding operations, which removes smoke from a welder's breathing zone."

The new layout improved efficiency and has been recognized as a best practice by the U.S. Occupational Safety and Health Administration.

"Even a small team like ours," Wilson said, "can make a huge difference when we work together and feel empowered to make changes." ■

marcy.woodhull@boeing.com

Safety and Well Being Empowerment resources for employee involvement teams are available at http://safetynow.web.boeing.com/ee_ei.asp



PHOTOS: (Below) Zane Brenner, left, and Jerry Robertson jack an aft bulkhead crown frame into position for installation on a 787 Dreamliner at the Boeing South Carolina site. **ALAN MARTS/BOEING**
(Insets, from left) Pete Koomjian works in the Kennedy Space Center, Fla., machine shop. An employee involvement team recommended modifying equipment to reduce the risk of inhaling particulates from grinding and welding operations. **KEVIN GILL/INDYNE IMAGERY SERVICES** Equipment engineer Pat Devine, left, and machine repairman Denis Siefert use thermal-imaging technology to check water temperatures in a pump used to apply aluminum to parts produced at Boeing's military aircraft and systems production facility in St. Louis. **RICHARD RAU/BOEING**



Back to the future

Venerable prop planes help Boeing team test smarter, quicker and more economically

By Adam Tischler and photos by Ron Bookout

On the edge of the Boeing St. Louis site, away from the sleek F-15 and F/A-18 fighters rolling off its production lines, is a drab, low-slung hangar that sits nearly empty. Inside are three seemingly unremarkable propeller airplanes.

But these planes have a remarkable history—and purpose.

For 30 years, the Test Bed team, now part of Boeing Test & Evaluation, has been pushing its aircraft to the limits to support key company programs. The two King Airs and a tiny Maule have helped test and reduce risk for everything from missile guidance systems to Wi-Fi for commercial airplanes.

“For decades, this team has been behind testing products that are so successful they are still part of Boeing’s revenue stream,” said Test Support Pilot Jim Pitcher. “A key difference is that we are able to test more efficiently than many people might imagine.”

Technician specialist Jim Shaw said the team has, essentially, learned to “fit a square peg in a round hole.”

They’ve taken avionics from aircraft as diverse as a huge commercial airliner to a sea-launched guided missile and found a way to mount them in and around their simple propeller planes. The result: run-of-the-mill airplanes operating state-of-the-art equipment, all ingeniously

adapted and tucked away for flight.

Myriad programs bring complex avionics systems to the Test Bed team, which then pieces together an electrical engineering puzzle. Parts must be adapted so the airplane can fly safely and at maximum performance while conducting rigorous flight tests.

Programs have long sought out the team based on technical performance, but the savings and capability this group offers also is turning heads: Non-Boeing test groups can cost up to four times more than the St. Louis team.

Performing test or training flights in the twin-prop





ing. Important pop-up tests for customers find their way to the team because of its unique abilities.

Those hours of risk-reducing flight tests in fuel-efficient, technically capable aircraft with experienced aircrews have saved programs “millions upon millions upon millions of dollars,” according to Herb Johnson, Lead Test Bed pilot.

The team’s reputation was once largely unknown outside of the programs based in St. Louis.

Now, as Boeing’s test community has been integrated into the Boeing Test & Evaluation organization, the team’s skills and tools are in demand around the enterprise as programs discover the potential savings.

And while the Test Bed team’s propeller airplane assets are important,

King Airs instead of tactical fighters and developing weapons technology without needing to actually launch a weapon has paid big dividends for Boeing.

The C-17 program, for example, recently sought testing of a new communications system from the Test Bed team—and realized significant savings.

“There’s tremendous value in bringing together the knowledge of the Test Bed team and the efficiency of the test platform,” said Bruce Glaser, C-17 program chief engineer. “The C-17 program continues to seek efficiencies like this one that keep the program competitive and provide a world-class product to our customer.”

Cost savings for the team’s business partners aren’t just found in planned test-



PHOTOS: (Far left) Test Support Pilot Jim Pitcher of Boeing Test & Evaluation conducts a preflight inspection on the King Air 90. **(Above, from left)** Flight mechanic John Kowalski, left, and technician specialist Jim Shaw prepare a pod for uploading under the King Air 90; Chief Pilot for Military Tactical Dave Desmond occasionally co-pilots the King Air when not flying F/A-18s. **(Left)** Technician specialist Jim Shaw checks out a test harness prior to installation. **(Below, from left)** Lead Test Bed Pilot Herb Johnson completes prestart checks; flight mechanic Tim Godwin prepares the Maule for flight.



the experience and training of the team is its competitive advantage—and difficult to find outside the company.

