



Frontiers

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Building on Success

Passionate employees help
777 program soar



A detailed photograph of an Apache helicopter in flight, viewed from a low angle. The helicopter is the central focus, with its main rotor blades blurred from motion. It is equipped with various sensors, including a large dome-shaped radar on top, and has several missiles or pods mounted on its stub rotors. The background consists of a vast, mountainous terrain with patches of snow under a clear sky.

BOEING PBL: READINESS ON DEMAND.

Performance-Based Logistics (PBL) are an effective solution in improving military readiness while saving billions. Under Boeing PBL programs, the Apache Longbow has exceeded readiness targets by 19.3%, the F/A-18 Super Hornet by 17.5%, while C-17 flying hour costs have been reduced by 26% since 2004. An AIA study estimates PBL savings to be \$25-\$30 billion per year. That's performance we can't afford to lose.

 **BOEING**

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

Inside cover:



This is one in a series of three ads featuring Boeing's Performance Based Logistics (PBL) capabilities. The ad highlights the success of the PBL program supporting the Apache Longbow, reducing cost while increasing readiness for its military customer. The campaign is currently running in military trade and congressional publications.

Pages 6-7:



"Enduring Mission," featuring the Commercial Crew Transportation System, is one of several ads in a Boeing Defense, Space & Security campaign highlighting the capabilities Boeing brings to its customers. The ads are running in print and online business, political and trade publications.

Pages 8-9:



With a recent order from Aviation Capital Group, sales of the new 737 MAX jetliner have surpassed 1,000. This ad celebrates that milestone and our partnership with ACG. It ran in *Aviation Week*.

Page 33:



Marking the 75th anniversary of Boeing's partnership with the United Kingdom, this ad ran in the Royal Aeronautical Society annual handbook. The ad, which is part of the "Together we fly higher campaign," highlights Boeing's customers, employees, suppliers and researchers and their shared vision for the future.

Back cover:



This ad highlights Boeing's leadership in satellite hosted payloads, an innovative business model that delivers capability, cost and schedule advantages to customers. The ad appears in trade publications.

18 Making the world smaller

Boeing's 777 jetliner has enjoyed great success since it entered service in 1995 and airlines continue to place orders at a rapid pace for the big, twin-engine jet. Production rates are now at a record-setting 8.3 airplanes per month and engineers are studying a potential 777X upgrade. Bob Whittington is in the middle of it all as vice president and chief project engineer for the 777 program.

COVER IMAGE: SECTIONS OF THE 777 ON THE PRODUCTION FLOOR IN THE EVERETT, WASH., FACTORY. BOB FERGUSON/BOEING

PHOTO: WINGS OF A 777 ARE MOVED INTO PLACE ON THE 777 PRODUCTION LINE. 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

Graphic designers:
Brandon Luong: 312-544-2118
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:
Len Vraniak: 312-544-2351

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
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Table of



24 Rising star

Boeing's relationship with India began 70 years ago with the start of domestic airline service using the Douglas DC-3. Today, India represents a major market for Boeing. But the relationship involves far more than sales of commercial and defense products, such as the P-8I maritime patrol aircraft. There are endless possibilities for growth of this important partnership with one of the world's fastest-growing economies.

PHOTO: JOHN PARKER/BOEING

Inside

10 Snapshot/Quotables

11 Why We're Here

34 Milestones

38 In Focus

of contents



12

Historical Perspective

Fifty years ago this month, a Boeing jetliner smaller than the 707 made its first flight from Boeing's Renton, Wash., factory. The sleek, three-engine 727 was a risky bet for Boeing at the time, but the plane went on to become one of the best-selling commercial jetliners ever and featured significant innovations. PHOTO: BOEING ARCHIVES



14

Target acquired

In St. Charles, Mo., just a short drive from Boeing's plants near St. Louis where F-15 and F/A-18 fighters are built, Boeing employees are making smart bombs even smarter. St. Charles is the home of the company's Weapons & Missile Systems program and the operations are a model of efficiency and assembly-line innovation. PHOTO: RON BOOKOUT/BOEING



22

Smart moves

Employees are using technology and other new learning tools to develop the right skills to help the company remain competitive and innovative. In this Q&A with *Frontiers*, Norma Clayton, vice president of Learning, Training and Development, explains how employee learning is changing. PHOTO: RON BOOKOUT/BOEING

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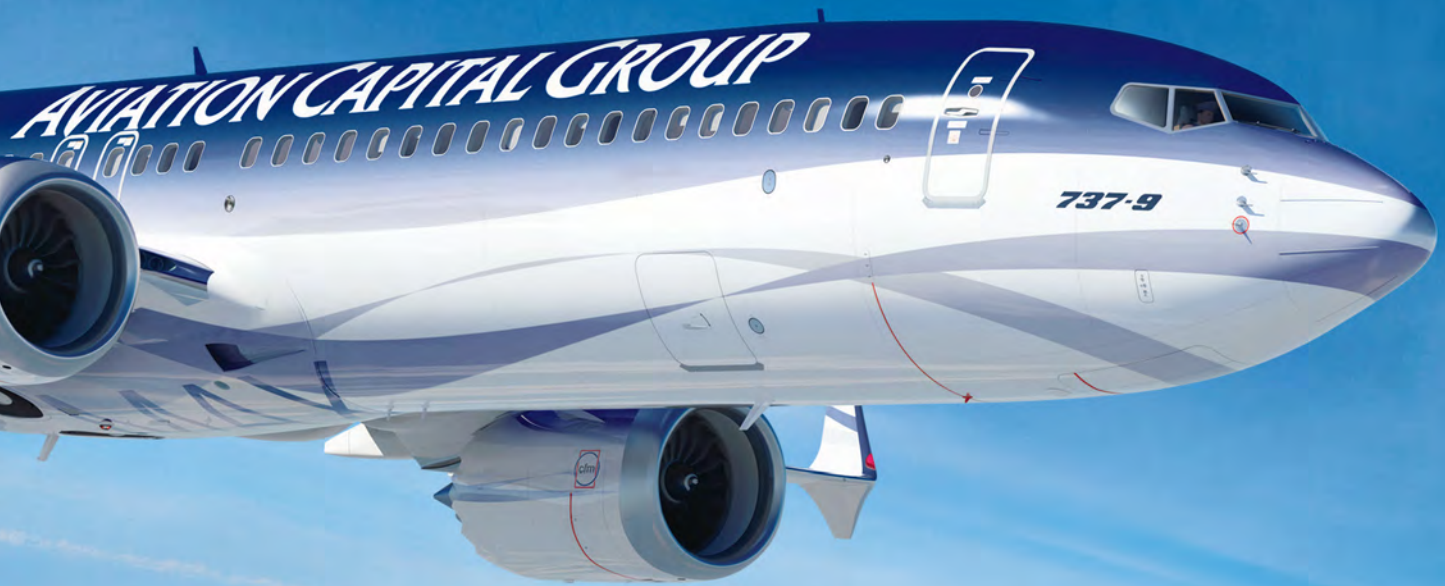


NOTHING LIKE GREAT NEWS

Thanks to a recent order for 60 new 737 MAX airplanes from Aviation Capital Group, total 737 MAX orders soared past the thousand mark in just over a year. ACG now joins our valued customers around the globe who've recognized the unmatched efficiency and reliability of the 737 MAX family. To all of them we say: here's to another great year of building success together.



