



# Frontiers

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OCTOBER 2012 / Volume XI, Issue VI

## Above and **beyond**

Boeing is playing a leading role in the next chapter of human space exploration







“It’s such a versatile airframe that we’re able to keep adding new technology—making it just that much better.”

**Christine Cameron**  
Lead Mission Systems Engineer,  
H-6U Unmanned Little Bird

# UNMANNED LITTLE BIRD

Stories of  
**innovation**  
at Boeing



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# Ad watch

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

Inside cover:



"Little Bird" is one in a series of innovation stories told by Boeing employees such as Christine Cameron. Learn more at [www.boeing.com/stories](http://www.boeing.com/stories).

Page 6:



This ad highlights key advantages Boeing's new 737 MAX jetliner offers over its competitors. The ad was placed in trade magazines in North and South America.

Pages 12–13:



Featuring a "Made with Japan" theme, this ad celebrates first deliveries of the 787 Dreamliner to Japan Airlines and will be displayed at Haneda Airport in Tokyo through year-end. It reads: "From Japan to the global sky. JAL Boeing 787. We serve you."

Back cover:



This new industry team ad highlights the P-8A Poseidon, which began production deliveries to the U.S. Navy earlier this year. The print ad currently appears in U.S. political and trade publications.



# 26

## The adventure continues

For more than a half-century Boeing has been a leader in the exploration of space—from the days when a tiny Mercury spacecraft orbited Earth to the Apollo moon landings to the space shuttles that enabled on-orbit assembly of the International Space Station. The next space age is here, and Boeing is once again playing a leading role. Across the enterprise, employees are working on a range of programs—including a powerful rocket that could take astronauts far from their home planet.

COVER IMAGE: BOEING IS DESIGNING AND BUILDING THE CORE STAGES AND AVIONICS FOR THE SPACE LAUNCH SYSTEM, A POWERFUL ROCKET WITH STRAP-ON BOOSTERS AND A MODIFIED DELTA IV UPPER STAGE THAT WILL BE CAPABLE OF CARRYING ASTRONAUTS TO THE MOON, MARS OR OTHER DISTANT PLACES. PHOTO ILLUSTRATION: BRANDON LUONG/BOEING; SPACE LAUNCH SYSTEM GRAPHIC: BOEING; EARTH AND MARS PHOTOS: SHUTTERSTOCK

PHOTO: BOEING EMPLOYEES IN HOUSTON WORK ON THE COMPANY'S COMMERCIAL CREW SPACECRAFT, OR CST-100, AS PART OF A NASA COMPETITION FOR A NEW SPACECRAFT TO FERRY ASTRONAUTS TO AND FROM THE INTERNATIONAL SPACE STATION AND TO OTHER LOW EARTH ORBIT MISSIONS. BOB FERGUSON/BOEING





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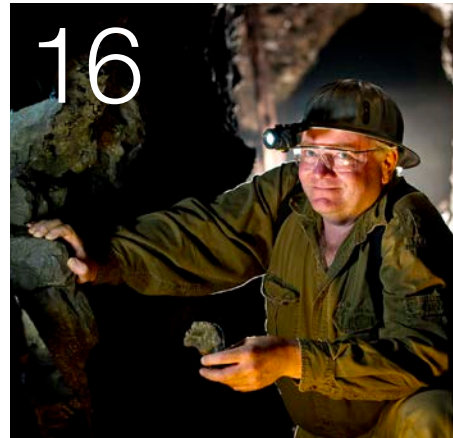
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# table o



## Showing his mettle

Meet Daniel Sanders, a Boeing Senior Technical Fellow and one of the company's experts in metal technology. Understanding and developing new metals gives Boeing an advantage over its competition, and Sanders has been digging metals since an early age. Literally. As a boy, he helped his grandfather mine for gold in the Pacific Northwest. He still enjoys working in his family's mine today.

PHOTO: BOB FERGUSON/BOEING



## Where Eagles dare

Boeing's F-15 Eagle continues to evolve, with many new capabilities being added, and it's continuing to meet customers' needs. An advanced new version of the fighter, the Silent Eagle, incorporates stealth technology that can make it less visible to radar.

PHOTO: U.S. AIR FORCE



## Boeing in Turkey

Turkey is a fast-growing market for Boeing commercial and military products and the company is helping develop the Turkish aerospace supplier base. Boeing Turkey also is an enthusiastic corporate citizen—having completed nearly 200 projects around the country from arts and culture to education to health and human services. More than 135,000 children have benefited.

PHOTO: GTC COMMUNICATIONS CONSULTANCY



# f contents

## 20 Flying into the future

Boeing last month took its 2012 ecoDemonstrator, a new 737-800 that will eventually go to American Airlines, to a remote location in Montana to test advanced technology that could make airplanes more quiet and efficient and reduce carbon dioxide emissions. Following testing in Montana, the ecoDemonstrator flew to Washington, D.C., to highlight the strong collaboration between industry and government the program represents.

PHOTO: BOB FERGUSON/BOEING



## INSIDE

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### 07 Leadership Message

It's a great time to be at Boeing, with unprecedented demand for the company's products and services, says Ray Conner, president and chief executive officer of Commercial Airplanes. But there are still lots of challenges and Boeing faces stiff competition from new jetliner manufacturers entering the market. For the company to continue to grow and prosper, Conner says, employees must innovate, execute work flawlessly—and always put the customer first.

### 08 Snapshot/Quotables

### 09 Why We're Here

### 10 Historical Perspective

### 45 Milestones

### 50 In Focus



THE NEW  
**737 MAX**



**YOUR 737 MAX ADVANTAGE.**

**8%**  
lower costs

The 737 MAX 8 will deliver 8% lower costs per seat than the A320neo because of its fuel efficiency and maintenance advantages.

The 737 MAX 8 will deliver the big savings in fuel that airlines are asking for, using 19% less fuel per seat than the A320.

**19%**  
more efficient

**99.7%**  
dispatch reliability

Flying 100 Next-Generation 737s, rather than the A320, will help an airline avoid delaying over 65,000 passengers a year. This advantage will be carried on to the MAX.



# Navigating the future

To increase market share and be profitable, Boeing must always put the customer first

I'm proud of the extraordinary team we have at Boeing. Since stepping into my new role at Commercial Airplanes in late June, I've seen firsthand the strides we've made to meet our customer commitments. A lot of hard work by dedicated and talented people goes into ensuring we deliver the best products and services to our customers every day.

I think it's a great time to be at Boeing. We are in the midst of a uniquely exciting period in our industry. Demand for our products and services is unprecedented and continues to grow. We have a tremendous opportunity to increase customer trust by delivering on our backlog. And we have the right team in place to design, build and deliver these amazing products and services.

We have lots of challenges as well. We share a business landscape with a capable and established competitor, and additional players are entering the market. Our customers urgently need more efficient and affordable products and services that will help them be profitable.

At Boeing, we have a culture and long legacy of raising the bar. We've launched some of the most successful and enduring programs in aviation history: the 737, 767, 747, 777 and 787, while continuing to evolve to newer products like the 737 MAX, the 787-9 and the 767-based aerial refueling tanker. And we are committed to expanding future twin-aisle offerings.

Successfully navigating our future requires execution and discipline. Our performance and investment today determines our future tomorrow.

We have to earn success.

Although our products are among the most complex on the planet, our strategic objectives are simple: to increase Boeing's market share and be profitable.

To do this, everything we do must be rooted in adding value to our customers' business. We have to give our customers reason to buy our products, not the competition's. I have a simple philosophy: Put the customer first and you can't go wrong.

To customers, we differentiate ourselves in four main ways:



“Our performance and investment today determines our future tomorrow.”

– Ray Conner

*President and chief executive officer  
Boeing Commercial Airplanes*

PHOTO: JOHN CROZIER/BOEING

- The quality and performance of our products and services
- The innovative way we design and build our airplanes
- The strength and talent of our team
- Our production rate capacity

Over the next three years, we will increase airplane production rates by 30 percent across all programs. Flawless execution on these increases is pivotal. Due to the high demand for our products, increasing capacity each year provides a major competitive advantage for us.

We can meet the demand through innovation. But that's not just about the design of the airplane. It's also about how we build the airplane. The materials we use need to be affordable and efficient to work with. Our design and build process has to eliminate waste and increase productivity across our production system, and suppliers'.

We also have to increase our first-time quality. Quality “escapes” not only lower the value and integrity of our product; they hurt relationships with customers whose highest priorities are quality and safety.

Finally, one of the most important ingredients of Boeing's success is our team. We need to continue to develop our people, to anticipate the skills we will need in the future and to provide the best training available. Just as we evolve the way we design and build airplanes, we have to continue to evolve ourselves.

Thank you, all. Together we are building the future. ■



**WE OWN THE NIGHT:** Two Boeing F/A-18 Hornets stand at the ready in an ordnance loading area at Royal Australian Air Force Base Darwin during Exercise Pitch Black 2012, held in July and August. For more than 20 years, the RAAF has conducted the biennial air combat training activity, traditionally using bases and training areas in the country's Northern Territory. Participating this year were more than 2,200 personnel and 100 aircraft from Australia, Singapore, Thailand, New Zealand, Indonesia and the United States. This was the first time Australia's Boeing-built F/A-18 Super Hornets and Wedgetail Airborne Early Warning & Control aircraft took part. **PHOTO: AUSTRALIAN DEFENCE**



## Quotables

“There isn’t a person on the shop floor who doesn’t stop to listen every time an F-15 takes off.”

– Bob Southerland, an F-15 sheet metal assembler riveter at Boeing’s plant in St. Louis, talking about the pride he and his fellow workers have in the jet fighter they make. The F-15 Eagle made its first flight 40 years ago. See story, Page 36.

“There’s a ton of new technology on the 787... It’s kind of like a sports car in the sky.”

– Phil Derner, founder of the aviation news site NYCAviation.com, talking about the passenger buzz and excitement surrounding Boeing’s 787 Dreamliner. CNN, Aug. 31.



# Let me count the ways

Boeing mathematician uses her aptitude for numbers to solve business challenges

By Candace Heckman

Sharon Arroyo is an Associate Technical Fellow with Boeing Research & Technology in Bellevue, Wash., and an expert in applied mathematics. In this *Frontiers* series that profiles employees discussing their jobs, Arroyo tells how she's using her math expertise to help Boeing teams find solutions to their challenges. PHOTO: MARIAN LOCKHART/BOEING

I've always loved math and enjoyed what math can do. Today, I continue to relish solving technically challenging problems using math, especially realizing what value those solutions can provide.

I'm in the Operations Research Group, part of the larger Applied Mathematics Group at Boeing Research & Technology. My colleagues and I specialize in applying operations research and optimization algorithm technology to reduce Boeing costs and make the company more competitive in various areas. We work directly with internal customers to develop tools that they use to analyze and improve their business.

For example, I worked with the KC-46A Tanker team to develop an algorithm to determine the number of airplanes needed to execute a refueling schedule in support of our bid. I also am working with Commercial Airplanes' Supplier Management team to develop optimization algorithms that would improve our raw-material contracts with mills. We are starting to explore extending this technology to reduce fastener costs for an airplane.

I have also been fortunate to work with Commercial Airplanes Marketing, where we have developed algorithms to determine

what airplane type works best with an airline's schedule to maximize profits. The results of this collaboration are used in a number of ways, including helping customers assess the value of new airplanes.

When I joined Boeing, I learned about the Technical Fellowship, which gives technical people like me a technical career path that's an alternative to a management career path. I knew it was something for me. I have the opportunity to manage projects and lead teams, while still focusing on technical details with minimal administrative overhead. I've been fortunate to have good support from my managers, who have understood why it's important to have technical leaders, such as Fellows, and how to use the special talents and capabilities we bring to the job.

I feel fortunate to work on challenging technical problems that force me to continuously learn about the business and extend my math skills. Not only is it exhilarating to work on these problems, but it's exciting to work for a company that is the leader in its industry and really knows how to multiply the power of mathematicians. ■

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# ‘Little Henry’ left big legacy

Innovative XH-20 was first ramjet-powered helicopter

By Henry T. Brownlee Jr.