For the group of mechanics, technicians and pilots working together with their business partners, little has changed. But it is busier in the hangar in St. Louis these days, and there are some new faces from programs that are just now leveraging this resource.

“They’re still kind of discovering us,” said Johnson. “Boeing Test & Evaluation is really helping spread the wealth to different locations.” ■

adam.m.tischler@boeing.com

To view a video about the Test Bed team, visit <http://videos.web.boeing.com/video/1063> on the Boeing intranet.





Italy at a glance

Official name: Italian Republic

Location: Southern Europe, a peninsula extending to the Mediterranean Sea; neighbors include France, Switzerland, Austria and Slovenia

Area: 116,348 square miles (301,340 square kilometers), slightly larger than the U.S. state of Arizona

Population: More than 61 million, ranks 23rd in the world

Official language: Italian

Capital: Rome

Direct Boeing employees in Italy: Approximately 290

Sources: The World Factbook, U.S. Department of State, Boeing

Viva l'Italia

Boeing and Italy enjoy strong ties and partnerships that benefit both By Eric Fetters-Walp

Italy encompasses a fine blend of old and new, from ancient architectural wonders to renowned modern design in automobiles, fashion and even everyday appliances.

That combination is demonstrated by the town of Grottaglie, home to both a 13th-century castle and a cutting-edge factory producing 787 Dreamliner fuselage barrels using large mandrels and autoclaves to form the single-barrel composite

pieces. Operated by Alenia Aermacchi, a Finmeccanica company, the factory makes fuselage sections 44 and 46—the middle of the Dreamliner.

“It has been extremely important for Alenia Aermacchi to be part of the global team that has worked—and will continue to work—on the 787 program,” said Alenia CEO Giuseppe Giordo. “It’s an experience that has enabled our company to take its



“Italy is an extremely important U.S. ally and a valued customer and industrial partner in both the commercial and defense markets.”

– Rinaldo Petrigiani, president of Boeing Italy

PHOTO ILLUSTRATION: (Far left) A Boeing 787 Dreamliner flies above Rome’s Colosseum. BRANDON LUONG/BOEING; COLOSSEUM PHOTO: SHUTTERSTOCK; 787 DREAMLINER PHOTO: BOEING **PHOTOS: (Above, from left)** A 787 composite fuselage barrel is loaded into the Dreamlifter at the Alenia Aermacchi facility in Grottaglie, located in Italy’s Taranto province. ALENIA AERMACCHI **Rinaldo Petrigiani**, president of Boeing Italy. **BOEING (Left)** A trio of Alenia employees work in the lower portion of a 787 barrel in Grottaglie. ALENIA AERMACCHI



technological expertise in composite materials to the highest levels and hence to become even stronger and more competitive as a global player in the aerostructures industry.”

Alenia also has made horizontal stabilizers for the 787 in Italy, as well as radomes, fins and control surfaces for the 767. It’s the continuation of a long-standing link between Alenia and Boeing on a series of Commercial Airplanes programs, including the McDonnell Douglas DC-9 and the 767, for which Alenia assisted with design and construction.

In addition to the supplier relationship, Boeing and Alenia in 2007 agreed to jointly develop research activities in advanced materials and aerostructures, leading to the opening of a Boeing

Italian Research Office near Naples.

“The 787 represents today the high point of the intense relationship that Boeing has been able to develop with the Italian air industry: a relationship which, as every relationship, has also had its difficulties, but which constantly proceeds and progresses in the mutual interest for the realization of this great airplane,” said Rinaldo Petrigiani, president of Boeing Italy. “Under their new leadership, both Alenia and Finmeccanica are now poised to make new progress and to improve and expand even further their relationship with Boeing.”

Boeing and Italy have a number of ties in commercial and military aviation, and the collaboration has grown significantly in recent years, said Shep Hill, president of Boeing International and senior vice

president of Business Development and Strategy. Italy is Boeing’s second-largest supplier in Europe, excluding engine purchases, he said.

“Italy represents both an important market for our business units and an important industrial and research partner,” Hill said.

Boeing’s ties to Italy include an important one with the nation’s flag carrier, Alitalia, which flies a mix of Boeing jets—including the 777-200ER (Extended Range), 767-300ER, the 737-400 and MD-80 to -82 models. The airline considers the 10 777s it flies as the flagship model of its long-haul fleet.

Pointing out that Airbus parent EADS has a presence in Italy and it might be considered to have a geographical advantage to that market, Hill noted



that “the Italians have been extremely practical and prudent customers; they want the best, both on the commercial and defense sides, which has advantaged Boeing.”