THE NEW
737 MAX



TO CAP A RECORD YEAR.



WAITING FOR A LIFT: A CH-47F Chinook waits for fog to lift so Boeing pilots can make a production test flight late last year at Boeing's H-47 production facility in Ridley Township, Pa. Boeing employees delivered a record 59 of the F-model helicopters to the U.S. Army in 2012; more than 220 CH-47F Chinooks have been delivered to date. In addition to U.S. Army aircraft, 2013 deliveries will include Canadian and United Kingdom Chinooks, for a total of 61 aircraft. The first Chinook was delivered 50 years ago. PHOTO: FRED TROILO/BOEING

Quotables

“We basically created a giant ear in the middle of the desert.”

– Rebecca Shupe, an acoustics engineer for Boeing Research & Technology, on how Boeing engineers placed dozens of microphones near NASA's Dryden Research Center at Edwards Air Force Base in California to capture the sound waves created by Boeing F/A-18s as they made passes over the array at just over the speed of sound. The tests will help engineers better understand the impact of supersonic sound waves over land. *Boeing.com*, Jan. 21.

“We're making smart bombs smarter.”

– Josh Stonebraker, a munitions mechanic with Boeing's Weapons & Missile Systems program in St. Charles, Mo., talking about what's next, including a wing kit that will extend the range of Boeing's Joint Direct Attack Munition “smart bomb” to more than 40 miles (65 kilometers). See story, Page 14.



Check IT out

Before Boeing makes an acquisition, this employee makes sure there are no significant IT security issues

By Meghan Boyer

In this Frontiers series that profiles employees talking about their jobs, Doug Broadbent, a system design and integration specialist with Information Technology in Bellevue, Wash., discusses his work analyzing IT security of companies Boeing may acquire.

PHOTO: MARIAN LOCKHART/BOEING

You wouldn't buy a used car without first checking out its systems, right? The same holds true for companies Boeing is considering purchasing.

Before it inks a merger or acquisition agreement, Boeing's leadership team must know about every aspect of the business under consideration to make a well-informed choice. My job is to check under a company's metaphorical hood and evaluate its IT security environment. I look for major IT security issues that could affect the purchase decision.

For most of my 17 years with Boeing, I've been part of the companywide team that performs due diligence on potential

acquisitions. Led by the Corporate Development group, each team member evaluates his or her area of expertise—from IT to human resources to legal—and reports their findings.

Those of us in IT work hard to minimize cybersecurity threats and place high importance on protecting and securing the business. I help make sure Boeing's high standards extend to companies under consideration for potential mergers and acquisitions.

I've seen companies with strong IT controls, those with systems that are not up to Boeing's standards, and every level in between. Each company has its own IT resources, policies and culture that must be checked and evaluated to determine how efficient they are and how they would integrate with Boeing's systems and standards.

When my evaluation is complete I present to the IT leadership team the key risks—and any mitigation plans—identified in the due diligence process. I report on the current state of the business that might be acquired and provide a plan for the work required to bring the IT systems to an acceptable level. If I don't work hard to vet these systems in the beginning, Boeing's IT network could be in jeopardy in the future.

My input helps the IT leadership team and Corporate Development make decisions about whether or not to bring on new partners, products and services—any of which could be a game changer for the company. I have a lot of pride when Boeing announces an acquisition because I know I have played an important role in the decision-making process and the security of the IT system. ■

meghan.j.boyer@boeing.com



Risk and reward

Boeing's 727 was a risky bet at the time, but it became one of the best-selling jetliners ever

By Mike Lombardi

Even before Boeing's 707 made its first flight in the last days of 1957, it was apparent that only the world's major airports could handle such big jets and Boeing would need to develop a plane that could bring jet service to smaller airfields.

A number of U.S. companies were already working to compete in this market, including Lockheed, Convair and, later, Douglas when it jumped in with what would become the DC-9. Boeing also faced multiple overseas competitors, including the De Havilland Trident, the Sud Aviation Caravelle and the BAC 111, all of which had the potential of shutting Boeing out of European and other international markets.

Adding to Boeing's challenges were the myriad conflicting demands from customers. Some wanted four engines; another wanted

a twin; still others were satisfied with prop planes and had no interest in a jet.

The harsh reality was the commercial jet business was in its infancy and Boeing was still grappling with the considerable startup and production cost of the 707. The decision to go forward on a new commercial plane was seen as a tremendous financial risk, one that many at Boeing advised against.

But that new Boeing jetliner, the 727, would prove a terrific bet.

It would become the first commercial airplane to break the 1,000 sales mark and it remains one of the best-selling commercial jets in history. With its distinctive swept-back T-tail and three engines clustered aft, the sleek 727, a plane that introduced a number of new technologies, first flew 50 years ago this month.



The 727 was born in one of the most formidable environments ever faced by a new airplane program. Fortunately the point man given the job of bringing the 727 to life was chief designer John E. “Jack” Steiner. He was brilliant and dedicated. And Steiner understood the challenge.

“The 727 program,” he said at the time, “must be classed as a very risky program because the goals are known to be barely attainable—if attainable at all.”

Steiner started out with a simple objective: “Bring out an airplane that was needed to extend jet travel into smaller cities. We want to get more people traveling, not just those who think they can afford it, but those who thought they couldn’t afford it.”

His strategy for winning was also simple: “Build the best possible airplane.”

Steiner credited teamwork across the company for the program’s success. This included firm guidance and trust from Boeing President William Allen. And Chief Engineer Ed Wells encouraged teamwork across engineering disciplines. Sales, Marketing and Flight Test did their part and supported a demanding world tour during the plane’s flight-test certification. This tour helped differentiate the 727 from the competition—so much so that orders began to pour in while the plane was on the tour.

While teamwork was key to bringing the plane forward, innovation was what beat the competition.