It wasn't very big, so engineers referred to it as "Little Henry," after the diminutive helicopter in a popular children's book of the day.

But the XH-20, at 290 pounds (130 kilograms), could lift almost twice its weight and fly up to 50 mph (80 kilometers per hour).

Designed and developed by McDonnell Aircraft Corp., one of Boeing's heritage companies, Little Henry was the world's first ramjet-powered helicopter.

A pioneer in naval jet fighter aircraft, McDonnell Aircraft realized the potential of jet propulsion for rotary wing aircraft as early as 1943 when, under the leadership of Constantine L. "Zakh" Zakhartchenko, the company's chief engineer for helicopters, it began examining self-propelled rotor blades for helicopters.

Three years later, in 1946, McDonnell Aircraft submitted an unsolicited proposal to the U.S. Air Force's Air Materiel Command at Wright Field in Ohio. It subsequently was awarded a contract to determine the feasibility of a small, lightweight ramjet rotor helicopter that could be used for a variety of military missions, including artillery reconnaissance, communications, wire laying, light cargo

transport, field messenger service and rescue operations.

The XH-20 design was simple. The concept demonstrator consisted of an open steel frame for the pilot and a two-blade rotary assembly 20 feet (6 meters) in diameter, with ramjets mounted on the tips and fed from two fuel tanks beside the pilot.

McDonnell Aircraft designed the twin "Tom Thumb" 10-pound (4.5-kilogram) ramjet engines specifically for the XH-20, and during the rotor testing phase experimented with several ramjet designs to achieve maximum efficiency.

A ramjet is a jet engine without moving parts that develops thrust by the continuous burning of fuel injected within a streamlined tube, which increases the velocity of air rammed in by flight. When the ramjets on the tips of the XH-20 rotor were ignited, the centrifugal force of the spinning rotor pulled the fuel into the ramjets through a fuel line that ran through the rotor blade to the fuel tanks. Because power for the rotor was generated at the tips of the rotor, the need for a tail rotor and other heavy parts—normally required on a helicopter for counter-torque or torque compensation—was eliminated.



**PHOTOS: (Clockwise from far left)** A test flight of the XH-20, flown by Charles R. Wood Jr., chief helicopter test pilot for McDonnell Aircraft; the XH-20 hovers over McDonnell Aircraft's XHJD-1 Whirlaway, the first twin-engine helicopter; the prototype XH-20, now on display at the National Museum of the U.S. Air Force near Dayton, Ohio. BOEING ARCHIVES



The first untethered flight of the XH-20 came on Aug. 29, 1947. Initially the XH-20 used propane for fuel, but engineers soon determined that automobile gasoline was sufficient, and several octane ratings were tested. Through testing and flight evaluation, McDonnell Aircraft and the U.S. Air Force determined there were several advantages for using ramjet-powered helicopters, including weight savings and an increase in load capacity.

The XH-20 could lift about 500 pounds (225 kilograms).

And it had “excellent controllability,” according to Charles Wood Jr., chief helicopter test pilot for McDonnell. He reported that the XH-20 “turns on a spot in either direction; cartwheels and lazy eights are easy for the pilot.”

Two XH-20 flying test stands were developed, Little Henry and Little Henry No. 2, a two-seat prototype that flew for the first time on Jan. 4, 1949.

With its open frame and steel tube structure, the XH-20 more closely resembled a go-kart than a flying test stand used to demonstrate ramjet technology for military helicopters. Some called

it a “flying jeep” or “aerial motorcycle.” But McDonnell engineers and the company’s public relations people referred to the XH-20 as Little Henry, from Eleanor Graham’s 1945 children’s book titled *Henry the Helicopter*. That name stuck with the Air Force, too.

The concept demonstration contract between McDonnell and the Air Force was successfully closed in July 1953. McDonnell had accomplished its task of developing and proving the concept of ramjet technology for helicopter propulsion.

Based on the XH-20 prototypes, McDonnell Aircraft also developed the Model 79 “Big Henry” utility helicopter, a larger and more powerful ramjet-powered helicopter for agricultural use. But high fuel consumption and engine noise diminished its attractiveness as a commercial product, and the project was abandoned.

Today, the first XH-20 prototype is part of the collection at the U.S. Air Force Museum at Wright-Patterson AFB, Ohio. ■

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Learn more about Little Henry and see a video at [www.boeing.com/history/mdc/littlehenry.htm](http://www.boeing.com/history/mdc/littlehenry.htm)







## MADE WITH JAPAN

日本から世界の空へ、JALボーイング787 わたしたちがお届けしています。

 **BOEING**



# The advantage

## Boeing's new health care plan could help employees save money

By Alex Wilson

**F**or Ryan Malawy, life is moving fast. An economics major at University of California, San Diego, Malawy started at Boeing two weeks after graduation. Since then he has earned a master's degree in business administration from the University of Southern California and married.

With new responsibilities, the 26-year-old financial analyst for Boeing Research & Technology in Seal Beach, Calif., is taking a close look at his 2013 health care options.

Boeing is making a number of changes to nonunion employee medical plans. Although Boeing offers market-leading health care benefits, it is emphasizing well-being and personal responsibility among employees to reduce health care costs and maintain Boeing's competitive edge in the global economy, according to Rick Stephens, senior vice president of Human Resources and Administration.

For 2013, Boeing will offer the Advantage+ health plan, the lowest-cost option of any offered, and Malawy believes this plan will be right for him.

"I was in a study about a few of Boeing's health care plans," Malawy said, referring to the focus groups held at several Boeing sites across the country in July. "And it sounds like the Advantage+ health plan could be beneficial."

A self-described "financially focused" person, Malawy anticipates he won't have many expenses for the next few years. He and his wife, who has insurance through her employer, aren't planning to have children for a few years, and he hasn't had many medical expenses since he started at Boeing five years ago.

He doesn't anticipate medical expenses next year, either, so he expects to hang on

to much of the \$600 Boeing will put into a related Health Savings Account that he can open as a participant in the Advantage+ health plan—money that will roll over from year to year if it is not used. When that money exceeds \$2,000, Malawy can invest in select mutual funds and build a fund for future medical expenses.

With his employee-only coverage under the Advantage+ health plan, Malawy can also contribute an additional \$2,650 into his Health Savings Account on a pre-tax basis, which can help build his medical expense fund.

For employees in similar situations, the choice may be fairly easy. But many employees with higher expenses also may benefit from the new plan, according to Stephens. That's because the company will fund nearly half the annual deductible through its contribution to the Health Savings Account, and the plan has lower paycheck contributions than any other plan.

"We designed the Advantage+ health plan to work for a wide range of employees," Stephens said. "With the optional Health Savings Account and the low payroll contributions, the cost of coverage compares favorably with other plans offered."

Stephens demonstrated his point through companywide analysis of Boeing health care claims in 2011. Using that data, the company's benefits team projected that in 2013, 55 percent of singles and 83 percent of families now in the Traditional Medical Plan would save \$500 to \$1,000 or more with the Advantage+ health plan. The majority of HMO participants—57 percent of singles and 69 percent of families—would save similar amounts if they

switched to the Advantage+ health plan.

Compared with the other plans offered in 2013, Stephens explained, the Advantage+ health plan has a higher deductible, but that is partially offset by the money Boeing provides to eligible employees via a Health Savings Account—\$600 for those with employee-only coverage and \$1,200 for those with family coverage. That money covers roughly half of the Advantage+ health plan's annual deductible, which is \$1,250 for employee-only coverage and \$2,500 for family coverage.

The plan will also provide a triple tax advantage, Stephens said: no federal taxes on contributions to the Health Savings Account, on interest or any earnings in the account, or on withdrawals for qualified medical expenses. In most cases, state taxes also do not apply.

Stephens highlighted four criteria that employees should consider for their own personal plan: their prior-year personal health care expenses, their projected expenses for next year, understanding health care plan terminology, and the differences of the plans.

"Boeing has provided several tools and opportunities for employees to learn about the plans and choose the right one," Stephens said. "My advice is to take advantage of them." ■

*alexander.m.wilson@boeing.com*

## Getting ready for annual enrollment

Consider these activities	Why it's important	Resources
Look back at personal health care expenses	Previous years' expenses help employees understand potential future expenses.	Generally available on the health care plan's website. Most employees will also find both a tool called the Medical Expense Estimator and the Health Care Cost summary populated with claims data.
Look ahead at medical needs for next year	Some major medical life events, such as having a baby or elective surgery, can be planned.	The Medical Expense Estimator will be available Nov. 5 to help employees understand what medical plans will cost in the next year.
Know health care plan terminology	A refresher on several terms, including annual deductible, out-of-pocket maximum, and the difference between copayments and coinsurance, will ease a decision.	The August and September issues of <i>Well Being News</i> (available for employees at <a href="http://hr.web.boeing.com">http://hr.web.boeing.com</a> under "Well Being") and other resources have lists of health care-related terms and their definitions.
Understand the differences in the plans—their benefit features and the doctors who participate	The right plan will make a big difference in how much an employee has to pay.	Once annual enrollment begins on Nov. 5, employees will have access to tools that compare plan benefits and show doctors who participate in each plan. Until then, employees can refer to the 2012–2013 Benefits Change Information to find a comparison of plans and a summary of the Advantage+ health plan and the Health Savings Account.

**PHOTO:** Ryan Malawy, financial analyst for Boeing Research & Technology, looks closely at his 2013 health care options. PAUL PINNER/BOEING



# Rock star

Boeing expert in metals has unusual pastime—a gold mine

By Candace Heckman

Photos by Bob Ferguson

**E**lementally speaking, titanium is some of the best stuff out there for jet engine fan blades and aircraft frames. It's super strong and lightweight, highly resistant to corrosion and fatigue, and is a low conductor of heat and electricity.

But not a lot of people can or even want to work with titanium, one of the most challenging metals on Earth.

"Of all the metal forming, this one you need to finesse," explains Boeing Senior Technical Fellow Daniel Sanders, whose work supports Boeing's Enterprise Technology Strategy for manufacturing. "It's so easy for things to go wrong, and no human being would want to have to drill titanium."

He would know. Sanders started with Boeing as a tool and die maker at age 19. He has worked with metals for his entire professional life and is now one of a handful of recognized titanium gurus in the world.

Not only is Sanders' deep knowledge a gold mine for materials science, but he also has a real one. His voracious enthusiasm for metallurgy extends even into his spare time, digging in his family's mining claim in Eastern Washington.

When he was 8 years old, Sanders began helping his grandfather mine for gold in the Northwest's Cascade Mountains. His fascination in the mine's history—claimed during the gold rush, since won and lost in countless Wild West-style card games—also fuels Sanders' interest in this hobby and his work at Boeing.

"As time went on, I never lost that interest in metals," he said on a late summer excursion to the gold mine. He recently bought a book on tantalum, a rare earth metal, because he just happened upon some out there.

Strategic metals mining in the West has experienced economic peaks and valleys, specifically driven by international competition. But one of the biggest issues in locating what are known as rare earth metals has recently become critical for U.S. manufacturers, and therefore, economically worthy once again. Sanders was excited to find some to study from his own tunnels of rock.

"It's not just a mine, it's a big puzzle here," Sanders explained about the meandering tunnels on his claim. "Where will we find the next big find? What did the old-timers leave behind? And







**PHOTOS: (Left)** Senior Technical Fellow Dan Sanders tunnels through his family's mining claim in Eastern Washington. **(Above)** At work at Boeing's Fabrication plant in Auburn, Wash., Sanders develops metal forming technologies and is considered one of the world's foremost experts in titanium.

why did they go left instead of to the right?"

While titanium, Sanders' specialty, is not rare, practical methods for working with it are. At work, Sanders, of Boeing Research & Technology, pioneered a technique for super-plastic forming of friction stir welds for titanium parts, something that had previously stood in the company's way for wide use of the strategic metal.

"The advantage that Boeing's always had is to be a step ahead of the competition in developing new materials, so that our airplanes perform in flight, whether you look at fuel burn or weight, or even the comfort of the passengers," Sanders explained. "So, material science and engineering go hand in hand and the two co-exist especially in aerospace. Particularly in the kinds of products that are way out there—hypersonics, supersonics, electronic transport, space travel, trips to the moon. We really will require alloys that do not exist right now, literally, to get there."

