

Frontiers

Peak performer

Boeing C-17s provide vital military airlift capabilities





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Whether hauling troops, helicopters and other military equipment and vehicles or providing hope and saving lives when natural disasters strike around the world, Boeing's C-17 Globemaster III has proved itself as the most versatile airlifter ever built. Although production of the C-17 in Long Beach, Calif., is about to end, this unique aircraft will continue to be the mainstay airlifter for the U.S. Air Force and international operators for many years.

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It's known as the Pit Crew Academy. With an automotive racing theme, this unique training facility is teaching 787 mechanics to work as a team—with speed, safety and efficiency.

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Cover: As the sun rises over the flight line at Joint Base Lewis-McChord near Tacoma, Wash., with Mount Rainier in the distance, a U.S. Air Force C-17 is readied for its next mission. **BOB FERGUSON | BOEING**

Photo: During a refueling operation in 2013, a C-17 from Joint Base Lewis-McChord approaches a tanker over the western United States. **U.S. AIR FORCE**

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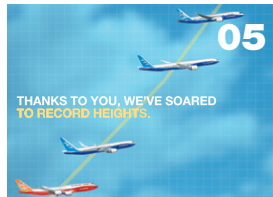
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This delivery milestone ad celebrates Boeing's 2014 order and delivery success—and expresses the company's appreciation to its customers, suppliers and employees. Learn more at <http://newairplane.com/orders-and-deliveries>.



Boeing will sustain the guidance systems of U.S. Air Force Minuteman III intercontinental ballistic missiles into 2023 under a contract awarded last month. This ad highlights Boeing's support of the Minuteman program since 1958 and appeared in trade publications late last year.

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723 Deliveries



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TO RECORD HEIGHTS.



2014 was certainly one for the record books at Boeing Commercial Airplanes. 1,432 new orders, a new Boeing record. Plus 723 new airplanes delivered to customers around the world, a new industry record and a new company record for the second consecutive year. For these remarkable achievements, we thank our customers, our suppliers and our Boeing workforce. By winning together, we've raised the bar high. And set our sights on even better things to come.

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LEADERSHIP MESSAGE

Jim McNerney

Boeing chairman and
chief executive officer



Breaking through to begin our 2nd century

Keep building upon the strong foundation we and our predecessors have created

The year 2014 was another big one for Boeing—one in which we continued our trends of strong annual operating performance and growth—thanks to everyone across the enterprise who worked together to support our customers and achieve our goals. Our team set many new records, reached numerous key program and business milestones, and demonstrated our commitment to the important initiatives and pursuits that will fuel our success in the years to come.

Yet our 2014 results reflect more than the achievements of a single calendar year; they also represent the tremendous

efforts of Boeing employees throughout the past decade to strengthen and transform the company. From establishing a “One Boeing” approach to our business and expanding our global footprint, to renewing and acting on our commitments to integrity, innovation, workplace safety, first-time quality, productivity and functional excellence, we have reaffirmed our foundational strengths and sharpened our competitive edge.