The challenge was to design a fast, quiet, reliable jet that could serve smaller airfields. To meet that, the team from the Technical Staff, including its leader, Bill

Cook, and Chief Aerodynamicist Joe Sutter, invented a new wing design that pioneered an innovative triple-slotted flap and included leading-edge lift devices that together enabled the 727 to take off and land at runways shorter than 5,000 feet (1,500 meters).

The clean swept-back wing also kept the plane fast, allowing the 727 to outpace its competition. Other technological firsts included the first commercial jet with an onboard auxiliary power unit. A distinctive feature was aft onboard stairs.

On Dec. 5, 1960, after nearly five years of intense study that looked at more than 150 different designs, Boeing announced the three-engine 727, with 40 orders each from launch customers United Air Lines and Eastern Air Lines.

On Feb. 9, Boeing test pilot Lew Wallick, co-pilot R.L. “Dix” Loesch and engineer M.K. Shulenberger took the 727 up for its first flight.

After a year of testing, the 727 went into service—and was even better than advertised. The 727’s actual performance was 10 percent greater than Boeing first projected.

The early success of the 727 was noted colorfully by Boeing President William Allen: “I’ve had a few dreams in my life ... One was to have a large airline customer call me up and, instead of giving me hell, tell me he is delighted with an outstanding airplane, better than he bargained for. This happened with the 727. We have done an outstanding job on that airplane.”

In September 1984, after a 22-year production run, the last of 1,832 727s, a 727-200 Freighter, was delivered to Federal Express. The once “very risky” 727 had become one of the best-selling commercial jets in history.

Looking back, Steiner credited the jet’s huge success to the almost unattainable goals set for the 727 program.

“I believe engineering/manufacturing teams are capable of far greater accomplishments,” he said, “if they are stimulated by goals that they recognize as almost unachievable.” ■

michael.j.lombardi@boeing.com

PHOTOS: (Clockwise from far left) The first 727, currently under restoration at the Museum of Flight’s Restoration Center in Everett, Wash.; rollout of the first 727 at the Boeing plant in Renton, Wash., in November 1962; prior to the plane’s first flight, John E. “Jack” Steiner (second from left), chief designer of the 727, congratulates lead pilot Lew Wallick (from left), co-pilot R.L. “Dix” Loesch and flight engineer M.K. Shulenberger.

MOREBANG

FOR THE BUCK

Whether building smart bomb kits or Harpoon missiles, the St. Charles site is a model of 'One Boeing' efficiency

By Garrett Kasper





A short, 20-minute drive from Boeing's facilities near St. Louis where employees make F-15 and F/A-18 jet fighters is St. Charles, once the home of frontiersman Daniel Boone and the original state capital of Missouri. Located along the banks of the meandering Missouri River, St. Charles was where, in 1804, Meriwether Lewis and William Clark deployed on their Corps of Discovery expedition to reach the Pacific Ocean, a journey that produced legendary scientific discoveries.

It is also home to Boeing employees who make some of the "smartest" and most reliable weapons used by the U.S. military and allies.

The St. Charles site consists of several nondescript buildings on several hundred acres of rolling green hills, woodlands and meadows. In fact, some of the picturesque hills surrounding the riverfront community aren't hills at all. Protected during storms by 50-foot-high (15-meter) lightning rods, they are military-grade bunkers that house live ordnance built at the Boeing St. Charles facility.

Boeing employees here mainly produce the Standoff Land Attack Missile (Expanded Response), the Harpoon anti-ship missile,

as well as the Joint Direct Attack Munition (JDAM) guidance kits and the Small Diameter Bomb. What they do is Lean+ and efficient production at its best.

A team of just 20 munition mechanics at the St. Charles site assembles approximately one JDAM kit every seven minutes. On any given day, the team will build more than 40 kits by the lunch hour, at which time they switch the line over to Small Diameter Bomb production.

Employees here take great pride in what they do, said Tom Reynoso, a sheet metal worker and riveter on the Harpoon program. His son is in the U.S. Air Force.

"Knowing the product I work on protects our military men and women in uniform, including my own son, gives me an enormous sense of pride and purpose," Reynoso said.

Nearly 1,000 Boeing employees work at the site, yet many more St. Louis employees reside across the river in St. Charles county.

"I love living and working in St. Charles because it's a small community with a charming history and great local events," said Sarah Reeves, a supplier quality engineer for Boeing's Weapons & Missile Systems program. "The site is a challenging, rapidly paced environment, and our employees are very engaged. There are so many opportunities to get to know virtually everyone."

Added David Fernandez, team leader of the weapons paint shop: "If you want to know the meaning of 'One Boeing,' just come to St. Charles and see how we interact with one another."

McDonnell Douglas, a Boeing heritage company, began acquiring property on what is now the St. Charles site in the mid-1960s, and started construction of the

PHOTOS: (Far left) Assembly mechanic Fred David prepares a harpoon anti-ship missile for encapsulation, which would allow it to be launched from a submarine.

RON BOOKOUT/BOEING (Above) A Boeing F-15 drops five inert MK-84 2,000-pound (900-kilogram) Joint Direct Attack Munitions, or JDAMs, during a training flight. U.S. AIR FORCE

Harpoon missile facility in 1978. The first production Harpoons were shipped from St. Charles the next year.

Since then, more than 7,300 Harpoons have been built there, including the latest version known as the Block II. The Harpoon has long been considered the world's premier anti-ship missile and is built for the U.S. Navy and more than 30 international allies. Designed primarily to hit enemy warships at sea, more than 600 ships, 180 submarines, 12 different types of aircraft and even land-based launch vehicles carry Harpoon missiles.

Boeing has also developed the missile system into the Standoff Land Attack Missile (Expanded Response), a weapon capable of attacking land-based targets with pinpoint accuracy, and which can

even be reprogrammed after launch.

In 2012, Boeing and the U.S. Navy reached an agreement to affordably produce more advanced versions of air-launched Harpoons, extending the life of the program for at least another decade. The Harpoon Block II+ will include a new GPS guidance kit to improve midcourse navigational accuracy. It can be carried on the F/A-18E/F Super Hornet and will be compatible with the company's P-8A Poseidon, a modified 737 used for submarine hunting and maritime patrol missions by the U.S. Navy.

"After four decades of successful cooperation with our Navy partners, Boeing continues to find innovative ways to incorporate system upgrades to enhance Harpoon's reach and interoperability," said Jeff Ayers,

director of Cruise Missile Systems.

The St. Charles site consists of several buildings on 210 acres (85 hectares). The facility used for making JDAM kits is across the campus from the Harpoon facility. The tail kits affordably convert unguided bombs, or "dumb bombs," into reliable, all-weather munitions that can precisely hit targets using GPS. These "smart bombs" not only are more effective but minimize collateral damage.