Roberto Russo, an Information Technology computing technician in Boeing’s Rome office, said there are many benefits from Boeing’s partnering with Italian suppliers.

“Boeing’s presence in Italy can speed up in many ways the industry and technological growth with partnerships and collaborations with private and public entities,” Russo said. “It also makes stronger the political friendship between the U.S. and the Italian government. Not least for the Italian suppliers, working for Boeing means creating more jobs

and opportunities for the Italians.”

Francesco Bombassei, Engineering, Operations & Technology’s IT International Operations manager, said those visible effects of Boeing’s presence are important, but he also sees more subtle effects from Boeing in Italy.

“Through work placement in cutting-edge programs such as the 787, Boeing sustains a large part of the entire national aerospace industry and the creation of know-how and high technologies that then have downstream positive effects on the Italian industry,” Bombassei said.

“In other words, through participation in Boeing programs, the Italian aerospace community grows in competence and ability to deliver.”

And, in return, Boeing receives from

Italy affordable, quality components to help keep its products competitive, as well as a presence in an important market for its commercial and military products. ■

eric.c.fetters-walp@boeing.com

PHOTOS: (Clockwise from left) A view from inside a 787 fuselage barrel of the composite fuselage factory in Grottaglie, Italy, operated by Alenia Aermacchi, a Finmeccanica company. **ED TURNER/BOEING** Alenia employees work on a 787 fuselage barrel in the Grottaglie, factory. **ALENIA AERMACCHI** Boeing partnered with Alenia Aeronavali and the Italian Ministry of Defense to produce four KC-767A Tanker Transport aircraft for Italy’s air force. **BOEING** Italy’s national airline, Alitalia, uses Boeing 777-200ER (Extended Range) jetliners as the core of its long-haul fleet. **TIM STAKE/BOEING**



Boeing products widely used by Italian armed forces

While Italy and Boeing collaborate on the 787 and other Commercial Airplanes programs, the nation's military and Boeing Defense, Space & Security also are solid partners on a number of fronts.

Rinaldo Petrignani, president of Boeing Italy, said Italy is an important U.S. ally, as well as a valued customer and industrial partner for military products. Most notably, the nation was a launch customer of the International 767 Tanker, and Italy's AgustaWestland is co-producing the Chinook helicopter for Italy's armed forces.

"Boeing enjoys long-standing relationships with all branches of the Italian military, and close collaboration with Italian industry has been, and will continue to be, critical to the success of programs such as the CH-47F," said Oris Davis, director of BDS International Business Development for Southern Europe. "Italy also offers great future market possibilities for areas such as energy, information assurance, maritime domain awareness and critical infrastructure protection."

Boeing partnered with Italy to develop, produce and support the KC-767A Tanker Transport aircraft for Italy's air force. The first three have been delivered, with the final one scheduled to be delivered by early 2012.

In May 2009, Boeing agreed to license production of 16 ICH-47Fs to AgustaWestland. Boeing provides aircraft sections, components and production support. The contract allows AgustaWestland to market and sell the ICH-47F in specific countries and around the Mediterranean.

"We have, in fact, produced in Italy, together with AgustaWestland, first the CH-47C for the Italian Army and now, also for the Italian Army, the new model, the -F, the industrial production of which is about to begin soon in northern Italy," Petrignani said. "And this is going to turn into another great success story in our relationship with the Italian Army."

Among other defense and space projects under way or recently completed



between Boeing and Italian partners:

- Boeing and Finmeccanica's Oto Melara subsidiary are making Joint Direct Attack Munition kits for Italy's air force and navy. The two also have agreed to produce Small Diameter Bombs for Italy's air force.
- Using its Delta II rockets, Boeing has successfully launched the first four satellites of the COSMO-SkyMed program in collaboration with the Italian Space Agency and Thales Alenia Space.
- Boeing Global Services & Support has an agreement with Alenia Aermacchi, a Finmeccanica company, to support the new-generation M-346 lead-in fighter jet trainer and M-311 basic

jet trainer by providing a ground-based training system and after-sales support services.

"There are many other examples of Boeing products and technologies, resulting from collaboration with Italian industry, that have been chosen by the Italian armed forces for the strengthening of the Italian defense posture on land, on sea and by air and in the interest of a successful accomplishment of the NATO missions in the Mediterranean and elsewhere," Petrigani said.