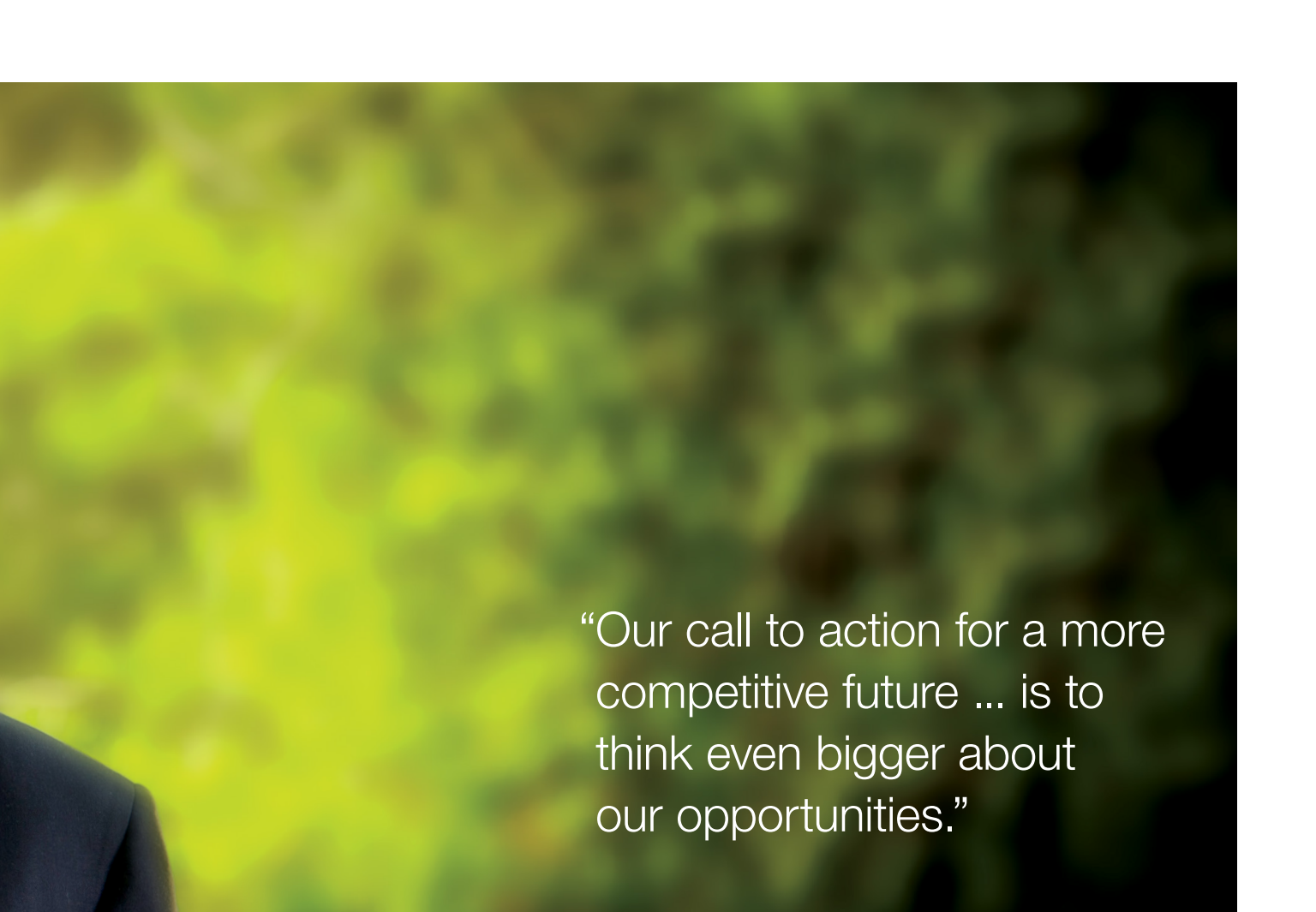
As a result of these and other efforts, we recaptured and have expanded our market-share leadership with superior offerings and increasing production

in Commercial Airplanes, and we strengthened our relative position in a difficult Defense, Space & Security market with franchise wins such as the P-8, KC-46 tanker, Space Launch System and Commercial Crew programs.

Like our founder and our predecessors who succeeded in making Boeing a great company in its first century, through the past decade of restoration and renewal, today’s generation of Boeing employees has built a bigger, better company for launching into our second century.

While we often point to July 15, 2016, as the centennial of our founding, our 100th year in business actually begins this year—on July 15, 2015. We approach this historic milestone stronger, healthier and more competitive than at any time in recent memory. That’s important. As the few enduring global industrial leaders have learned, the second century is always more challenging than the first.

We should expect nothing less,



“Our call to action for a more competitive future ... is to think even bigger about our opportunities.”

because our existing competitors are getting better, and new, lower-cost competitors are on the rise. On top of that, our customers' expectations for the value we provide them have never been higher. They want more capability, more efficiency, more quality and reliability—all for less money, because that's what their customers, or governments, are demanding of them.