Sanders credits his various successes to hard work, education and a reverence for the practical knowledge he learned on the shop floor.

Growing up with the mine, Sanders first learned engineering by practice. He fixed engines, modified and invented machinery, and did whatever else the family needed to find gold.

Not able to afford college, Sanders went nearly straight from high school to the factory. He worked second and third shifts at Boeing's final assembly plant in Everett, Wash., so he could attend classes at the University of Washington during the day.

The lure of shiny metals and his mining hobby kept him motivated.

After many years of part-time school, Sanders, a machinist, earned an engineering degree. Through Boeing's Learning Together program, he also gained a master's degree. In 2008, Sanders was awarded a doctorate in mechanical engineering. By that time, he had already been inducted as a Boeing Senior Technical Fellow, becoming one of an elite group representing the company's top technologists.

As a Senior Technical Fellow, he can be called upon for support and expertise from anywhere in the company. Sanders even has been asked to investigate possible explosive activities



for the company. As a miner, he's an expert registered with the U.S. Bureau of Alcohol, Tobacco, Firearms and Explosives.

As a Boeing engineer, Sanders started developing spare titanium parts in 1990 in a small corner of one plant building in Auburn, Wash. Today, the whole building works titanium—and has been expanding. Sanders has also taught metal forming at the University of Washington, and continually looks for talented professionals who are ready and able to understand, design with and work titanium. He knows Boeing will have to develop those new experts because he hasn't many peers in the world of titanium.

"I stay active with the schools, studying and mentoring, because I can't say enough how important it is for us to find, and maybe

even lure away, talented people," Sanders said. "I tell the students, 'You know, I'm just amazed that they pay me to do something that's so much fun and that's so adventurous.'" ■

*candace.k.heckman@boeing.com*

*Want to know more about titanium? Boeing employees may connect with Sanders on inSite.*

*Watch a video interview with Dan Sanders at [www.boeing.com/Features/2012/10/corp\\_sanders\\_10\\_05\\_12.html](http://www.boeing.com/Features/2012/10/corp_sanders_10_05_12.html)*

**PHOTO:** Titanium expert Dan Sanders examines a spot weld on a titanium tail cone assembly for the 787 Dreamliner.





# Seeds of success

“Passenger feedback has been really positive in the year since we put our 737-800s in service.”

— Hiroshi Takahashi, president and CEO of Solaseed Air

PHOTO: SOLASEED



Japanese airline has a catchy new name, along with new Boeing 737 jets

By Kevin Yoo

**M**iyazaki-based Solaseed Air may well be Japan's best-kept secret. That's because it is a newly minted Japanese domestic airline that until recently was known as Skynet Asia Airways.

After a decade of service connecting customers from Tokyo to locations in Kyushu—a popular leisure destination in southern Japan and the nation's third-largest island—airline executives and employees celebrated the 10th anniversary milestone by presenting themselves with an unconventional birthday present—a refreshed brand with a new logo, name, livery and airplanes.

Boeing played an important role in the airline's strategic makeover. Renewing its all-Boeing fleet of 10 737-400 airplanes, the airline took delivery of its first two Boeing Next-Generation 737-800 airplanes ahead of the milestone celebration. Equipped with Boeing's new Sky Interior, they were the airline's first 737s to take to the skies under the new brand name—Solaseed Air. The carrier continues to operate an all-Boeing fleet of 10 737s that now includes four Next-Generation 737-800s and six 737-400s.

“As we entered our 10th year of operation, we not only had a new look and feel to mark the special occasion, but we were one of the first operators in Japan to fly the 737-800 with the advanced and passenger-pleasing Boeing Sky Interior,” said Hiroshi Takahashi, president and CEO of Solaseed Air. “Passenger feedback has been

really positive in the year since we put our 737-800s in service—they love the new brand and the added comfort of the new cabin. The economic benefits in terms of fuel efficiency and maintenance have made a real difference to our bottom line.”

Solaseed Air's new Boeing 737s also are the first to wear the airline's distinctive pistachio-green-and-white insignia, which defines its motto to “seed smiles in the sky.”

“The fresh, pistachio green of our logo and the color highlights and patterns of our interior trim symbolize youth, energy and growth,” said Kaz Yokota, general manager of Corporate Planning for Solaseed Air. “They also represent the beautiful natural landscape of Kyushu—the island on which our hometown is located—as well as evoking the unique gardens of Japan.”

“Sola” is the Japanese word for sky, while “seed” represents new life, vitality, strength and momentum.

“Solaseed” is a play on words,” Yokota said. “In Japanese, it sounds like ‘so, la, si, do,’ which follows ‘do, re, mi, fa’ in the musical scale.”

The airline hopes its catchy name will also be music to customers' ears when they book flights—on its growing fleet of Boeing jets. ■

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**PHOTO:** One of Solaseed's Next-Generation 737-800s takes off from Boeing Field in June 2011. JIM ANDERSON/BOEING



# Sound innovation

At a remote site in Montana, Boeing tests new commercial jetliner technologies that benefit the industry—and the environment

By James Wallace and photos by Bob Ferguson

During the Farnborough International Airshow in July, Mike Carriker, the Boeing test pilot who flew the 787 Dreamliner on its first flight in 2009, provided journalists with a running commentary as the carbon-fiber aircraft performed for huge crowds during one of its daily flying demonstrations.

“Now listen. Just listen,” Carriker said as the 787 came in to land.

The journalists, watching from the balcony of the Boeing media chalet, fell silent as they focused on the 787 approaching the runway from about a quarter mile away. They heard nothing until the Dreamliner was almost directly in front of them, one later wrote.

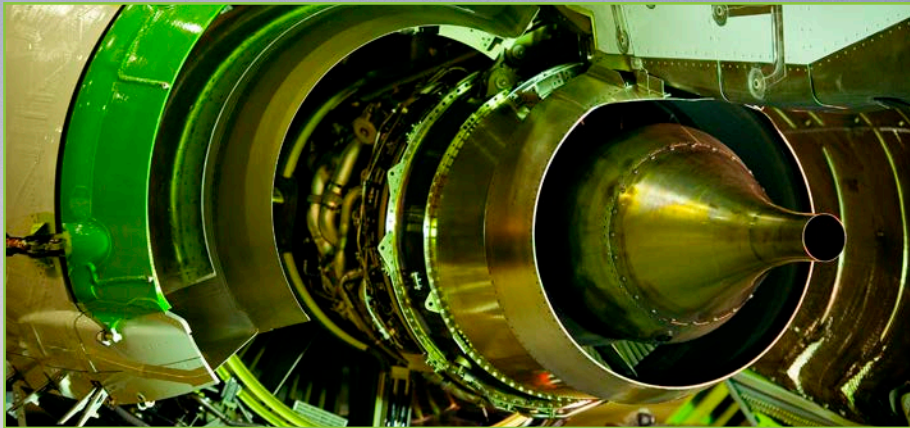
Commercial jetliner technology has come a long way from the noisy 707 that pioneered jet service in the 1950s. The 787 is the world’s most technologically advanced jetliner, one that Boeing engineers made as friendly as possible for passengers and the environment. But more advancements are on the way that will make commercial jets even more quiet, while improving fuel burn and lowering carbon dioxide emissions. And reducing the environmental footprint of the world’s passenger planes, be it from noise or emissions, is one of the aerospace industry’s top priorities.

Several of these new technologies are already being tested on the first aircraft of Boeing’s ecoDemonstrator program, a 737-800.

After the testing is completed, test equipment will be removed and the plane returned to its factory-new condition, and the Next-Generation 737 will be delivered to American Airlines. But until then, the 2012 ecoDemonstrator is a flying laboratory that







**PHOTOS: (Below)** The ecoDemonstrator 737-800 prepares for a sunrise test flight at the Montana Aviation Research facility in Glasgow, Mont. **(Insets)** The ecoDemonstrator technology includes wing and engine innovations that will improve fuel burn and reduce noise and carbon dioxide emissions.





showcases just how much more is possible.

In September, Boeing test pilots flew ecoDemonstrator from Seattle to Glasgow, Mont., for about three weeks of extensive testing. One of the pilots participating in the testing is Carriker, now chief pilot for New Airplane Development, Boeing Test & Evaluation.

Glasgow, in the northeastern corner of Montana, is the perfect place to measure how much noise a jetliner makes—it's pretty much in the middle of nowhere. During World War II, the airfield was used to train B-17 pilots, and in late 1944 a camp was built there to house German prisoners of war. In the 1960s, a B-52 strategic bomber wing was located at what by then was Glasgow Air Force Base. The base closed in the 1970s and much of the property was purchased by Boeing as an aircraft test facility. Today, the site is maintained by Montana Aviation Research Co., a Boeing subsidiary. Billings and Great Falls, the two nearest cities with commercial airline passenger flights, are hundreds of miles away.

The remoteness of the site, the lack of background noise, no air traffic and a massive 13,500-foot (4,100-meter) runway make it ideal for flight testing. It's essentially a supersensitive listening post—for all kinds of noise made by an airplane.

Scattered about the site and under the flight path taken by Boeing test aircraft is a phased array of microphones. They work like an acoustic camera and can pinpoint specific aircraft sounds, even the noise made by turbulence from the movement of control surfaces on the wing during landing. Nearly 2,000 different listening devices were deployed for the ecoDemonstrator testing at Glasgow to measure both airframe and community noise.

"We can actually tell which component on the plane is making the noise," explained David Akiyama, ecoDemonstrator program manager.

Noise heard on the ground is referred to as "community noise." During takeoff operations, this mostly comes from the engines. But on landing, both engine noise and airframe noise, such as that made by turbulence from the wing flaps and the landing gear, contribute to community noise.

Among the technologies on the ecoDemonstrator tested at Glasgow is an "adaptive trailing edge," which improves airflow at the trailing edge of the wing. This smart wing technology allows the wing aerodynamics to be optimized for each phase of flight—takeoff, cruise and landing. On takeoff, for example, the airplane climbs faster, which means less community noise because the airplane spends less time close to the ground. During cruise, the trailing edge adjusts to reduce airplane drag to lower fuel burn and reduce carbon dioxide emissions.

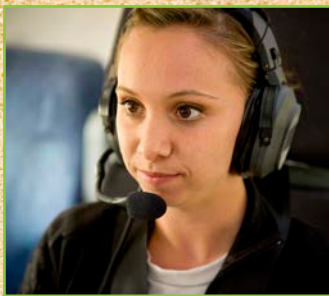
Akiyama referred to this innovation as "wing morphing." Think of a bird in flight, he said. A bird will change the shape of its wings depending on whether it's climbing, gliding, diving or landing.

"So we change the shape of an airplane wing for various flight conditions," he said.

Another important technology on ecoDemonstrator tested at Glasgow is a "variable area fan nozzle," which opens the engine



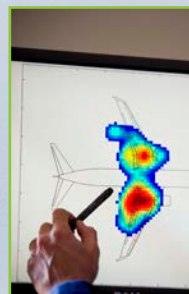




**PHOTOS (Below):** An aerial view of the acoustical array of microphones, used to pinpoint aircraft noise, at the end of the main runway at the Glasgow site. **(Insets, clockwise from top left)** The ecoDemonstrator team in Glasgow included: Steve Rapp; Tim Rahmes holding an iPad; Noel DePeralta; Dave Russell installing test sensors, Chief Pilot Mike Carriker on the flight deck; Kristin Crawford; and Kevin Johnson.











fan exhaust nozzle area by up to 10 percent. During takeoff, the engine operates more efficiently with a larger fan nozzle. Essentially, the same amount of thrust is produced by moving a larger amount of air through the nozzle at a slower speed.

"It's more efficient to move a large volume of air at lower velocity, more comparable to the airplane's speed, than a lower amount of air through a smaller nozzle at a faster speed for the same amount of thrust," Akiyama explained. "It also reduces community noise."

Akiyama pointed out that the engines on the early 707s were very noisy and less fuel-efficient because they sported turbojets or low-bypass turbofans with very high exhaust jet velocities.

"Newer planes are getting bigger and bigger fans," he noted.