– Eric Fetters-Walp

PHOTOS: (Clockwise from left) In May 2009, Boeing agreed to license production of 16 ICH-47Fs, new versions of the Italian Army's CH-47C Chinook, like the one shown here, to AgustaWestland. Boeing also provides aircraft sections and components, as well as engineering, technical and in-service logistics support. **BOEING** Finmeccanica's Oto Melara subsidiary and Boeing are producing Small Diameter Bombs for Italy's air force. **BOEING** As part of the *Natural..mente scuola* environmental awareness program, Italian students tour Alenia's 787 factory in Grottaglie. **BOEING** Boeing and Italy-based Alenia Aermacchi, a Finmeccanica company, are cooperating on marketing, sales, training and support activities for the M-346 fighter trainer. **BOEING**



Boeing and Alenia engage Italian students on the environment

While Italian employees are helping build one of the world's most environmentally progressive airplanes, the 787, students in Italy are learning about sustainability through a program launched by Boeing and industry partner Alenia Aermacchi, a Finmeccanica company.

In its first three years, *Natural..mente scuola* has involved more than 26,000 Italian elementary and secondary students at 860 schools in the Puglia region, near Alenia's 787 fuselage barrel plant. It has gained the United Nations Educational, Scientific and Cultural Organization's patronage as well.

Armida Balla, Global Corporate Citizenship administrator in Italy, said the program provides plenty of hands-on activities to engage students in the topics of sustainable technologies and environmental protection. Environmental issues are a big concern in the Puglia region, and *Natural..mente scuola* teaches children practical ways how they can limit their impact on the world around them.

"We are proud of this program and look forward to its next edition, when we will enjoy the contribution of various universities," said Rinaldo Pettrignani, president of Boeing Italy.

Education and the environment are two of the five target areas where Boeing focuses its corporate citizenship efforts in partnership with community organizations. The other areas are health and human services, arts and culture, and civic awareness.

Boeing Italy has sponsored "Migration and Change: Learning to Live Together in an Increasingly Diverse World," which addresses—through workshops aimed at students—issues of cultural, ethnic and religious diversity. The program was co-organized by the Center for American Studies in Italy.

Balla said local governments and institutions have been receptive to working with Boeing on corporate citizenship projects. Also, suppliers beyond Alenia are cooperating on charitable projects.

"The corporate citizenship initiatives have enormously increased Boeing's reputation in the country," Balla said. "I like to tell people that I work for a company that does great things in the world."

— Eric Fetters-Walp

Financing the future

Boeing Capital's role supporting customers is critical—and growing

By John Kvasnosky



A glance at the headlines is all it takes to understand that global banking and investing is going through dynamic times.

Financial institutions are the glue that binds much of the world's economic progress. That obliges the Boeing team that connects customers with needed financing to stick close to them.

"As financiers go through dynamic times, it will require us—and our customers—to be dynamic as well. We have to go through it with them to see that we all get through," said Mike Cave, president of Boeing Capital Corporation.

Cave now has two years at the helm of the company's aircraft financing and leasing arm and its team of about

150 financing professionals.

He and colleagues spent 2011 anticipating that new global banking regulations, and higher prices for export-credit borrowing from agencies like the Ex-Im Bank of the United States, would complicate aircraft financing beginning in 2013.

Recent events have changed that.

"We couldn't have foreseen the impacts of the European debt crisis," Cave said.

"We believed that credit would get tighter and more expensive in 2013—but with pressure being put on European banks and U.S. dollar funding around the world, we're seeing that accelerate."

However, Cave believes 2012 will see sufficient, but more expensive, financing.

"We are unique in our ability to look at

every delivery and understand where the financing will come from," he said. "That gives us a great deal of confidence."

This year, AirTran, BCC's major leasing customer for its substantial 717 fleet, was acquired by Southwest Airlines. Southwest initially said it would operate the 717s long term. Recently it signaled it wants to move more quickly to a 737-only fleet.

"Southwest has had good success with the 737," Cave said. "I think they'll honor their 717 commitments to us, but I believe we'll have to work together to help them transition to a single type over the next five to six years."

BCC ramped up its financing support in 2011 to Boeing Commercial Airplanes. Notable was July's order by American



Airlines, where Boeing agreed to provide operating leases for up to 100 new 737s. Customer requirements drove the unusual response.

“BCC has been a great partner and helped us win some key campaigns this year, including American and Delta,” said Commercial Airplanes President and CEO Jim Albaugh. “We went to customers with integrated proposals that reflect what this company is all about—innovation in everything we do. We don’t think of BCC as a ‘lender of last resort’ but rather as a provider of innovative financing that gives Boeing a competitive edge.”

Less visible was BCC’s support to Defense, Space & Security customers, particularly as BDS pursues its goal to

increase and sustain international business revenues by more than 25 percent.

“BCC helps provide ‘One Boeing’ solutions for our international customers,” said Bob Verbeck, BDS chief financial officer. “This is even more important today when potential customers have to find the best way to acquire new products and services with constrained resources.”