To sustain and grow our industry leadership in this more-for-less world, and continue delivering for our customers and our company in 2015 and beyond, means there can be no letting up on either the strategies that have enabled our success or the big goals we have set for our innovation and business performance.

We must continue to meet our commitments to customers on our production programs, deliver our development programs on time and on cost with the performance we promised, and drive higher safety, quality and productivity across

the enterprise and throughout our supply chain. Remember, at the most fundamental level, productivity is what funds our innovation; innovation fuels our growth; and growth leads to employment for our people, opportunities for our suppliers, returns to our shareholders, and continued investment in our communities.

Fortunately, we have the right people, programs and enterprise initiatives in place to help us accomplish our goals, including Lean+/Capturing the Value of Quality, Partnering for Success, and the Boeing Product Development System for productivity, quality and reliability improvements; Go for Zero to reduce and eliminate workplace injuries; and (at Defense, Space & Security) market-based affordability to address defense and space market pressures. These foundational efforts have produced steady, year-over-year, incremental performance gains.

Our call to action for a more competitive future, however, is to think

even bigger about our opportunities—to also set seemingly unattainable goals that will require step-function improvements to be achieved and that will take the very best of Boeing to find the solutions. This challenge may seem daunting, but it is no less so than those we have overcome in the past.

Since the beginning, when our founder Bill Boeing flew in a barnstormer's floatplane over Lake Washington in 1914 and remarked, “I think we can build a better one,” we never have shied away from big goals that others thought were impossible. As stewards of this incredible legacy, we constantly need to be asking as much of ourselves as all those before us asked of themselves.

We are poised for another tremendous year—and a strong second century. I know what amazing work this team is capable of accomplishing, and I believe we can get it done together. ■

PHOTO: BOB FERGUSON | BOEING

SNAPSHOT

Osprey strike

A Bell Boeing V-22 Osprey fires a rocket during testing late last year at the U.S. Army proving grounds in Yuma, Ariz. The trials showed the Osprey can be armed with a variety of forward-facing munitions such as rockets and missiles that can hit their targets reliably, further increasing the capabilities of the unique tilt-rotor aircraft, according to Bell and Boeing.

The ability of the Osprey to land and take off like a helicopter but fly fast like a fixed-wing aircraft allows it to perform a variety of military and humanitarian missions. More than 240 have been delivered to the U.S. Marine Corps. It also is operated by the U.S. Air Force Special Operations Command. PHOTO: BELL





QUOTABLES

“When I’m 70, I’ll be telling my grandchildren about this.”

—American Airlines pilot David Hensley in an internal newsletter about making the first customer flight with selected employees on the airline’s first 787 Dreamliner. *Fort Worth Star-Telegram*, Jan. 15

“At Boeing, more than 75 percent of our commercial airplane research and development efforts are focused on advancing environmentally progressive innovations.”

—Brian Moran, Boeing president for the European Union and NATO relations, speaking to aviation stakeholders and members of the European Commission and European Parliament in Brussels, about Boeing’s investment in developing more fuel-efficient commercial airplanes. *Boeing News Now*, Dec. 22

WHAT WE DO

Engineering change

This Boeing engineer is helping guide the future of flight—autonomously

AS TOLD TO DARYL STEPHENSON

Jim Paunicka is a Technical Fellow in St. Louis who leads development of autonomous technologies for unmanned aerial vehicles. In this *Frontiers* series that profiles employees talking about what they do at Boeing, Paunicka explains what it means to be a Boeing engineer on projects that are critical to the company's future—and that of aerospace.

When I was a kid growing up in northeast Indiana, I was fascinated by how things worked. I would take things apart to see what was inside and how things were put together. That led to an ongoing fascination with computers and electronics.

As a Boeing engineer today, I'm still fascinated by how things work. Most of what I do at Boeing Research & Technology is related to unmanned aerial vehicles, or UAVs, and autonomy-related technologies. It's an important area for Boeing to be in because of the bright future that many see for these types of vehicles. There are new mission areas in the civil sector where UAVs can play a critical role and do things more affordably and safely than people can. But to meet the promise of a future market, these systems will have to be capable, safe and affordable.