A number of other technologies also are being tested on ecoDemonstrator, from regenerative fuel cells for onboard power to carpet tiles made of recycled materials. Worn or damaged carpet tiles could be replaced individually during service, which would lower maintenance costs since the entire carpet would not need to be replaced as often. And landfill waste would also be reduced since the tiles are completely recyclable.

The ecoDemonstrator program is made possible through funding provided to Boeing Research & Technology by the U.S. Federal Aviation Administration's CLEEN program, short for Continuous Lower Energy, Emissions and Noise. The adaptive wing trailing edges, as well as the ceramic composite engine nozzles, are two of the technologies that are being developed by a team of Boeing researchers for the CLEEN program. Experts believe ceramic composites offer the potential for better thermal and structural performance, while helping to reduce weight and noise.

The program also builds on the company's Quiet Technology Demonstrator programs that led to a number of noise-reduction technologies tested at Glasgow and later incorporated on the 787 and 747-8, including chevrons, the sawtoothed aerodynamic devices at the rear of the engine nacelle and on the exhaust nozzle of Boeing's two newest jets.

After the 737-800 ecoDemonstrator is delivered to American Airlines, a Boeing-owned 787 will be used as the 2013 ecoDemonstrator. Preliminary planning for ecoDemonstrator test flights in 2014 and beyond has already started.

Akiyama has been on the ecoDemonstrator program for three years. "You are bringing all the best parts of Boeing together," he said. That includes Commercial Airplanes, Boeing Test & Evaluation and Boeing Research & Technology.

"It's all about accelerating technology and innovation," he added. And flight-test programs such as ecoDemonstrator are one of the best ways of doing that. ■

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*To learn more about ecoDemonstrator, see Page 22 in the May 2012 issue of Boeing Frontiers or view a video at [www.boeing.com/Features/2012/09/bca\\_eco\\_demonstrator\\_09\\_17\\_12.html](http://www.boeing.com/Features/2012/09/bca_eco_demonstrator_09_17_12.html)*

**PHOTOS: (Top)** The 2012 ecoDemonstrator lifts off the runway for another round of flight testing over Glasgow. **(Insets, clockwise from top left)** The ecoDemonstrator team in Glasgow included: Kristin Crawford, from left, Meredith Anderson and Wayne Wenneman analyzing the flight-test plan; Barry Finnely, left, and John Wasilewski preparing for a flight; Jessica Lee working on the fuel cell; Joey Reed; Leon Brusniak looking over noise data; Cederic Daniels, left, and Pat Cappelto; and Tom Alston and Dean Parham (kneeling) preparing the variable area fan nozzle.







# Bold new steps

The next journey of human space exploration has begun, and Boeing is once again taking a leading role

By Bill Seil

As a leader in human space exploration, Boeing has been part of a remarkable journey of discovery and accomplishment for more than 50 years. Today, the company is once again taking bold new steps toward the next space age. Employees across the enterprise are engaged in a range of programs and studies that one day will take astronauts far from their home planet.

"The space shuttle was a wonderful vehicle, but it wasn't designed to go beyond low Earth orbit," said Mike Raftery, Boeing director of International Space Station Utilization and Exploration. "It was designed to be a truck to build and support the space station, and it did that very well."

Boeing played a major role in the Space Shuttle program, which ended last year.

"What we're talking about now is developing the ability to go way out and begin the exploration of our solar system," Raftery said.

NASA is focusing on destinations beyond low Earth orbit. Ultimately, this could include

sending astronauts to Mars. But NASA will continue to conduct research aboard the International Space Station and widen opportunities for private enterprise to provide access to low Earth orbit. Boeing continues as prime contractor on the space station, including both sustaining operations and enhancing utilization.

Boeing is designing and building the cryogenic stages and avionics for the Space Launch System, or SLS, a powerful vehicle capable of propelling astronauts and payloads to the moon, asteroids, Mars and other distant locations.

Closer to home, Boeing was recently awarded a NASA contract to further develop its Commercial Crew spacecraft, CST-100, which is designed to ferry astronauts to and from the space station, and other low Earth orbit locations.

Boeing Advanced Space Exploration, part of Phantom Works, is developing a number of futuristic concepts, including systems that will allow the efficient movement of people, structures and cargo on long-distance and long-duration missions.

In addition, employees are working on systems that will support a far wider range of requirements for space exploration.

Regardless of where they work or what they are working on, employees know Boeing's rich history and leadership in space exploration, and they are excited about where the company is going next.

"I've had a passion for human space-

flight ever since I was little," said Brenda Isaza, a Boeing structural design engineer at Kennedy Space Center in Florida, who is designing ground support facilities for the Orion program. The spacecraft is being developed by Lockheed Martin to carry astronauts on missions beyond Earth orbit.

"My job is never boring. Every day there's something new and different going on," Isaza added. "You always want to get up and go to work, then go home and share what you did."

In Huntington Beach, Calif., another Boeing site that has played a huge role in past space exploration, John McKinney shares that same excitement and enthusiasm about the work he is doing. McKinney is landing and recovery system lead for Boeing's Commercial Crew program. He conducts tests on the spacecraft to ensure that returning astronauts will land safely.

Boeing's years of experience in manned space exploration—beginning with Project Mercury—is of enormous value in designing future space vehicles, McKinney said.

"Our long history in spacecraft development has given us a unique capability to leverage proven concepts with the highly mature technologies of today," McKinney said. "This allows us to minimize risk and keep costs as low as possible."

That history began more than 50 years ago when the United States named seven Mercury astronauts to compete with Russian

**PHOTO ILLUSTRATION:** The Space Launch System rocket, for which Boeing is building the cryogenic stages, could send astronauts to the moon or to Mars. NASA





cosmonauts in the early days of the “space race.” NASA followed Project Mercury with the Gemini program. Both the one-man Mercury capsule and two-man Gemini spacecraft were built by McDonnell Aircraft Corp., a Boeing heritage company. The larger Apollo spacecraft that followed, which was designed by another Boeing heritage company, North American Aviation, carried astronauts to the moon and back.

After Apollo came the Space Shuttle and International Space Station programs. Boeing was NASA’s prime contractor for designing and building the space station, and Boeing heritage company North American Rockwell was prime contractor for the shuttle. Another former Boeing division, Rocketdyne, built the shuttle’s main engines.

The Commercial Crew vehicle that McKinney and other Boeing engineers are developing today includes many features borrowed from the Apollo spacecraft.

This next chapter in human space exploration will take on challenges that require the best talent of this generation, as well as young scientists and engineers who have not yet entered the workforce, according to Raftery.

There is general agreement that the ultimate mission would be landing a crew on Mars, said Raftery, who is researching future space utilization and exploration. But a trip to the “red planet” would take roughly 10 months, and before such an expedition can be undertaken much must be learned about space technology and the effects of long-duration space travel on the human body.

Today, a lively debate is under way, internationally and within the United States, over whether the first goal should be a base on the moon or a more distant expedition to explore an asteroid. A modern moon base would allow astronauts to stay on the moon for extended periods—good training for exploring Mars.

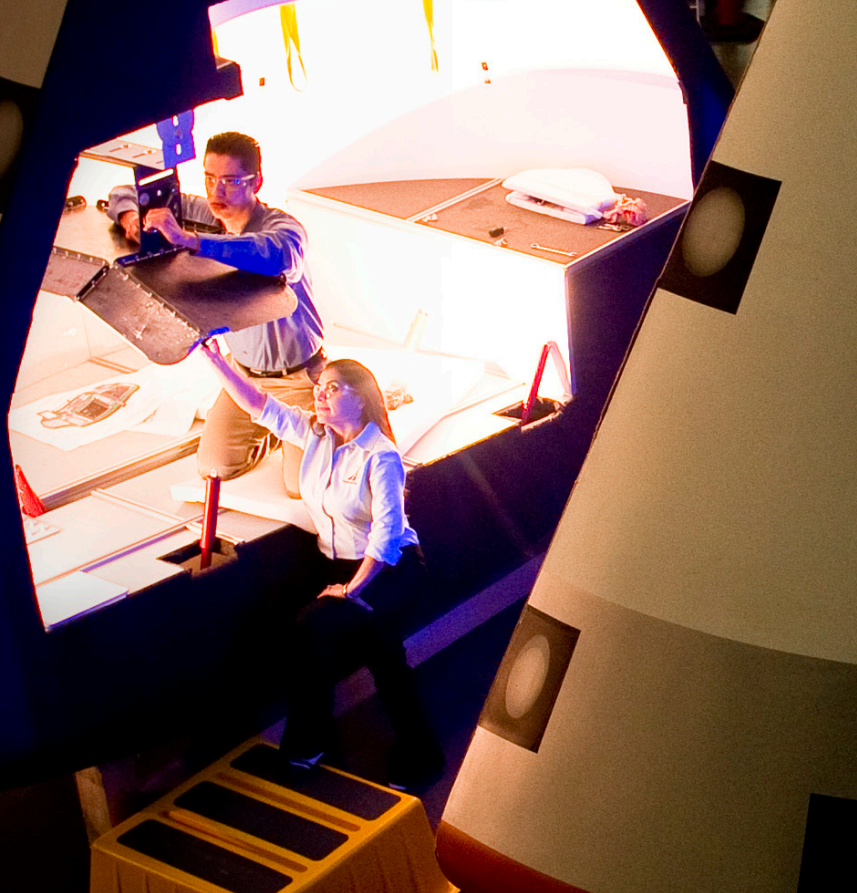
“You couldn’t actually ‘land’ on an asteroid, as you would on the moon, because [asteroids] have virtually no gravity,” Raftery said. “But we do need to understand how crews are going to survive on a long trip outside the protection of Earth’s radiation belts. And we need to gain experience in longer-duration missions, which could eventually last one to two years.”

The Space Launch System is adaptable to any deep space voyage in the foreseeable future. Jim Chilton, vice president and program manager, Exploration Launch Systems, said one of the primary uses of the Space Launch System will be to launch the Orion spacecraft. But the Space Launch System is intended as a multipurpose vehicle that will be in use for decades.

“The history of exploration is that we adapt the devices we have to new purposes as we develop new missions,” Chilton said.

The initial design will consist of two cryogenic stages, using liquid oxygen and liquid hydrogen for propulsion. In some respects, it will be similar to the Saturn V, which had three cryogenic stages. The Space Launch System also borrows some ideas from the space shuttle, including two solid fuel boosters to add to the thrust at liftoff. As missions become more demanding and complex, it will evolve to meet those challenges, Chilton said.