Cave is convinced BCC has the expertise to differentiate Boeing among rivals.

“I think we’re universally regarded as having the potential to be a real competitive advantage for Boeing. I say potential because we always have to have ‘one heartbeat’ with our internal customers.”

Senior leaders share that perspective.

“The BCC team’s expertise, experience

and strong relationships have them positioned to make a big difference for our customers and business performance in 2012 and beyond,” said Boeing Chairman, President and CEO Jim McNerney.

“Our mission,” Cave added, “is to provide the most choice we can for our customers and help them find the best-value financing. If we can do that better than others, we will make a difference.” ■

john.kvasnosky@boeing.com

PHOTO: One of three additional 717s leased from Boeing Capital by Hawaiian Airlines in 2011 is seen here in pre-delivery preparations. The carrier in 2011 also purchased the 15 717s it already had on lease from BCC. PAUL PINNER/BOEING

Eye for photos

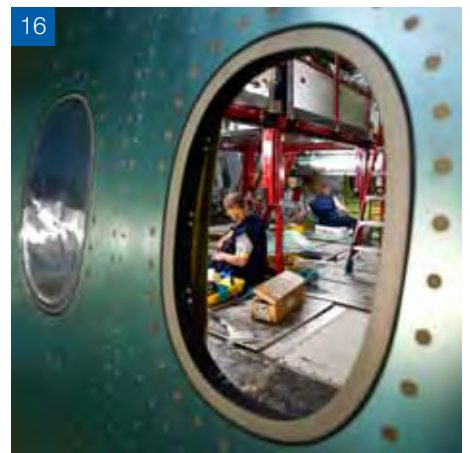
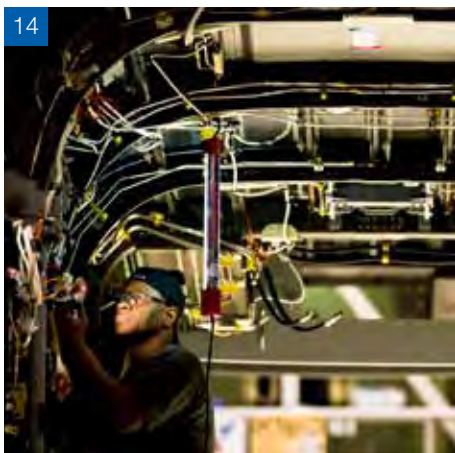
To recognize the work that Boeing photographers do every day to capture the breadth and depth of Boeing, as well as the pride, spirit and dedication of its employees, *Frontiers* asked for their best photos from 2011. Here are some of those images, as selected by *Frontiers* editors.











17



18



19



20



21



22



BOEING PHOTOS:

1. C-17 engine. **SALLY ARISTEI**
2. 777 Everett, Wash., machinist. **GAIL HANUSA**
3. 787 at sunset. **JOHN CROZIER**
4. Apache Longbow Crew Trainer. **RICHARD RAU**
5. 747-8 Intercontinental. **ED TURNER**
6. Dreamlifter at Boeing Huntsville family day. **ERIC SHINDELBOWER**
7. ANA 787. **BOB FERGUSON**
8. 747-8 Intercontinental rollout. **BOB FERGUSON**
9. F/A-18 Super Hornet at Aero India. **KEVIN FLYNN**
10. 737-800, Solaseed Skynet Asia Airways. **JIM ANDERSON**
11. 787 Reveal light show. **JOHN CROZIER**
12. GPS-IIF satellite. **SALLY ARISTEI**
13. Portraying soldiers for the Advanced Force Protection program. **FRED TROILO**
14. V-22 assembly at Ridley Township, Pa. **FRED TROILO**
15. Painting ANA 787 livery. **GAIL HANUSA**
16. 777 production line. **GAIL HANUSA**
17. 787 at Boeing South Carolina site. **ALAN MARTS**
18. Boeing aerobics class, Alabama. **ERIC SHINDELBOWER**
19. Moonbuggy race, Huntsville, Ala. **ERIC SHINDELBOWER**
20. 747-8 Intercontinental factory rollout. **GAIL HANUSA**
21. P-8 touring trailer, Washington, D.C. **FRED TROILO**
22. Phantom Ray on NASA 747. **RON BOOKOUT**

Paint the Sky

Boeing employee provides splash of color for U.S. naval aviation centennial

By Mike Lombardi

On Jan. 18, 1911, Eugene Ely landed his Curtiss Model D Pusher onto a wooden platform built on the after-deck of the armored cruiser USS *Pennsylvania*.