I work closely with our business unit customers to ensure we develop technology that's really going to help them and their future business. And I work with people in government labs to enhance Boeing's technical credibility so that whenever they think of technology, they think of Boeing.

Our work with autonomous systems technologies is helping create breakthroughs that will enable UAVs

to perform functions in civilian society that are long, tedious or where we don't want to put people in harm's way. These include monitoring agricultural and coastal areas or pipelines, railroad tracks and other infrastructure.

But before the Federal Aviation Administration approves expanded use of UAVs in U.S. airspace, we in the technical community have to prove these systems are really ready for prime time. It's up to us to develop the technologies further, then verify and validate them, so the FAA can make an informed decision that this autonomous operation with autonomy software is safe enough to put UAVs in the air.

It's exciting work, but I've had many opportunities at Boeing to help shape our future. I've also been fortunate to have mentors in my life who inspired me. My grandmother, who grew up in the Great Depression, was very influential. She told me on many occasions I should strive to do well in school because, she said, education is something no one can take away from you. When I was in high school, I was in a theater group, with a diverse, multi-generational set of people, and met a guy who was an electrical engineer. His stories about engineering inspired me to become one.

Engineers provide value to society in more ways than just designing new products or bringing new technologies to market. I've learned many skills that I've used in volunteer and educational activities in our community in St. Louis. Like my grandmother did with me, I try to bring kids hope that if they stay in school, study hard and graduate, they can do well—and discover new and exciting worlds just as I did. ■

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Jim Paunicka

HAS WORKED FOR BOEING:
32 years

ORGANIZATION:
Boeing Research &
Technology

**HAS BEEN PART OF
THE TEAM:**
16 years

PHOTO: RON BOOKOUT | BOEING

HISTORICAL PERSPECTIVE



From props to jets

The Douglas DC-9 transformed airline travel in the U.S.

BY DAN RALEY

The sleek, twin-engine jet, trimmed in red, white and blue, was ready for takeoff at the Long Beach airport in California, idling on the main runway, when Rene Francillon drove up for work on Feb. 25, 1965, and had to wait. The Douglas Aircraft Co. employee couldn't pass through the gate and reach his office near the runway until the airplane was airborne.

Realizing he was about to witness history—the first flight of the Douglas DC-9—Francillon did what any serious aviation enthusiast would have considered: He climbed out of his car and watched.

"It was exciting," recalled Francillon, who worked as a cost analyst. "We all felt it was going to be a success. We all thought it would do well. It was a beautiful airplane."

Francillon watched as the new jetliner, with pilot George Jansen, co-pilot Paul Patten and flight-test engineer Duncan Walker aboard, lifted off the runway and headed out over the Pacific Ocean until it disappeared from view, eventually landing more than 100 miles (160 kilometers) away at Edwards Air Force Base, Calif.

This month marks the 50th anniversary of that milestone at Boeing heritage company Douglas. The distinctive T-tail, narrow-body twinjet would change the way much of America, and elsewhere in the world, traveled by air. Initially designed to hold 90 passengers, the DC-9 introduced jet service—and the jet-smooth ride—to small and intermediate cities that previously relied on propeller-driven piston- and turboprop-powered planes and had shorter runways. Designed to operate from 98 percent of the nation's primary airports, the DC-9 could fly up to 1,500 miles (2,400 kilometers) without refueling, but typically was used on routes of 500 miles (800 kilometers) or less.

Originally conceived with four engines, the DC-9 was built with two attached to the rear fuselage rather than on its wings. That was one fewer than the three that powered Boeing's larger 727, which had already entered commercial service. Airlines still weren't exactly sure what to think about the hybrid Douglas jet. At the time of the Long Beach first flight, the company had orders for just 61 DC-9s.