The first unmanned launch of the Space Launch System



## Developing systems today for tomorrow’s space explorers

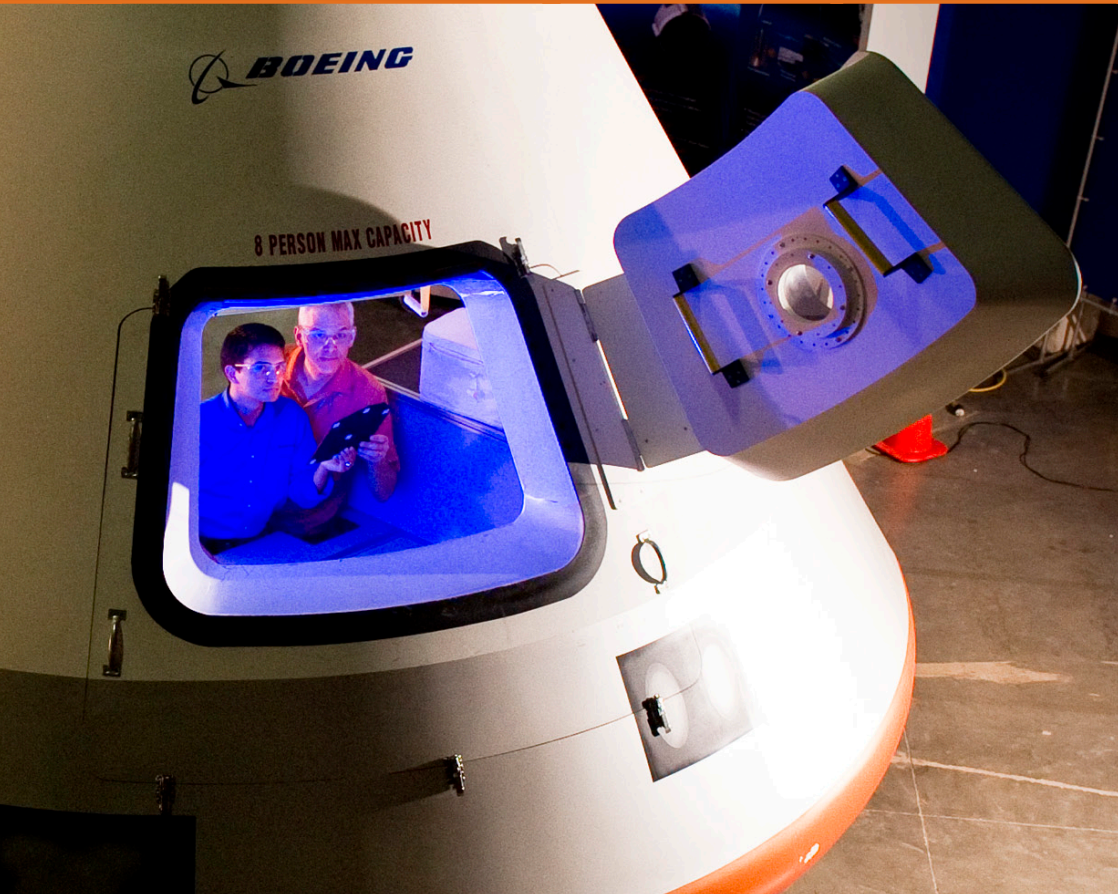
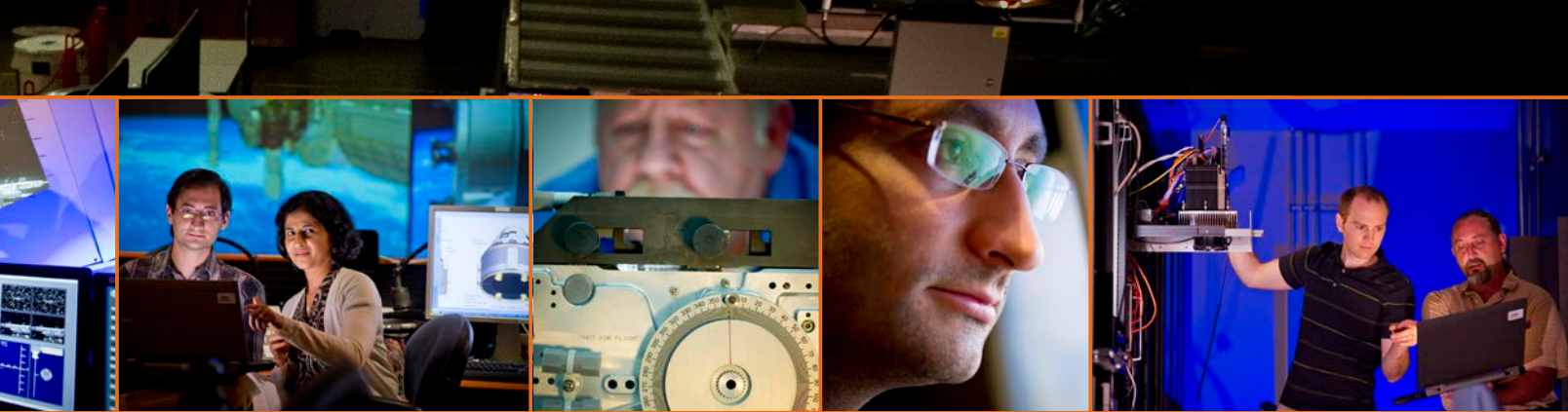
As NASA plans missions beyond low Earth orbit, Boeing is exploring concepts once limited to the stories of science fiction writers and futurists.

Advanced Space Exploration, a division of Boeing Phantom Works, is conducting studies on how people, structures and supplies might one day be transported to such distant locations as Mars and the asteroids.

Steve Johnston, director, Advanced Space Exploration, said his division has the job of developing new capabilities that will allow the company to grow its space exploration business to meet the needs of NASA and emerging markets. His team serves as a bridge between existing programs and long-range planners, such as Space Exploration’s Mike Raftery, who are developing long-range space exploration concepts.

“We work pretty closely with Space Exploration to better under-





**PHOTOS: (Below)** In Houston, engineers Jonnathan Medina-Espitia, from left, Melanie Weber, Juan “Tony” Castilleja and NASA’s Lee Morin update the interior configuration of the CST-100 mock-up. **(Insets, from left)** Tom Mulder, foreground left, and Lynna Wood observe flight simulation; John Wissinger monitors a simulation of the CST-100 automatically docking with the International Space Station; Jason Owens and Sneha Kuruvilla discuss the design of the CST-100 flight software; Joe Finley, product acceptance specialist, examines a CST-100 docking system assembly; Jason Owens studies software code that will control the CST-100 flight computers; Michael Voightmann, left, and Zane Goff work with a CST-100 flight computer. **BOB FERGUSON/BOEING**

stand what the future exploration architecture might be and translate that into what kinds of advanced systems we need to develop in order to support future missions,” Johnston said.

One such study, being carried out for NASA, is to develop methods to store cryogenic fuels—liquid oxygen and liquid hydrogen—in space for extended periods of time. Cryogenic fuels are commonly used to launch rockets from Earth into space. But in space, there is so far no effective way to store liquid hydrogen. Cryogenic fuels would be particularly valuable in transporting astronauts at high speeds to distant locations.

“Liquid hydrogen tends to permeate its container and it only wants to remain liquid at very, very cold temperatures,” Johnston said. “We just completed a study contract for NASA on new storage technology that can be tested in a demonstration mission in space.”

Boeing is also conducting studies related to solar electric propulsion, which is much less powerful but far more efficient than cryogenic rockets. Small systems using this technology are used in commercial satellite programs. Larger systems would

offer an economical alternative for moving hardware in space, beyond Earth orbit.

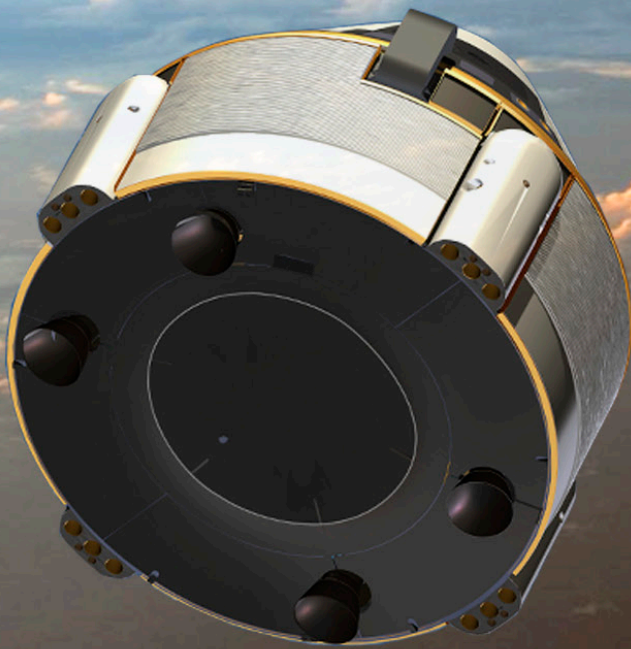
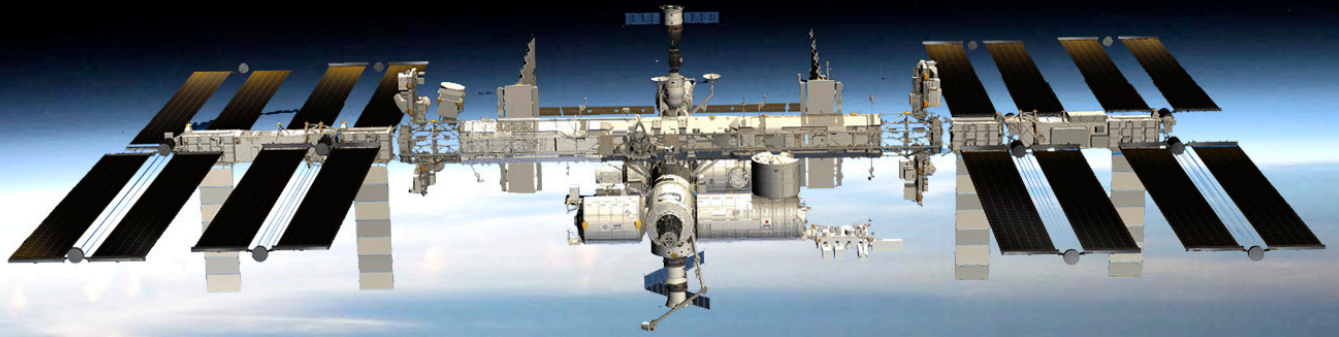
“You wouldn’t use solar electric propulsion on manned missions; it’s too slow,” Johnston said. “But you might want to use it to create a base—en route to Mars or some other destination—and continue to supply that base over time.”

In addition to innovative systems for space exploration, Advanced Space Exploration is developing efficient methods for transporting payloads into Earth orbit. For example, Boeing is working under a U.S. Air Force contract to develop concepts for a Reusable Booster System. The program is defining the requirements and completing conceptual design for a demonstration system that can autonomously fly back to the launch site after a simulated separation of an upper stage.

“In the decades ahead, I think we’ll see ourselves going to a lot of different places in space and taking on a variety of missions,” Johnston said. “And when we do that, we’ll be using the infrastructure that we’re putting into place right now.”

—Bill Seil





## Boeing is taking innovative steps to prolong unique space station research

The world's most exciting research laboratory is literally out of this world.

Orbiting about 240 miles (320 kilometers) above Earth, the International Space Station is not only a unique low-gravity research facility, but it is helping future astronauts meet the challenges of lengthy space missions.

"It's an international laboratory that is impacting our lives here on Earth, as well as improving our knowledge to explore far beyond Earth," said Joy Bryant, Boeing's vice president and program manager for the International Space Station.

Although the space station is officially slated to stay in service through 2020, Boeing is conducting structural integrity and other analyses for NASA that will determine whether the station's mission could be extended to 2028.

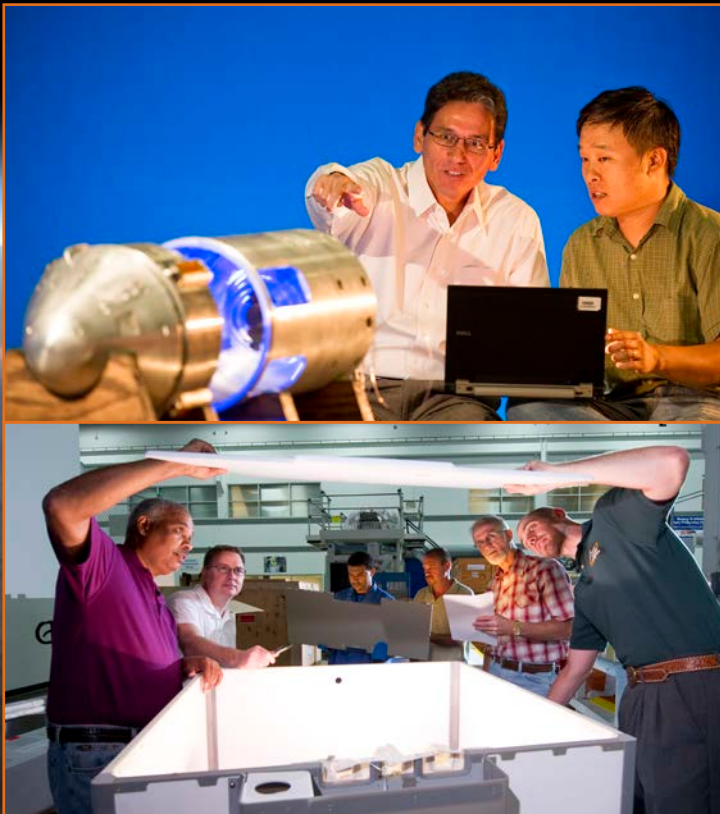
In the space station's weightless environment, scientists

study the structure of protein molecules used in pharmaceutical research for cancer treatments, stroke prevention and other medical needs. The space station is also a platform for studying effects of gravity and lack of gravitational forces on materials and processes, and addressing issues related to weather and the environment of the Earth. It is also an orbiting laboratory to study the effects of spaceflight on the human body.