Also built on the same line is the Small Diameter Bomb, a winged 250-pound (115-kilogram) guided bomb that allows aircraft to carry more weapons per station. Most U.S. Air Force aircraft will be able to carry a pack of four Small Diameter Bombs in place of a single 2,000-pound (900-kilogram) bomb by using the BRU-61 smart weapons carriage.

To date, nearly 240,000 JDAM tail kits



and more than 10,000 Small Diameter Bombs have been delivered on time and at cost because of the efficiency of using one production line for two programs.

“The idea to merge the JDAM and Small Diameter Bomb production lines came directly from our employees because they understood firsthand how much more efficient and economical it would be,” said John Caré, senior production manager for Weapons & Missile Systems.

Caré noted as few as 20 employees are needed to build both—at very high production rates.

“People are always amazed when they learn that such a small team can produce so many high-quality products each day and that there is a high degree of flexibility among team members,” he said. “Everyone

can do every job on the production line. What one person assembles today might be the one they test tomorrow. So, there’s a healthy respect for the worker ahead of and behind you, which results in a great pride for the end product.”

That production quality and efficiency, according to employees, comes with the knowledge of just how important what they do is—especially for the warfighter.

“We are always looking for creative ways to improve efficiency and productivity, but most of all, quality,” said Direct Attack munitions mechanic Sean Richardson.

“This isn’t just a job to us. Every day we realize lives are at stake. Realizing that men and women in harm’s way depend on us to get it right is a great motivator.” ■

garrett.d.kasper@boeing.com

PHOTOS (Clockwise from top far left):

Thomas Reynoso attaches wings to a Small Diameter Bomb warhead; Shirley McCollum assembles a guidance control unit on a JDAM tail kit; Willie Austin applies decals on an assembled Small Diameter Bomb; Russell Evans (below right) installs explosive lines in a capsule used to launch a Harpoon from a submarine. **RON BOOKOUT/BOEING** The U.S. Navy guided-missile destroyer USS *Donald Cook* launches a Harpoon anti-ship missile during an exercise. **U.S. NAVY**

PHOTO ILLUSTRATION (Below left):

The extended-range JDAM will have a wing kit that will nearly triple its range. **BOEING**



Making **smart bombs** smarter

Boeing’s Weapons & Missile Systems program in St. Charles changed warfare by taking unguided “dumb bombs” and converting them into precision guided munitions. With the addition of a GPS sensor and tail kit, the Joint Direct Attack Munition, or JDAM, ushered in the “smart bomb.”

It was just the beginning.

When warfighters needed a smart bomb that could hit a moving target, such as a vehicle, Boeing developed the laser-guided JDAM. Boeing then transferred some of that same technology and innovation to develop the laser-guided Small Diameter Bomb.

What’s next?

A wing kit will extend the range of the JDAM to more than 40 miles (65 kilometers). Also in development is a jet-powered JDAM for significantly longer range. It will incorporate a small turbine engine between the warhead and JDAM tail kit.

“Everyone here is dedicated to providing a highly capable product while remaining affordable,” said munition mechanic Josh Stonebraker. “We’re making smart bombs smarter. It has our customers eager to see what we have in store for Boeing’s next generation of weapons systems.”

– Garrett Kasper



BRINGING PEOPLE TOGETHER

A passion for airplanes and the job drives the 777's chief engineer

By Devona Walker and photos by Bob Ferguson

PHOTO: Bob Whittington, vice president and chief project engineer for the 777 program, on the catwalk overlooking 777 final assembly in Everett, Wash.

It's the world's largest building by volume, and Bob Whittington sits in one of the many nondescript office cubicles at the center of Boeing's sprawling Everett, Wash., factory.

The cubicles are separated from the rest of factory operations by 360 degrees of soundproof glass. These cubicles, according to Whittington, were designed deliberately for collaboration—and to keep leadership connected to the aircraft and the employees who assemble them. He stands up from his desk and looks out, just as an overhead crane moves the wing of a 777 the length of the factory floor. About 30 feet (9 meters) from his desk is the fuselage.

Whittington is a vice president and chief project engineer of the 777 program.

This plane is his baby.

"The idea that you can make something that is 775,000 pounds (350,000 kilograms) of aluminum, fuel and people launch off the ground and fly for 17, 18 hours to the other side of the globe is still fascinating," Whittington said like a proud father.

"It seems like magic, yet we do it every day."

The big, twin-engine jet, which entered service with United Airlines in 1995, had its best order year ever in 2011 with 200 firm orders, surpassing the previous record of 154 orders set in 2005. The program delivered the 1,000th 777 early last year, a milestone reached faster than any twin-aisle program in history.

With only two engines, the 777 was so much more efficient than the

competing four-engine A340 that Airbus ended production of its plane.

Orders for the 777 keep rolling in, and to meet demand, production rates are now at 8.3 planes a month, or 100 a year. Meanwhile, Boeing engineers are at work on what will come next in the 777 family based on talks with customers. The 777X program will build on the success that has followed each new model of the 777.

And Whittington is right in the middle of it all.

As chief project engineer for the 777, Whittington has the responsibility—and vision—for strategy, development and design oversight, as well as the compliance, certification and safety of all 777 models, and post-delivery





“BEING ABLE TO CRAFT THE FUTURE VISION OF AN AIRPLANE AND SEE THAT TAKE HOLD—AS SOMETHING SOLID AND SEE IT BEING BUILT RIGHT OUTSIDE OF MY WINDOW—IS REALLY REWARDING.”

— Bob Whittington, vice president and 777 chief project engineer

upgrades. Product lines across Boeing have their own chief engineers, some of whom have the title of Chief Program Engineer, who have oversight duties similar to Whittington's. They create a culture of proactive technical oversight, managing risks and the fast resolution of issues.

“Boeing strengthened the role of the chief project engineer to provide an additional tier of safety and technical oversight,” said Patrick Goggin, vice president of 747, 767 and 777 Engineering. “On a fairly regular basis our chief project engineers make decisions that impact human safety.”

Whittington didn't set out to be an engineer. As a youngster, he dreamed of becoming an astronaut. A guidance counselor suggested a path through the Air Force Reserve Officers' Training Corps, or ROTC, and a degree in aerospace engineering would put him in the best position to realize the dream.

Whittington never became an astronaut, but he never lost his passion for airplanes and aviation.

“Aviation enthusiasm absolutely has to be part of the job,” Whittington said. “I think that's true for a lot of people at Boeing. There are a lot of smart people who work here who could choose to make money doing something else. But they love airplanes. ... When an airplane flies over, they all look up.”