It was the first time an airplane landed on a ship.

That and other key events that year marked the beginning of a century of U.S. naval aviation, and during 2011 the U.S. Navy celebrated its centennial of flight with spectacular air shows that featured modern naval aircraft painted in vintage

Navy colors and markings.

The program to paint modern naval aircraft in vintage finishes was the brainchild of Boeing employee Richard Dann, a captain in the U.S. Navy Reserve who, until his recall to active service, worked in St. Louis as an analysis integrator team lead on the P-8A Poseidon program.

Dann, also an aviation writer, artist and historian, was given the job of planning the Navy's response to this important anniversary.

"I determined a unique way to do this would be to paint current Navy aircraft in vintage or throwback markings, in

much the same way that the National Football League will occasionally sport throwback jerseys for their players," Dan said.

Unlike the finishes of modern naval aircraft that include subdued markings and low-visibility camouflages in shades of gray, the U.S. Navy air fleet in the past was extremely colorful—from the "yellow wings" period of the 1920s and 1930s to highly visible squadron markings of the 1960s through the 1980s.

The "Heritage Paint Project" painted U.S. Navy aircraft in vintage colors and the markings of the U.S. Navy, Marine Corps and Coast Guard aircraft from the past 100 years.





PHOTOS: (Far left) A T-45C Goshawk carries a heritage paint scheme typical of aircraft operated from the USS *Enterprise* in 1938. **U.S. NAVY (Left)** Louise McWorter and Capt. Rich Dann. **RICH DANN (Below, from left)** An E/A-6B Prowler, foreground, and an E/A-18G Growler display a throwback tactical paint scheme honoring U.S. combat aircraft that fought in the Battle of the Coral Sea during World War II. **U.S. NAVY** A Boeing F4B-4 carrier-based fighter of the early 1930s shows the yellow wings and colorful squadron markings that were typical of U.S. Navy and Marine Corps airplanes from that period. **BOEING ARCHIVES** This North American Aviation PBJ-1J, a U.S. Navy version of the B-25J Mitchell bomber, shows the three-color camouflage used by the U.S. Navy during the Second World War. **BOEING ARCHIVES**



Dann originally planned for 18 planes to receive vintage livery, but there now are 28 aircraft in the program, with perhaps more to follow. They include Boeing F/A-18s and T-45s, as well as T-34s, EA-6Bs, SH-60s, S-3s and P-3s.

“It was an effort to create living history,” Dann said.

Dann directed the painting of the F/A-18s in color schemes that originally decorated U.S. Navy and Marine Corps fighters during World War II, and the painting of training planes with the colorful yellow wing finishes of the 1930s. Even a venerable P-3 Orion was painted in the stately “seaplane gray” and white finish

the plane originally sported in the 1960s.

To minimize cost, planes selected for the heritage paint schemes were those requiring paint as part of scheduled major maintenance and not planned for deployment.

The wrap-up of the centennial celebration does not mean the Heritage Paint Project planes will immediately be returned to their standard finishes. The airplanes will retain their heritage colors and markings until their next rework cycle, which means some of the planes will continue to be a feature at air shows for the next seven to eight years.

Meanwhile, Rich has returned to Boeing with fond memories of a once-in-a-lifetime

job, including a special memory: the painting of an F/A-18C Hornet in the markings of Lt. Hamilton McWhorter, an F6F Hellcat ace in World War II.

McWhorter recently died, but his widow, Louise, in the San Diego area, and their grown children were invited to see the newly painted Hornet. The event took place on what would have been McWhorter’s 90th birthday.

“It was a very touching moment,” Dann said, “and a reminder that behind our airplanes there are real people who build, fly and maintain them, and behind those people are real families.” ■

michael.j.lombardi@boeing.com



MAXimum performer

New 737 MAX will build upon a legacy of accomplishment and success

By Mike Barber

When Pete Parsons left one of the first meetings of the small group developing the foundation for the 737 MAX program recently, his enthusiasm was immense.

"It's impressive, the best I've seen," Parsons, director for Program Management Best Practices and Program Management functional excellence for Commercial Airplanes, said of his encounter.

"Clear communications, high level of collaboration. The leadership are people with vast experience who are open to lessons learned and to using those lessons learned, and willing to use program management best practices," Parsons said, excited at the possibilities ahead.

Reaching into his experience as a former U.S. Navy officer, Parsons cited one more attribute: "Battle-hardened. They've been there."

The team that wowed Parsons is an acorn now. But it's about to grow into a mighty oak, laying the groundwork for a successful program to re-engine the best-selling Next-Generation 737 into the even more efficient and competitive 737 MAX.