Boeing has the leading role in sustaining the space station's operations. Now that the Space Shuttle program has concluded, new solutions are in development to transport astronauts and supplies to the station.

Currently, astronauts are carried to the station in Russian Soyuz spacecraft. Supplies are being shipped to the station on Russian Progress spacecraft as well as international carriers from Japan and Europe. Boeing is participating in NASA's Commercial Crew Program to build a spacecraft to ferry astronauts to and from the station. Another NASA program, Commercial Orbital Transportation Services, is in development with private U.S. companies to transport cargo.





**PHOTO ILLUSTRATION:** Boeing's CST-100 spacecraft prepares to dock with the International Space Station. **BRANDON LUONG/BOEING; SPACE STATION PHOTO: NASA; CST-100 GRAPHIC: BOEING (Insets, from top)** At the Boeing facility in Houston, engineers Olman Carvajal, left, and Peter Jang study results from wind tunnel testing of a model of the CST-100 spacecraft; design engineers Luis Lebron (foreground, from left), Chad Ensor, John Cannon and Ryan Luke inspect a mocked-up enclosure that will house the lithium-ion batteries destined for the International Space Station. **BOB FERGUSON/BOEING**

Space station operations have transitioned in the absence of the shuttle. For example, it is no longer possible to transport large oxygen and nitrogen tanks to the station. So Boeing engineers in Huntsville, Ala., are developing a high-pressure Nitrogen Oxygen Recharge System, or NORS, which can deliver more of these gases in smaller payloads.

"When we had the shuttle flying, we had a pretty good way to transfer these gases in large quantities," Bryant said. "It's a little like having a semi-truck delivering your supplies every three months, and replacing that with more frequent deliveries using smaller trucks. Fortunately, NORS will make those smaller shipments both efficient and affordable."

Boeing is also preparing to replace the station's nickel-hydrogen batteries with lithium-ion batteries, which will store more energy and take up less space. Improvements are also being made to the station's communications system, video capabilities and interior lighting.

— Bill Seil

is tentatively scheduled for late 2017. The first crewed launch, using the Orion spacecraft, will occur sometime after the first successful unmanned test.

Chilton said NASA found Boeing to be the clear choice to build Space Launch System because of the company's competitive advantage in both supplier partnerships and meeting schedules. Boeing also has a highly skilled workforce, with decades of experience in every aspect of space exploration.

In August, NASA awarded Boeing \$460 million in the Commercial Crew Integrated Capability program to continue CST-100 spacecraft development through critical design review. CST-100, along with spacecraft being developed by two other companies in this program, are in competition to provide taxi service to and from the International Space Station, as well as other locations in low Earth orbit. For example, independent space complexes, such as the inflatable facility planned by Bigelow Aerospace, could host international researchers and even space tourists.

In designing the CST-100 spacecraft, Boeing drew on proven concepts developed during the Apollo era. Its structure is modeled after the Apollo command module. Its intricate parachute system, used in returning safely to Earth, was also used in Apollo. The most important change is the use of inflatable air bags, which will allow the capsule to touch down on land, rather than water.

John Mulholland, vice president and program manager of Commercial Programs for Boeing Space Exploration, leads Boeing's Commercial Crew Development program. He noted that NASA's efforts to develop low-cost, low-Earth-orbit transportation is freeing up resources for the federal government to fund more ambitious space exploration projects. It's also part of a move to open space to private enterprise.

"One really exciting aspect of working in the Commercial Crew program is that we're on the verge of opening up new business opportunities in space," Mulholland said. "There's a good mix of companies exploring different market segments in low Earth orbit and suborbital transportation. As this market matures, it could be very lucrative to Boeing and the aerospace industry as a whole."

Boeing's Commercial Crew program has been conducting a variety of tests that focus on various aspects of the spacecraft's systems. The first crewed test flight of the spacecraft, depending on funding, could occur as early as 2015.

"We are uniquely positioned to succeed in the commercial space arena," said Mulholland, who previously led Boeing's Space Shuttle program. "We know how to design and build successful commercial products. We also have a legacy of designing and building spacecraft, from Mercury, Gemini and Apollo to the space shuttle and International Space Station. That's a winning combination." ■

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## Employee volunteers inspire the next generation of space visionaries

Brenda Isaza, a Boeing structural design engineer at Kennedy Space Center in Florida, spends much of her free time introducing young students to careers in space and mentoring older students who are looking ahead to getting engineering degrees.

"I tell them that they are entering a very exciting time for human space exploration," she said. "Space is becoming commercialized and there are going to be more and more opportunities to get involved. And some from their generation will be exploring places beyond Earth, including Mars."

This next generation of space explorers will be working in a very different environment than today's astronauts and aerospace engineers. NASA is shifting its focus to missions beyond Earth orbit, which ultimately could include trips to Mars. Earth orbit will become a new frontier for private enterprise.

As a member of the Society of Women Engineers, Isaza gives presentations on rocketry to elementary school students at the society's semiannual Introducing Girls to Engineering Workshop. This includes basic discussions of the principles of physics, as well as showing pictures of today's launch vehicles. During the workshop, children have the opportunity to build "bubble-powered" rockets using paper, 35 mm film canisters and antacid tablets that fizz in water.

"Some of the students have never talked with an engineer before, so they're excited to hear from someone who actually works in the field," she said. "And I love doing it because I have a passion for reaching out to kids and getting them to think about future careers."

Space continues to be a hot topic among students both in class and at various science and technology-related events.

Beth Keller, a teacher in Huntsville, Ala., recalls the enthusiasm shown by students as they participated in Space Camp.

"There was so much speculation about the end of the Space Shuttle program and what it meant," Keller said. "But the kids are just as excited as ever because of all the talk about deep space exploration. It feels like their frontier."

Scott Strickland, Isaza's manager at Boeing, works with students in the FIRST Robotics program, a competition in which teams of students design and build robots that perform specialized tasks. As manager of hardware development and sustaining Spacecraft Services at the space center, he is involved in a range of programs from the International Space Station to equipment that will be used with the Orion spacecraft for exploration missions on the Space Launch System.

Strickland said Boeing and its employees are strong supporters of STEM outreach programs, which encourage students to explore careers in science, technology, engineering and mathematics. He sees this approach as an effective way to ensure Boeing and industry as a whole will have talented employees to meet future challenges.

"I tell students that if they want to be involved in the cutting edge of aerospace, they can't go wrong by pursuing careers in space," he said. "And the folks I've brought in as interns have definitely gotten enthused, after they see what we do and how we do it."

*—Bill Seil*

**GRAPHIC:** The next bold steps in the human exploration of space could eventually see an outpost on Mars. **SHUTTERSTOCK**





**“Some from their generation will be exploring places beyond Earth, including Mars.”**

*– Brenda Isaza, a Boeing structural design engineer at Kennedy Space Center in Florida, who mentors students interested in careers in engineering*



# Taking the **lead**



## Employees learn what it takes to be tomorrow's leaders

By Ann Beach

*This is the second in a three-part series that focuses on graduates of Boeing's leadership development programs who are using what they've learned to help drive business results.*

**A**fter 25 years as a manager in the auto industry, Joann Wells joined Boeing South Carolina in 2009 as a quality technician.

"I wanted to learn more about the aerospace business," Wells said. "I learned a lot and as a result I had that opportunity when a management position opened."

That management job opened about 18 months after Wells went to work for Boeing, and she signed up for First-line Leadership training at Boeing South Carolina. The course helps new managers learn how to develop and coach employees who report to them, and teaches them how to be effective managers.

Since completing the course, Wells said, her team of 13 quality specialists and technicians is more "cohesive."

"I make a conscious effort to be a good listener especially if they have different ideas," she said. "I never assume anything

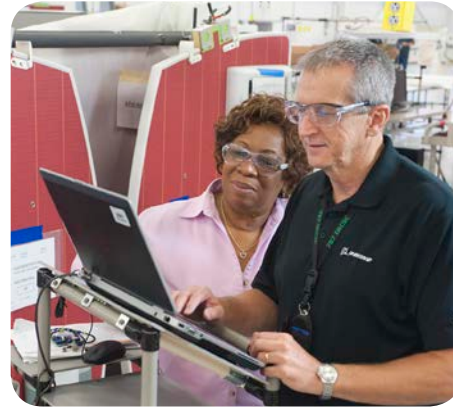
about their motives; like mine, I assume they want to better the team. So I do a lot of sharing and listening."

The First-line Leadership course is one of many management courses that Boeing offers at the Boeing Leadership Center or at work sites. These include the Basics of Boeing Management course, a prerequisite for First-line Leadership, and the Transition to Management course for non-managers who might be team leads or acting managers.

Caleb Behrmann completed the First-line Leadership course this past summer.



## For Mike Herskovits, some of the most valuable lessons he learned from his Transition to Management course were about information sharing and how to be a better listener.



**PHOTOS:** (Far left) Toolmakers Kevin Crotsley, from left, and Shane Smith with Caleb Behrmann at the Auburn Tooling Services weld area in Auburn, Wash. **MARIAN LOCKHART/BOEING** (Insets, from left) In El Segundo, Calif., Matthew Link discusses a project with Lynn Stanford, software and ground engineering team member. **PAUL PINNER/BOEING** Joann Wells and Tom Holbrook, quality technician team leader, review documents at the Boeing South Carolina Interior Responsibility Center. **ALAN MARTS/BOEING** Del Leonard Jr., left, sheet metal mechanic, and Mike Herskovits check equipment in Mesa, Ariz. **MIKE GOETTINGS/BOEING**

Behrmann joined Boeing in December 2011 from GKN Aerospace in St. Louis and initially took the Basics of Boeing Management class offered at Boeing Renton-Longacres.

"One of the most important lessons was in having candid conversations, especially around issues like behavior, attendance and performance," said Behrmann, who is responsible for 35 second-shift machinists, toolmakers and welders at Auburn Tooling Services in Boeing Fabrication.

For Mike Herskovits, some of the most valuable lessons he learned from his Transition to Management course at the Leadership Center were about information sharing and how to be a better listener.

Herskovits is a government property manager for Boeing Defense, Space & Security Global Services & Support.

Unlike Wells, who works with her team in one building, Herskovits manages a virtual team of 11 employees from California to Montana to Virginia. His office is near Mesa, Ariz., but he's usually on the road at least twice a month.

"I didn't recognize that things I did or said came across differently," said Herskovits, recalling those lessons learned in the classroom. "It's not so much about

being aware of those around you, but be aware of yourself and how you are being perceived by other people."

Herskovits reports to Bob Parry, a senior manager who has encouraged and supported Herskovits' development plans, which include finishing a master's degree while keeping up with a demanding work and travel schedule.

"We foster our employees' growth because we know that they'll expand their knowledge and increase their ability to make connections across functions and programs," Parry said.

Matthew Link also learned from colleagues during his class in Transition to Management. The experience, he said, helped him be "more reflective about whether or not to pursue a management position."

He started his Boeing career as a co-op student before graduating from Embry-Riddle Aeronautical University in Daytona Beach, Fla. After completing his bachelor's degree in computer science and his master's in software engineering, Link joined Boeing full time.

Almost immediately, he was nominated and applied for the HiPo program at the El Segundo, Calif., site. Short

for High Potential, this program is for non-managers who aspire to leadership positions. He is one of 39 employees—six of whom are considered High Potentials—who report to Yi-Feng "James" Chen, a senior Ground Systems Engineering manager for Space & Intelligence Systems in Defense, Space & Security.

Link's abilities were recognized early on and when opportunity came, he was named as an Integrated Product Team lead. Link is responsible for a team of 25 employees that, with the help of experts across the company, is developing a network management system for satellite ground stations.

At this point in his career, Link said, he's focused on accepting "opportunities that can become stepping stones" to management.