As Whittington talks in his office, a dog-eared copy of the U.S. Federal Aviation Regulation manual is on his desk. On the wall, next to photographs of his family, are pictures he's taken on recent business trips. One is of St. Sophia's Cathedral in Istanbul, another of the Salisbury Cathedral in England. In addition, there are the red sands of Dubai and shots of Amsterdam's famous canals and St. Basil's Cathedral in Moscow's Red Square.

Whittington brings 25 years of experience to the role of chief project engineer.

“Airplanes and the automobile are really

the same age,” Whittington explained at one point. “They were built and were commercially available around the same time. But the automobile is mundane. Everyone's got one. Airplanes are still fascinating. There is still that aura of excitement.”

The 777 also has been a standard bearer for innovation and Whittington, as chief project engineer, is the top technical leader on the program.

If an airline wants bigger television screens in its back cabins, in-flight Wi-Fi, or more robust landing gear due to a flight schedule that now includes Antarctica's infamous Ice Runway, chief engineers dissect every potential impact.

Whittington must weigh what an airline customer might want with what can be perfected in design and on the factory floor. It's a daunting task considering the longevity of an aircraft and the ever-evolving dynamics of computer-generated, digital and environmental technology.

Airplane structures are built to last. Yet they must accommodate evolving technology, some of which hadn't been invented when the airplane was designed.

Whittington revels in the challenge.

“Being able to craft the future vision of an airplane and see that take hold—as something solid and see it being built right outside of my window—is really rewarding,” he said.

On the factory floor outside his office, one such vision took shape last year when Boeing delivered its first domestic customer, American Airlines, a 777-300ER (Extended Range) with an all new in-flight Internet system.

“We took that from a customer request to reality,” Whittington said. “Even the smallest change must be engineered. Even the color of the curtains, everything has to be thought through, every problem solved in a systematic way.”

The color scheme of a jetliner's interior affects lighting or, more important, the

availability of light in an emergency situation. And that has an effect on safety.

“To do the job right,” Whittington said, “it's got to be better. Not just for today or tomorrow, but for the foreseeable future.”

When it comes to safety, the buck stops with him. When it comes to the service, support and upgrades of all 777 models throughout their life span, it starts with him.

“I really feel that we make the world smaller,” Whittington said of Boeing and its commercial airplanes and the many thousands of engineers, mechanics and others who make and support those jets around the world.

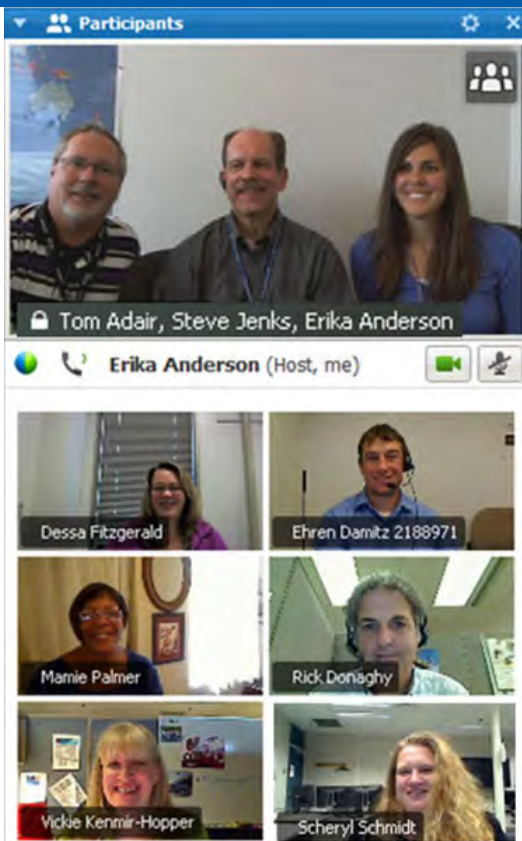
“Being able to be somewhere completely different tomorrow—on the other side of the globe—brings people together in a way that nothing else can. Being a part of making that happen is amazing.” ■

devona.walker@boeing.com

PHOTOS: (Top) In the past 31 months, the 777 program has increased rate twice and is now at 8.3 per month—the highest rate of production ever for a Boeing twin-aisle airplane. **(Left)** The horizontal stabilizer of the 777 is made of composite, as is the vertical stabilizer, which has not yet been attached in this photo of 777s on the Everett, Wash., production floor.

The future of learning

The way employees learn new skills is changing — and so is Boeing



PHOTOS: (Clockwise from top left) A screen capture shows the Virtual Classroom Services team demonstrating new video capabilities. **BOEING** James Le Blanc (foreground) instructs a virtual classroom while Ehen Damitz produces the session. **JIM ANDERSON/BOEING** Norma Clayton, vice president of Learning, Training and Development. **RON BOOKOUT/BOEING**

To encourage development in critical skill areas, tuition is covered 100 percent in technical fields of study.



Boeing's ability to remain an innovative company depends on having the right people with the right skills. Continuous learning combined with on-the-job experiences gives employees the chance to develop skills in key technical areas that are critical to Boeing's business, such as engineering, computer science, cybersecurity and mathematics.

Through the Learning Together Program, employees can pursue courses in these areas with no funding limits. Employees can also develop critical skills through formal and informal development and rotation programs.

Norma Clayton, vice president for Learning, Training and Development, talked with *Frontiers* about how employees are using technology and other new learning tools to develop these skills.

How is the way we learn changing?

Boeing has traditionally been a formal learning organization, utilizing tools like instructor-led training, Web-based training and continuing education courses at colleges and universities. What we're seeing in the training industry now is a move aligned with technology that is social and collaborative. And this is the space we're moving into.

All across the organization we're seeing a distinct move toward smaller snippets of learning and we're looking to leverage this. It's all about giving people what they need at the moment of need. Instead of taking an entire course, we can break it down and give them a small piece of information that can be used right away.

And we're testing different technologies, such as mobile learning, as an enabler to deliver these small pieces of information.

Employees are also using these technologies to share information more than ever before. They're texting, leveraging Wikis, blogging, connecting through inSite and using cellphone apps.

How is this affecting formal education?

While there will always be a demand for higher education, we're seeing a distinct move from four-year degrees to certificates, particularly at Commercial Airplanes.

As people are navigating their career, the strategy of shorter-term learning is attractive as a professional tuneup. It's not as expensive or as big of a time commitment as a four-year or advanced-degree program.

We've developed the Continuing Education Advising toolkit, which aligns skills with programs at colleges and universities available both at a local and national level. The courses are eligible for the Learning Together Program, Boeing's tuition assistance program. If you're pursuing a career interest in supply chain management, there's probably a local or online university that has a program. Certificates are a great option to give someone an overview on a particular career path while providing applicable skills they can put to use right away.

How does Boeing plan to utilize emerging learning technologies?