As details materialize and the 737 MAX begins to take shape, the newest variant of the world's best-selling airplane looks very familiar. And that's exactly the point.

"We're going to make this the simplest re-engine possible," said Jim Albaugh, president and chief executive officer. "We're only going to touch the part of the airplane impacted by the engine and a couple of other improvements."

The MAX is based on years of improvements to the Next-Generation 737 to meet customer needs and growing market demand.

When the program was launched in late summer, Nicole Piasecki, vice president of Business Development & Strategic Integration, described the MAX as the optimization of "everything we and our customers have learned about designing, building, maintaining and operating the world's best single-aisle airplane."

The 737 MAX will deliver maximum efficiency, maximum reliability and, with the Boeing Sky Interior, will continue to offer maximum passenger comfort, she said.

And it promises to deliver maximum profitability for its operators.

The efficient and lower-weight design of the 737, which requires less thrust than other single-aisle airplanes, will be a boost to operators.

In November, Boeing announced the selection of a 68-inch (1.7-meter) engine fan.

"Weight and thrust have a significant effect on fuel efficiency and operating costs," said John Hamilton, vice president of 737 Engineering and chief project engineer. "With airlines facing rising fuel costs and weight-based costs equating to nearly 30 percent of an airline's operating costs, the optimized 68-inch fan design will offer a smaller, lighter and more fuel-efficient engine to ensure we maintain the current advantage we have over the competition."

The MAX will have 10–12 percent lower fuel burn than current 737s, according to Albaugh and other executives.

The MAX will deliver the big fuel savings that airlines will need to successfully compete in the future. Hamilton estimates that the MAX will provide airlines a 7 percent advantage in operating costs over future competing airplanes as a result of optimized engines, more efficient structural design and lower maintenance requirements.

Boeing has received more than 700 order commitments to date from nine customers, up from 496 airplanes ordered from five customers when the program launched.

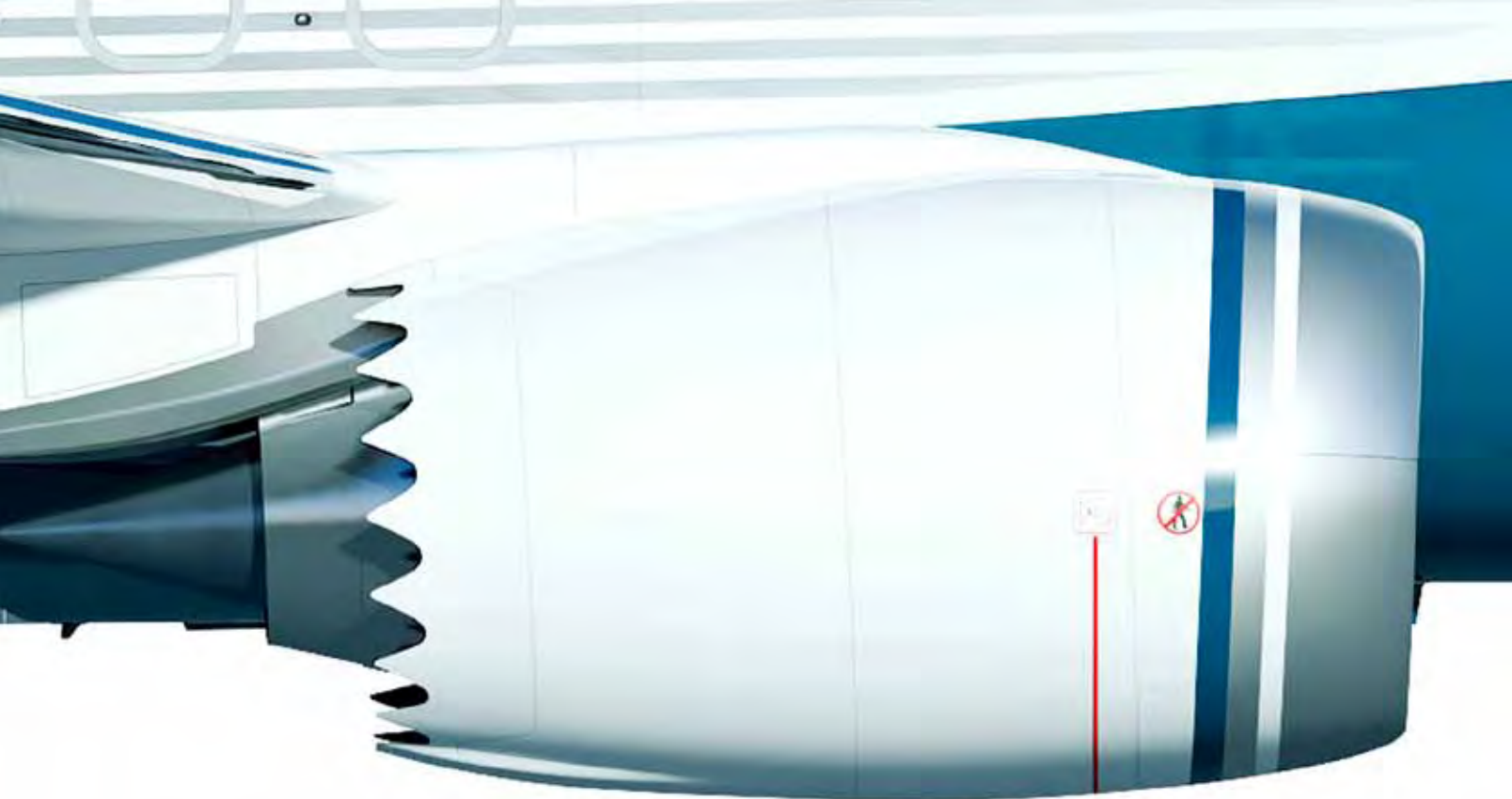
Firm configuration is scheduled for 2013, with first flight