"I always try to remind myself that when dealing with stretch assignments things may at times seem hard and you may doubt your ability," Link said, adding: "But if it isn't hard you're not stretching yourself, and we're not helping push our boundaries as a company." ■

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# Roaring

Since its first flight 40 years ago, the F-15 jet fighter continues to evolve—as does its customer base

**By Kelli Blue**

**B**ob Southerland still remembers the thrill he felt at age 19 when he first saw a Boeing F-15 Eagle take off from Holloman Air Force Base in New Mexico.

“I stood there in awe,” Southerland said, recalling the powerful and deafening roar of the twin engines on full afterburners that made the ground shake. “A true Viking takeoff! Unbelievable!”

For a “Viking” takeoff, the pilot points the nose of the fighter straight up after the jet has lifted off the runway and reached a certain speed. The F-15 has the power to accelerate straight up. It was the first fighter to have that capability. Early media stories about the performance of the F-15 noted that it could reach 50,000 feet (15,240 meters) in less time than the mighty Saturn V rocket that hurled U.S. astronauts toward the moon.

When he watched that memorable takeoff, Southerland was serving in the U.S. Air Force, working on Boeing’s F-15 program. Thirty years later, he’s still with the program, but now as a sheet metal assembler riveter in the Boeing St. Louis factory where the fighter is made. And he’s still exhilarated by the power of the F-15.

“It’s hard not to be,” he said. “There isn’t a person on the shop floor who doesn’t stop to listen every time an F-15 takes off. There’s a tremendous sense of pride among the men and women who build this machine.”

George Louis, also an F-15 sheet metal assembler riveter in St. Louis, shares Southerland’s passion.

“Every time I see an F-15 fly or I hear about its successful combat mission record, I feel amazed and proud that I have a hand in building it,” Louis said.

Added Theotric Jackson, another F-15 sheet metal assembler riveter, “We have come a long way on this program, and in building them.”

And there is no end in sight to production of this highly maneuverable fighter that was designed to gain and maintain air superiority in aerial combat in all weather conditions. Its primary mission—aerial combat—is the same as when it first flew 40 years ago. The F-15 is used extensively worldwide and most recently has seen combat in Iraq and Afghanistan.

The U.S. Air Force has no plans to retire the F-15; Boeing is under contract to perform full-scale structural fatigue tests on the F-15C/D and E models to demonstrate





# success

their durability and to extend their original design life. Current orders for the F-15 extend production into 2018.


Not only has the fighter been significantly upgraded with new technology and capability over the years, but Boeing is now offering the Silent Eagle, which incorporates stealth technology that makes it less visible to enemy radar. The Silent Eagle is one of the fighters that South Korea is considering in an ongoing competition. It is an evolved derivative of the F-15K Slam Eagle currently in service with the Republic of Korea Air Force.

“The boron and titanium used to build the F-15 allow it to perform at the elevated temperatures reached at higher speeds,” explained John Heilmann, F-15SA development program manager. “Because of how it’s built and what it’s built of, the F-15 can easily reach Mach 2.5 (more than twice the speed of sound) while more recently designed fighter aircraft are limited to Mach 1.8 or less.”

Over the years, the latest strike weapons, smart weapons and missiles have been integrated into the aircraft’s electronics systems. An advanced crew station with large area displays and various technologies that make the F-15 less detectable with radar are but a few of the many upgrades Boeing has performed on the F-15.

As the F-15 has evolved, so has its customer base, including Israel, Japan, Saudi Arabia, South Korea and Singapore. Last December, the U.S. government announced that Saudi Arabia will purchase 84 new F-15SA Eagles and upgrade their existing 70 F-15S aircraft to a similar configuration.

Heilmann said a key development that has kept the F-15 in demand was the Conformal Fuel Tanks that add



**PHOTO:** Two F-15C's maneuver during a training sortie earlier this year. The flares are deployed as countermeasures to heat-seeking missiles. These F-15s are flown, maintained and supported by the Oregon Air National Guard's 142nd Fighter Wing based in Portland, Ore.

JIM HASELTINE/HIGH-G PRODUCTIONS



10,000 pounds (4,500 kilograms) of fuel and additional weapon stations to the aircraft. The tanks enable the F-15 to carry heavy weapon loads long distances and spend increased time in the combat area.

The tanks were crucial to Boeing's winning the U.S. Air Force "dual role" fighter competition with the F-15E Strike Eagle version, he said. The U.S. Air Force was looking for an aircraft that had both excellent air-to-air and long range air-to-ground capabilities for "dual role" missions.

The initial F-15 design came about in the 1960s when other aircraft were consistently being shot down in the Vietnam War. In the middle of the decade, the Air Force released a requirement for an air-to-air superiority aircraft. Boeing predecessor company McDonnell Douglas won that competition in 1969, and the F-15 Eagle was born.

The fighter has never been defeated in air-to-air combat. Its perfect record—104 victories and zero defeats—is due to its maneuverability, advanced electronic equipment and extreme firepower, according to Heilmann.

It's a point not lost on the men and women who initially build the F-15 in the St. Louis factory, those who later perform the upgrades, or those who manage and support the program.

"However big or small our part in building this plane, none of us take it lightly," Southerland said.

Added Louis: "Every time we hear it roaring off the runway we're all reminded of the important role we play in the F-15's amazing success record. The F-15 design is just something that clicked and I don't see any end to its use. It's phenomenal." ■

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***"Every time I see an F-15 fly or I hear about its successful combat mission record, I feel amazed and proud that I have a hand in building it."***

— George Louis, F-15 sheet metal assembler riveter, St. Louis



**PHOTO: (Below)** The F-15 Silent Eagle's stealth technology makes it less visible to an enemy's radar. **BOEING (Insets)** Theotric Jackson (clockwise from top left), Bob Southerland and George Louis are sheet metal assembler riveters on the F-15 line in St. Louis.

RON BOOKOUT/BOEING





# Learning Curve

Boeing interns are given real-world work problems to solve

By Tim Houston and Marcy Polhemus

**W**arren Tichenor, a senior at the University of Southern California majoring in aerospace engineering and economics, had dreamed since childhood of one day working for Boeing.

This summer, his dream came true when he worked for Boeing as an intern with Commercial Airplanes in Everett, Wash.

"I've been an aviation nut since the age of 6 and felt like working at Boeing was the right fit," he said.

In Everett, Tichenor gathered engineering data for customers and collaborated with Boeing's sales and marketing experts.

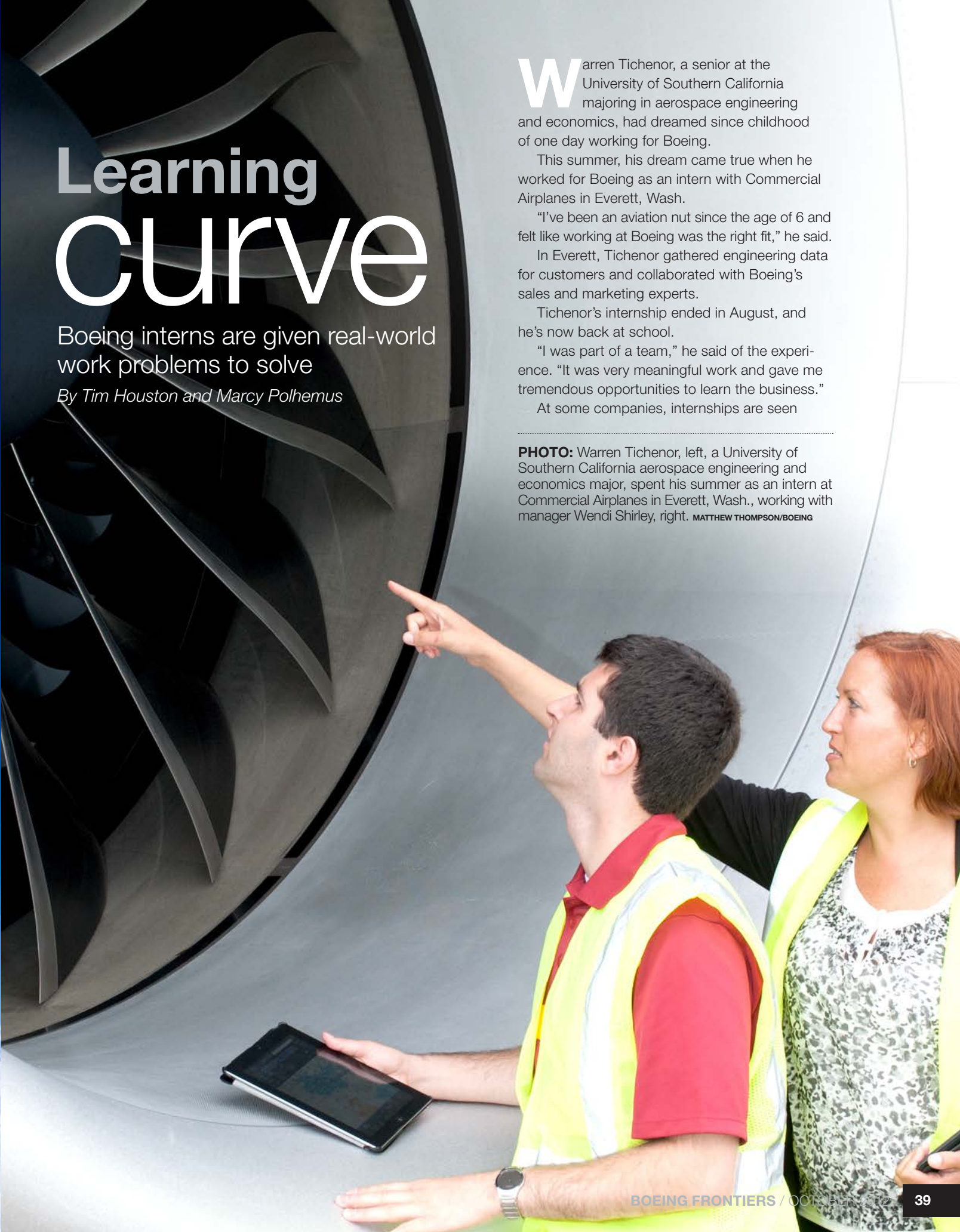
Tichenor's internship ended in August, and he's now back at school.

"I was part of a team," he said of the experience. "It was very meaningful work and gave me tremendous opportunities to learn the business."

At some companies, internships are seen

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**PHOTO:** Warren Tichenor, left, a University of Southern California aerospace engineering and economics major, spent his summer as an intern at Commercial Airplanes in Everett, Wash., working with manager Wendi Shirley, right. **MATTHEW THOMPSON/BOEING**





simply as a time to “pay dues,” where the intern assists regular employees with routine tasks as a way to learn the business and get an idea of what their chosen career would be like.

That’s hardly the case at Boeing.

At sites across the company, college juniors and seniors, and even some high schoolers, are given opportunities to perform real-world work and solve business-relevant problems.

“It’s no longer enough to have interns watch as more experienced employees do the work,” said Rick Stephens, senior vice president of Human Resources and Administration. “It’s been demonstrated that performing hands-on work is the most effective way to learn. The experience interns gain by solving real-world problems is so valuable, I can see hiring someone with a lower grade-point average who has intern experience over another candidate with a higher GPA but no internship experience.”

Internships also give Boeing a glimpse of how these students could fare as full-time employees, enabling the company to identify the top performers as the ones

## From high school to real-life engineering

Employees at the Boeing Huntsville site in Alabama were introduced to several young faces this summer — high school students.

The select group of students worked with and learned from Huntsville engineers on a variety of activities related to science, technology, engineering and mathematics, or STEM.

Seven students from Bob Jones High School in Madison, Ala., spent eight weeks as part of Huntsville’s Engineering High School Internship Pilot Program. Each of the budding engineers was paired with an employee from Advanced Designs and Prototype Solutions, the Huntsville Design Center or the International Space Station Payload Integration department. These employees served as mentors and guided the students through a number of real-life engineering projects.

“This is a way for Boeing to attract the best and the brightest talent at an early age,” said Robert Grondin, the



Huntsville site manager in charge of the program. “Our long-term objectives are to promote STEM at a high-school level, get the students interested in STEM-related careers and give them insight into what we do.”