We're using technology as an enabler of learning where it's appropriate. In our delivery

methods, we aim for the highest level of knowledge transfer. Sometimes that means formal learning and sometimes it means using technology. Our big near-term technology advancements are around collaborative learning environments. This may take the form of a more interactive classroom where the instructor changes his or her role as the sole knowledge expert to a knowledge facilitator. In this kind of environment, the facilitator integrates the latest learning technologies to leverage the knowledge of the learners. This approach not only increases learner engagement during the class, it exponentially increases the knowledge shared and gained between learners.

What is a learning path?

A learning path defines the sequence of formal, informal and experiential learning that's needed to prepare someone for either additional advancement or overall career growth. A learning path looks at a career over the long term and the learning and experiences needed along the way. It's very personalized, allowing each person to move at his or her own pace.

Not all job functions have formal learning paths, but there's nothing stopping employees from working with their managers to lay out a plan. We've provided the means to do so through a number of tools, such as the Continuing Education Advising Toolkit, Learning Together Program, LTD courses and much more. ■

ENDLESS POSSIBILITIES

Boeing and India have a growing partnership that includes much more than the company's military and commercial products

By Bill Seil

Boeing's 70-year relationship with India has gone into high gear. Jetliner sales have increased dramatically, a growing defense market has emerged and new technology partnerships have been formed.

That relationship began in the early 1940s, when India's Tata Airlines began flying DC-3 aircraft, built by Boeing heritage company Douglas Aircraft. While Boeing continued to sell airplanes to Indian airlines over the years, the creation of Boeing India in 2003 gave the company a big boost in India's rapidly growing defense market.

Military sales to India have evolved since the mid-2000s when agreements and closer strategic ties between the United States and India allowed U.S.-based defense firms to compete for India's business. Since that time, India has been a strong customer for C-17 airlifters and P-8I long-range maritime reconnaissance aircraft. Details are also being discussed for the purchase of Boeing helicopters.

"Our strategy to leverage the entire Boeing enterprise to partner with India has been highly successful, and this has been especially true over the past five years," said Shep Hill, president, Boeing International, and senior vice president, Business Development and Strategy.

"India represents a very important market for us. It's the second-most populous nation in the world, and it has one of the fastest-growing economies."

Hill pointed out that India has long been a steady customer for Boeing Commercial Airplanes. But Air India's 2005 purchase of 68 Boeing jetliners, he said, marked a milestone in India's rapidly growing demand for commercial air travel. Then, in 2009, Boeing opened a new research and technology facility in India. That same year, the Indian government made its first major purchase of Boeing defense products.

In addition to being a strong market for commercial airplanes, India is committed to increasing its defense capabilities, Hill said, adding that India will have a continuing need for commercial and military aircraft and an array of services to support these aircraft.

Headquartered in New Delhi, Boeing India has approximately

PHOTO: This P-8I, pictured during flight testing over Washington state, is one of three maritime patrol aircraft that will be delivered to India by the end of this year. JOHN PARKER/BOEING



**INDIA IS "PART OF THE MODERN WORLD, WHILE
RETAINING THE VALUES OF THE PAST. ... WE ARE EXCITED
ABOUT OUR GROWING PARTNERSHIP WITH INDIA AND
EXPLORING ITS MANY POSSIBILITIES."**

– Pratyush Kumar, president, Boeing India

PHOTO: BOEING







300 locally based employees, with all but a few being Indian nationals. They work in the company's commercial and military operations as well as subsidiaries and the research and technology facility.

In December 2012, Boeing announced the appointment of Pratyush Kumar as the new president of Boeing India. He replaced Dinesh Keskar, who has rejoined Boeing Commercial Airplanes as senior vice president, Sales, Asia Pacific and India. Keskar had served as president of Boeing India since 2009.

Prior to joining Boeing, Kumar was based in Delhi serving as president and chief executive of GE Transportation for South Asia.

Kumar said Boeing has built a solid partnership with India that spans a broad range of business activities.

"India, with its rapidly expanding economy, has aspirations to become a leading economic force on the world stage," Kumar said. "Boeing's growing presence in India is founded on common goals in advancing technology, innovation and local manufacturing. We also see exciting new opportunities for the sale of military and commercial products."

The government of India has selected Boeing to provide eight P-8I maritime reconnaissance aircraft for use in the Indian Navy, with the first three to be delivered in 2013. The P-8 is a modified 737-800. India's Ministry of Defense also has signed an agreement with the U.S. government to acquire 10 Boeing C-17 airlifters. And Boeing has sold Harpoon missiles to both the Indian navy and air force.

In addition, Boeing and the Indian government are discussing final details for the purchase of both Apache and Chinook helicopters.

"We see India as a key long-term partner with potential for product sales, services and collaboration with suppliers," said Dennis Swanson, vice president, International Business Development, India, and head of Boeing Defense, Space & Security's sales effort there. "An important barometer of our success will be our ability to offer the right solutions, execute to plan on our existing programs and build trust with our customers and partners."

The Indian government has forecast a need for \$100 billion in defense-related equipment over the next 10 years. Swanson sees a growing market for unmanned systems, security solutions, support services, training and network-centric systems.

"They're acquiring new defense products to replace many of their aging platforms," Swanson said. "Boeing has a unique set of products to support the Indian military."

Boeing's services and support business, Swanson added, is expected to gather significant traction in India as customers seek to ensure the long-term operational readiness of their aircraft.

India's demand for commercial airplanes also is going strong.

"India has a rapidly growing economy and an expanding middle class," Keskar said. "As a result, its commercial airplane

PHOTOS: (Bottom left) A 787 painted in Air India colors takes off from Boeing's plant in North Charleston, S.C. **ALAN MARTS/BOEING (Insets, from left)** This 777 is among the Boeing airplanes flown by Jet Airways, a private carrier that began service in 1992. **TIM STAKE/BOEING** Boeing is on schedule to deliver five C-17s to the Indian Air Force in 2013 and five additional aircraft in 2014. **SALLY ARISTE/BOEING** SpiceJet, which began service in 2005, has been a strong customer for the Boeing 737.

JIM ANDERSON/BOEING Boeing will supply India with a total of eight P-8I aircraft, a modified 737-800 for anti-submarine and maritime patrol missions. **JOHN PARKER/BOEING**

fleet has roughly tripled over the past seven years.”

Air India’s order for 68 Boeing airplanes included 23 777s and 27 787 Dreamliners, as well as 18 737-800s for Air India’s wholly owned subsidiary Air India Express. In September 2012, Boeing and Air India celebrated the delivery of the airline’s first Dreamliner.