“We’re going to make this the simplest re-engine possible.”

– Jim Albaugh, president and CEO of Boeing Commercial Airplanes

PHOTO ILLUSTRATION: A redesigned tail cone to reduce drag and improve fuel efficiency is one of the more noticeable changes to the MAX. **BOEING**



“Weight and thrust have a significant effect on fuel efficiency and operating costs ... the optimized 68-inch fan design will offer a smaller, lighter and more fuel-efficient engine.”

– John Hamilton, vice president of 737 Engineering and chief project engineer

scheduled in 2016. Customer deliveries would begin in 2017.

Meanwhile, the 737 MAX workforce is about to grow.

“We’re standing on the shoulders of the Commercial Airplanes Product Development team and the 737 program team,” said Bob Feldmann.

He knows.

Feldmann, as vice president and general manager, leads the 737 MAX program. “We call it our MAX working-together team.”

When Albaugh tapped Feldmann for the post from Boeing Defense, Space & Security, he also moved Michael Teal from the 747-8 program to join the MAX as vice president, chief project engineer and deputy program manager.

“We got a running start on the MAX program because Product Development had been working on 737 re-engine studies and efforts to design a new small airplane,” Teal said. “So there was already a substantial body of work and a coordinated team that had been working toward the MAX for a couple of years.”

Feldman added that the 737 program team has brought to the MAX “a tremendous level of experience around this world-class aircraft and production system.”

In naming Feldmann and Teal to the top MAX posts, Commercial Airplanes acquired two senior leaders with recent experience in program management and engineering. Feldmann previously led the Surveillance and Engagement division within Boeing Military Aircraft, a unit of Defense, Space & Security that includes

the P-8 Poseidon, a U.S. Navy maritime patrol aircraft based on the Next-Generation 737 platform.

Teal spent six years on the 747-8 program, where he was chief project engineer and instrumental in the airplane’s configuration, integration, performance, safety, testing and certification.

In addition to product development and the 737 program, that group is successfully integrating others’ expertise into the mix, such as Commercial Airplanes’ Marketing and Sales, as well as adding customer input.

“Getting there,” Feldmann said, “takes a deliberate and disciplined approach that leverages best practices and the enterprise gated process for program development. On top of that, we get huge value from the working-together relationships that have been established.”

Using another of his Navy terms, Parsons talks about the “full speed ahead” cadence that the program members have adopted.

“Their quick start is no accident,” Parsons said. “No doubt that the collaboration of the Commercial Airplanes teams is the catalyst behind MAX performance.” ■

michael.barber2@boeing.com

PHOTO ILLUSTRATION: The MAX, which improves on the already efficient Next-Generation 737 with an additional 10–12 percent fuel burn reduction, features new LEAP-1B engines developed by CFM. BOEING

KINGS OF STING

Royal Australian Air Force F/A-18F Super Hornets from RAAF Base Amberley cruise over Queensland, Australia, Oct. 21, part of a flyover to mark the last four deliveries in the RAAF's 2007 order for 24 Super Hornets. Delivery of all 24 fighters was accomplished on budget and ahead of contract schedule. PHOTO: AUSTRALIAN DEFENCE FORCE







LIFE IS AMAZING IF YOU KNOW WHERE TO LOOK.

To a child, it's not just a sky. It's a dream. We proudly support those who strive to introduce children to the many wonders of the world. And help us all see through young eyes.

 **BOEING**