Jacob Locke, one of the high school students, said the experience of working in an actual engineering environment was invaluable.

“It is hard to understand,” Locke said, “how different disciplines of engineering collaborate on a project until you actually take part in it.”

— Christian Chapman (intern)

**PHOTOS: (Above)** High school interns Jordan Riley, foreground, and Brandon Leach prepare component tests at the Huntsville, Ala., Stress Rupture Lab. **ERIC SHINDELBOWER/BOEING**  
**(Below)** This was the second year University of Kansas mechanical engineering major Trudy Curley spent as a Boeing intern — last year with Commercial Airplanes in Everett, Wash., and this year with Boeing Research & Technology in Mesa, Ariz. **(Inset right)** Curley hopes her work with manager Caleb Frederick on the Apache program will help her become a Boeing design engineer. **BOB FERGUSON/BOEING**







**PHOTOS: (Above)** Nicole Bruck, Iowa State software engineering and Spanish major, enjoyed the team atmosphere at Boeing's Cyber Engagement Center in Annapolis Junction, Md. **(Inset left)** Bruck forged lasting relationships with the center's team led by manager Alfred Lewis, right. **FRED TROILO/BOEING**

they want as new hires. In 2010, nearly two-thirds of interns were hired as full-time Boeing employees, a higher rate than the industry average.

This year, some 1,700 college and university students served as interns throughout the company—with 1,200 of these in technology-related positions. That's almost double the number from two years ago, reflecting the importance Boeing places on ensuring it has a steady pipeline of diverse, qualified candidates to meet current and future business needs, according to Stephens.

The search for interns in 2013 is already under way.

While Boeing interns experience work situations as varied as the organizations they support, a concerted effort is made to ensure they have challenging projects to work on from their first day at Boeing. Much of this responsibility falls to their managers, who are asked to work closely with interns to develop their career goals and mentor them—just as they do their permanent employees.

"Internships are the first step in what we

hope for some will be a long and mutually beneficial relationship with Boeing," said Mark Burgess, chief engineer for Engineering, Operations & Technology. "To make that happen it's vital they feel valued and involved in their positions, so they leave with a positive feeling about the company and want to come back."

Trudy Curley, a mechanical engineering major at the University of Kansas, spent the summer working in her second Boeing internship, with Boeing Research & Technology in Mesa, Ariz. The senior served as a design engineer on ultrasonic phased array development for the Apache program, where she was able to further develop her technical skills and build on her experiences as a Commercial Airplanes intern in 2011.

"My experience at Mesa helped me develop not only my engineering skills but also my communication and leadership skills, which are just as important," said Curley, who hopes to pursue a doctorate degree and become a full-time design engineer, ideally at Boeing. "I know my intern experience will open doors for me in the future."

Nicole Bruck, a software engineering and Spanish major at Iowa State University, worked this summer as an intern at Boeing's Cyber Engagement Center in Annapolis Junction, Md.

A lot of the cybersecurity work she did at the center was team-based, Bruck said, adding: "This internship was a great experience and has encouraged me to get more into software development."

As for Tichenor, the intern who spent his summer with Commercial Airplanes in Everett, he hopes to return to Boeing full time after graduation. His dream job? Boeing test pilot. ■

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*The search for interns in 2013 is already under way. Current internship opportunities can be viewed at [www.boeing.com/careers/internships](http://www.boeing.com/careers/internships)*

*For those nearing graduation, check out Boeing's career opportunities at [www.boeing.com/careers/collegecareers](http://www.boeing.com/careers/collegecareers)*



# Fabric of the future

Boeing's partnership with Turkey helps local communities thrive

By Bill Seil

Only months after Boeing opened its first office in Ankara, Turkey, in August 1999, the country was rocked by a devastating earthquake.

In cooperation with Turkish Airlines, Boeing brought in a medical team with enough supplies to treat 10,000 people. Boeing's support also included relief materials, dialysis machines and financial aid.

Indeed, the company's vigorous earthquake response effort set the theme for Boeing's corporate citizenship in Turkey. From supporting schools to sponsoring archeological digs, Boeing today is part of the warp and weave of Turkish society, helping communities and building important relationships in a country where it has a strong presence.

"After our initial relief response to the 1999 earthquake, we wanted to see what else we could do to help," said Greg Pepin, who had joined Boeing in 1999 and was the new country director for Turkey at the time of the quake.

"We found out about a school—Inkilap Primary School—that had been badly damaged by the earthquake. So we built an annex, which included computer and science labs."

Boeing went on to locate funds to finance other school projects in the area, including more computer and science labs and library facilities.

In 2002, when Boeing launched its formal international corporate citizenship program, Boeing Turkey took a broader view and identified a range of projects to address some of the country's most important needs. Primary education was given the greatest emphasis, but



**PHOTOS: (Top)** A ribbon-cutting ceremony celebrating the opening of a fully equipped computer lab at Sahakyan-Nunyan Armenian Primary School in Istanbul last November. **GTC COMMUNICATIONS CONSULTANCY (Above left)** A Turkish Peace Eagle Airborne Early Warning and Control aircraft. **BOEING GRAPHIC: (Above right)** A Next-Generation 737-800 (foreground) and a Next-Generation 737-900ER (Extended Range) in Turkish Airlines livery. **BOEING**





“We might have just changed the life of that youngster, and that’s what it’s all about.”

– Greg Pepin, president of Boeing Turkey



**PHOTOS:** Opening ceremony for the computer lab at (clockwise from top) Catak Primary School in Macka, Trabzon, in 2008; the computer lab at Huriye Askar Primary School in Afyonkarahisar, opened last May; and students at the Boeing-provided computer lab at Cumhuriyet Boarding Primary School in Almus, Tokat. **GTC COMMUNICATIONS CONSULTANCY**

Boeing found much more could be done.

Since 2000, Boeing Turkey has completed 186 corporate citizenship projects in 40 cities. In addition to education, the company has worked in the areas of arts and culture, and health and human services. More than 135,000 children have benefited.

“Boeing has maintained a long-standing relationship with Turkey since the mid-1940s,” said Shep Hill, president, Boeing International and senior vice president, Business Development & Strategy. “During Greg’s tenure as president of Boeing Turkey, our relationship went to the next level. He implemented a robust country strategy that grew our business, grew our industrial collaboration and established Boeing as meaningful partner in the Turkish community. Greg’s commitment to Boeing, his passion for Turkey and the Turkish people enabled our success in this strategic market.”

Pepin came to Boeing after serving in

the U.S. Army for 26 years and, between Boeing and the military, has spent a total of 23 years in Turkey. In 2002, he was named the first president of Boeing Turkey, a position he has held since. He will retire the end of October and turn over the leadership of the organization to another Army veteran, Bernie Dunn, who has extensive executive experience in the Middle East and Africa.

Dunn said Boeing Turkey’s support for needed corporate citizenship projects will continue in the years ahead.

“Boeing has long demonstrated a global commitment to supporting communities where our people live and work,” Dunn said. “Greg has been an exemplary leader in this regard, and I look forward to continuing the great work he has done over the past 14 years.”

Dunn will lead a dynamic Boeing business presence in Turkey. The company supports more than 1,000 direct jobs in the country, with the placement of more than

\$1.2 billion in contracts to various Turkish industries, including technology transfer and investment, extending through 2013.

Turkey is a growing market for Boeing products. Turkish commercial aviation is among the fastest-growing in the world, with passenger traffic doubling over the past five years. The country has become an important commercial aviation gateway for European, Asian, African and Middle Eastern passenger and cargo flights. Boeing’s Current Market Outlook forecasts the nation’s airlines will purchase airplanes valued at \$85 billion over the next 20 years.

Eleven Turkish carriers are operating more than 170 Boeing airplanes. The market is dominated by Turkish Airlines, which has ordered almost 50 Boeing jetliners since 2009.

Turkey also has been a customer for Boeing defense products since the 1970s, when heritage company McDonnell Douglas delivered the first F-4 Phantom



aircraft to the Turkish Air Force. In the 1980s, the Turkish Navy took delivery of its first McDonnell Douglas Harpoon antiship missiles. Turkey's Peace Eagle program, when deliveries are complete, will fly four of the Boeing 737-based Airborne Early Warning and Control aircraft. These aircraft provide airborne surveillance and command, control and communications for tactical and air defense forces.

Much of Boeing's corporate citizenship work in Turkey today involves health and human services. Boeing Turkey is active in the field of neonatal care, supplying incubators for premature babies, as well as other equipment, to children's hospitals. Seven hospitals currently benefit from the program. Boeing also is involved in educational programs in Turkey. The company funds an early learning program in Eastern Turkey that involves parents in getting their 5-year-old children ready for school.

Boeing also sponsors two archeological digs in Turkey. In fact, the Catalhoyuk excavation in Konya—a 9,000-year-old Neolithic site—was originally sponsored by Boeing before the company opened its Ankara office in 1999.

"This may be the oldest site where humans stopped being hunter-gatherers and settled into villages," Pepin said. "This year it became a UNESCO (United Nations Educational, Scientific and Cultural Organization) heritage site, which is a great honor."

In addition, Boeing supports the Kaman-Kalehoyuk Excavation outside of Ankara, along with a related archeological museum and laboratory facilities. The company also provides funding to assist the Turkish university students who go there each summer during the digging season.

Boeing Turkey's cultural contributions include supporting a range of music festivals, with repertoire ranging from classical to contemporary. It has funded performances at the International Istanbul Music Festival since 1992, and supports the Ankara Music Festival and the Ankara Jazz Festival.

Boeing looks to the future by serving as a founding co-sponsor of Space Camp Turkey, located in Izmir on the coast of the Aegean Sea. For more than 10 years, the company has been sending students, ages 7 to 16, to participate in the camp's programs. Space-themed activities include virtual flight, sky observation, a space shuttle mission, and making and launching a single-stage rocket.

Pepin was especially touched when a young girl came up to him to thank



Boeing for sending her to the camp. She was from a school Boeing had rebuilt in an Eastern Turkey town called Kars, which gets about 6 feet (1.8 meters) of snow each year. The girl mentioned that her trip to Space Camp was the first time she had ever seen the ocean.

"Here's a little girl who lives in a little town in the mountains," Pepin said. "And maybe, because she learned about space and saw the ocean, she'll be inspired to study hard, go to college and do something special with her life. We might have just changed the life of that youngster, and that's what it's all about."

Pepin has long noted that the first time you help someone, it's because you want to help. When you continue to help them, it's because you really care. Boeing Turkey's

corporate citizenship program has been one of caring and lasting relationships. For example, Boeing has returned to schools it has helped in the past and upgraded Boeing-built computer labs.

"One of the most remarkable things about Turkey is the warmth and hospitality of its people," Pepin said. "Our support is rooted in the feeling that we are truly part of the community." ■

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**PHOTOS: (Clockwise from top)** The Boeing-supported Catalhoyuk Research and Excavation project in Konya; students from Izzet Latif Aras Primary School in Ankara visit Boeing's Turkey office last November; the opening concert at the 26th International Ankara Music Festival in April 2009. **GTC COMMUNICATIONS CONSULTANCY**







## JOYS OF FLIGHT

Tibetan students test-fly model airplanes in front of the world-famous Potala Palace in Lhasa. Boeing China recently expanded its successful science and aerospace education program “Soaring with your Dream” to Tibetan students; more than 20 Tibetan elementary and middle schools are participating. Since the Boeing program started in 2009, more than 45,000 elementary school students have attended the aviation and science courses and experienced designing, building and flying a model aircraft from scratch. The program is designed to inspire teachers and elementary school students to learn more about science and engineering-oriented subjects.

PHOTO: BOEING







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On course, closing in.

The first P-8A Poseidon, the world's most advanced maritime patrol aircraft, was recently delivered to the U.S. Navy. On time and on-budget, the P-8A will soon provide critical capabilities the U.S. Navy and allies need to keep sea lanes open and combat the increasing threat of hostile submarines. Poseidon is on its way, with all due speed.

GE AVIATION RAYTHEON BAE SYSTEMS CFM  
NORTHROP GRUMMAN SPIRIT AEROSYSTEMS