Two private Indian carriers, SpiceJet and Jet Airways, have also been strong Boeing customers. SpiceJet, which began service in 2005, then placed an order for 20 Next-Generation 737-800 airplanes and has since expanded its 737 fleet. Jet Airways, which began service in 1992, operates a fleet that includes both 737 and 777 airplanes.

Boeing forecasts that India will need 1,450 new commercial airplanes valued at \$175 billion over the next 20 years. As a result, India’s commercial aviation fleet is likely to grow to more than 4.5 times its current size by 2032.

Boeing is enhancing support services to keep pace with this growth. For example, it is working in partnership with Air India to build a maintenance, repair and overhaul facility in Nagpur, which is scheduled to open in mid-2013.

Another milestone in Boeing’s relationship with India was the opening in March 2009 of Boeing Research & Technology–India in Bangalore. The center works with research and development organizations throughout India—including universities, government agencies and the private sector—to develop new technologies that can be applied to Boeing products.

Bala Bharadvaj, managing director of the Boeing research center, said India has much to offer.

“There are many technically-savvy people in India and they have a lot of enthusiasm for aerospace,” Bharadvaj said. “Their analytical skills are outstanding, both in terms of modeling fundamentals and developing software. We are working with them to focus these talents on solutions.”

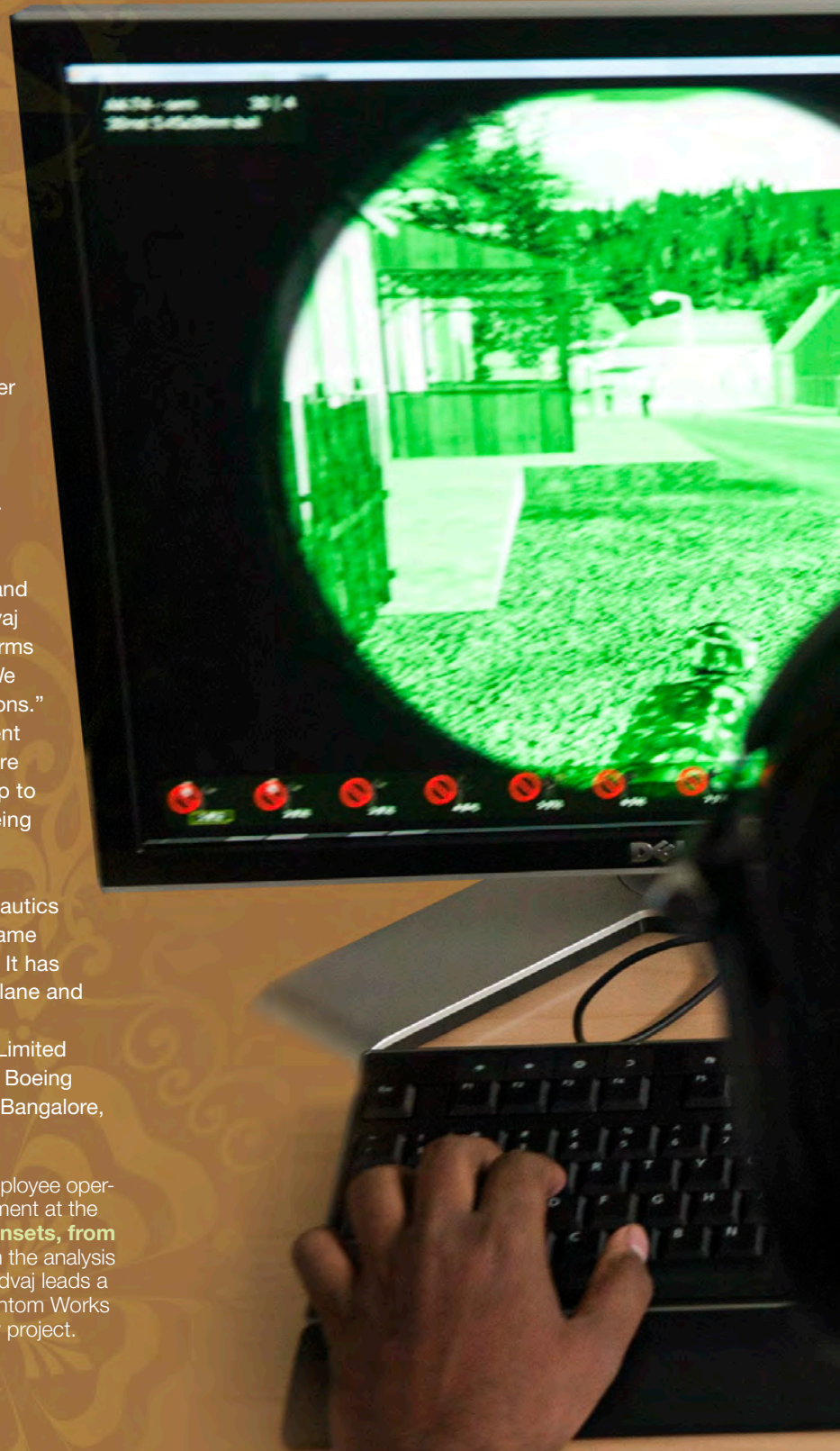
Boeing has collaborated with the Indian Department of Science and Technology to form the National Centre for Aerospace Innovation and Research, a partnership to create a world-class aerospace industry in India. Boeing also leads a collaborative effort to conduct network systems research and development in India.

Boeing’s relationship with India’s Hindustan Aeronautics Limited (HAL) began in 1991 when the company became a single-source producer of 757 overwing exit doors. It has continued to support Boeing in both commercial airplane and military aircraft programs.

Boeing also has partnered with Bharat Electronics Limited (BEL) on the P-8I and F/A-18 programs, as well as the Boeing Phantom Works Analysis & Experimentation Centre in Bangalore,

PHOTOS: (Bottom right) A Boeing Phantom Works employee operates a simulated ScanEagle during a surveillance experiment at the Analysis & Experimentation Centre in Bangalore, India. **(Insets, from left)** The Boeing Phantom Works team holds a briefing in the analysis center; Phantom Works staff conduct a test; Bala Bharadvaj leads a Boeing Research & Technology–India staff meeting; Phantom Works operations analysts review the results of a future mobility project.

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which engages India's armed forces to understand future capability needs. Indian suppliers such as HAL, BEL, Avintel, Electronics Corporation of India, Dynamatic Technologies and Tata Advanced Materials provide components that will be integrated into the U.S. Navy's P-8A and Indian Navy's P-8I aircraft.

Since 1997, Boeing has also worked with India's premier software development companies to set up centers of excellence in various areas, including systems re-engineering and development, test and evaluation, business systems, analytics, and Commercial Aviation Services information technology applications.

Boeing's Indian presence is further strengthened through its subsidiaries—Jeppesen in Hyderabad, NARUS in Bangalore and Continental Data Graphics in Chennai—which are also expanding in the country.

Boeing has had an active corporate citizenship program in India for more than six years, with a focus on health care and education. It has included both corporate funding and volunteer support.

"We have actively engaged with more than 15 organizations and self-help community groups at eight locations throughout the country," Kumar said. "We estimate that approximately 85,000 people have benefited from these efforts over the past five years, including 16,000 who benefited in 2012 alone."

In India, Boeing has been a dedicated supporter of Operation Smile, which provides free surgeries to children born with cleft lip, cleft palate and other facial deformities. Education programs supported by Boeing include Building Blocks, which provides early learning opportunities for children ages 3 to 6 from impoverished families.

Save the Children India, also supported by Boeing, is a vocational skills development program for women and adolescent girls in Sarai Kale Khan Village, New Delhi.

Kumar said the Indian people are proud of their heritage, which dates back 5,000 years. However, the country is focused on the future and becoming an important player in the global economy. Many leaders have Western university educations.

Added Kumar about India and its people, "They're part of the modern world, while retaining the values of the past. Their beliefs, which have been passed on from generation to generation, are still intact," he said. "At the same time, they are very comfortable blending into the Western world. We are excited about our growing partnership with India and exploring its many possibilities." ■

william.j.seil@boeing.com

PHOTOS: (Bottom right) Children gather in one of four play areas funded by Boeing at Building Blocks, which provides early learning opportunities for children ages 3 to 6 from impoverished families.

(Insets, from left) Children at Building Blocks show off new uniforms provided by Boeing. **BUILDING BLOCKS** A child with a cleft palate deformity is examined by an Operation Smile medical volunteer; a child looks at herself for the first time after receiving cleft lip surgery; parents are shown with their child, who received surgery provided by Operation Smile. **OPERATION SMILE**





Global reach

Taiwan's largest carrier looks to expand with Boeing jetliners

By Kevin Yoo



Strategically located in the heart of Asia, China Airlines is positioned for growth.

It's already Taiwan's largest carrier. And its home market, regional cross-strait traffic, has continued to expand. China Airlines now operates more than 100 scheduled passenger flights per week from Taiwan to mainland China. What's more, Taipei has quickly developed into a major hub in Asia for global passengers and air cargo.

The decades-long partnership with Boeing grew significantly when the airline placed an order in 1999 for 13 747-400 Freighters—Boeing's largest 747 Freighter order ever. Doing so bolstered China Airlines' all-Boeing 747 Freighter fleet and propelled it to become one of the world's largest 747 Freighter operators.

It was only fitting that China Airlines would take delivery of the last four passenger 747-400s to be manufactured by Boeing in 2004–2005. Those long-range airplanes helped expand the airline's rapidly growing global network, which led to China Airlines' officially joining the global SkyTeam alliance in 2011, and SkyTeam Cargo the following year.

"China Airlines is a leading global airline committed to providing passengers with world-class service to 112 destinations across 28 countries and four continents," said Huang-Hsiang Sun, president of China Airlines. "We will continue to expand our global network and introduce new airplanes, such as the 777-300ER, which feature new interiors that will enhance the flying experience for our passengers."

The airline, based in the northwestern Taiwan city of Taoyuan, finalized its first-ever order for 777s in December, announcing plans to add six 777-300ERs (Extended Range) to its long-haul fleet. The order comes as the carrier enjoys unprecedented growth in air traffic, as well as demand from neighboring Asian

countries following the recent signing of open-skies agreements with Japan and Singapore.

"China Airlines has truly solidified itself among the world's leading airlines," said John Wojick, senior vice president of Global Sales, Commercial Airplanes, referring to the airline's becoming Boeing's newest 777 customer.

The introduction of 777-300ERs will provide China Airlines with added flexibility as well as improved airplane performance and economics to its long-haul fleet, Wojick said, adding: "The 777-300ER is the flagship of the world's most successful airlines and with China Airlines joining the SkyTeam alliance, it is a perfect fit."

China Airlines became Taiwan's first airline to participate in an international airline alliance, which is expected to benefit passengers on cross-strait, inter-airline travel and improve online booking on mutual websites. Just last month, the airline partnered with SkyTeam's members, including China Eastern, China Southern and Xiamen Air, to launch the "Greater China Connection" program.

As China Airlines continues to prosper, it has implemented a fleet modernization program that will increase the fleet to 100 airplanes within the next 10 years. The airline currently operates 72 airplanes, including 44 from Boeing that consist of 747-400 passenger airplanes and freighters, and 737-800s.

With its latest order for the 777-300ER, that long partnership is certain to grow. ■

kevin.k.yoo@boeing.com

GRAPHIC: An artist's concept of the Boeing 777-300ER (Extended Range) in the China Airlines livery. China Airlines became Boeing's newest 777 customer when it finalized an order for six 777-300ERs in December 2012. **BOEING**



TOGETHER WE FLY HIGHER.

2013 marks 75 years of Boeing's partnership with the UK. We're proud of what we have built together and we will continue to rely on our UK partners — customers, employees, suppliers and researchers — as we innovate for our shared future. As Boeing continues to deliver aircraft, including the first 787 Dreamliners to our UK airline customers, and remains a committed supporter of the UK Armed Forces, we can't think of a better place to grow. Together, we'll soar even higher in the next 75 years. Learn more at www.boeing.co.uk/together



75
YEARS
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COLD CALL

The stark landscape of Antarctica provided a stunning backdrop as a Boeing 737-700 touched down on a runway of blue ice at the Troll Research Station late last year, marking the first time a commercial 737 flight landed on Earth's southernmost continent. The flight, operated by PrivatAir, a Geneva-based business aviation and private scheduled service operator, carried Norwegian Polar Institute staff, PrivatAir management and a flight crew to the research post, which is dedicated to environmental and climate monitoring, scientific research and mapping. PrivatAir aims to make this a regularly scheduled flight in 2013. PHOTO: NORWEGIAN POLAR INSTITUTE





A large satellite payload is being assembled in a cleanroom facility. The payload is a complex structure with a central octagonal platform and four large cylindrical components. The cleanroom has blue acoustic panels on the walls and ceiling. Two workers in white protective suits are visible in the lower right corner, working on the payload. The floor is polished and reflects the overhead lights.

ONE SOURCE HOSTING FOR A HOST OF PAYLOADS.

At Boeing, we build the buses and payloads for a range of commercial and government satellite systems. As a result, our hosted payloads come with unique advantages. Your payload can be perfectly integrated into complementing architecture with less development and infrastructure investment. So you can be on orbit sooner with full capability at lower cost. And in a better place from day one.

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