The DC-9, however, just needed time to introduce itself. Over the next 10 months, 183 jets were purchased. It beat Boeing's competitor, the two-engine 737, to factory rollout by about two years, and would go on to become the most successful Douglas transport since the DC-3.

The DC-9 eventually was built in five different versions, designated the Series 10, 20, 30, 40 and 50. The Series 50, stretched to a fuselage length of 133.6 feet (40.7 meters), could accommodate about 140 passengers, depending on cabin configuration. (The fuselage length of the first DC-9 was 104 feet 4 inches.) Another version, the DC-9-80, later was re-designated the MD-80 and launched a family of T-tail commercial airliners with the McDonnell Douglas "MD" designation—the MD-80 series, the MD-90 and the MD-95, which became the Boeing 717 after the merger with Boeing in 1997.

By the end of production in

Long Beach in 1982, 976 DC-9s had been built. A total of 2,441 DC-9s and MD-series jets, including the 717, were built through May 2006.

In addition to its ability to access smaller airports, the DC-9 will be remembered for its comfort, according to Francillon. With three seats on one side of the aisle and two on the other, passengers found they had less chance of getting stuck in a middle seat.

The compact airplane filled a welcome niche.

"It was Volkswagen size, but with the ride of a Cadillac," Francillon said.

The DC-9's final commercial airline flight in the United States came in January 2014, when Delta flight 2014 traveled from Minneapolis to Atlanta. A few weeks later, the plane reached its permanent gate—going on display at the Carolinas Aviation Museum in Charlotte, N.C.

Delta Air Lines had been the launch customer for the DC-9. It also inherited a large fleet from Northwest Airlines when the two companies merged.

As for that original DC-9, after flight testing and certification it was refurbished, repainted in gray, white and blue, and operated by Trans-Texas Airways, followed by four other American airlines, before it was used in Spain and retired back in the U.S. in 1992. ■

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Photos: (From far left) An early DC-9 is shown on a compass-calibrating "rose." The jet made its first flight in February 1965 and entered service just 10 months later. **BOEING**



Fueling

First flight of the tanker test aircraft marks significant program milestone

BY JAMES WALLACE

Three days after Christmas, a 767 took off from Paine Field in Everett, Wash., on its first flight. That's nothing unusual, of course. Boeing's Everett plant is the production home of the 767.

But this flight made aviation history.

The 767-2C was the first test aircraft for the KC-46 tanker program. The flight, lasting just over three and a half hours, represented a significant step in Boeing's commitment to deliver a new air-refueling tanker—the KC-46A Pegasus—to the Air Force. And it marked another milestone in Boeing's long legacy of developing and building tankers for the U.S. Air Force.

“Getting in the air is a really critical step in the life of this program and

Photo: The tanker program's first test aircraft completed its inaugural flight in December. MONICA WEHRI | BOEING



the future





the development of this important capability for the warfighter,” said Brig. Gen. Duke Richardson, Air Force program executive officer for Tankers. “The team at Boeing has done a really remarkable job creating an entirely new aircraft that will soon become the backbone of our ability to project power anywhere in the world.”

Boeing has built four test aircraft. The first flight of one of the aircraft with the refueling boom is scheduled for later this year. Wiring challenges that delayed the first flight of the 767-2C have been resolved, according to Boeing, and it remains on track to

deliver 18 combat-ready tankers to the Air Force in 2017.

In all, Boeing will build and deliver 179 KC-46A tankers to the Air Force, which must replace its aging fleet of KC-135 tankers.

In the weeks leading up to that Dec. 28 first flight, Boeing employees were busy
(Continued on Page 21)

Photos: (Above) Electrician Vea-Sna La-Madrid performs a quality check on electrical wiring. (Right) A KC-46A tanker exterior light. The tanker also features cueing lights that are used by pilots of receiver aircraft during refueling operations. **BOB FERGUSON | BOEING**





Photo: Tanker Integration team members Niem Le, from left, Phong Nguyen and QuocAnh Ly discuss the airplane systems.
BOB FERGUSON | BOEING



ARCTYX





preparing the test aircraft at the Everett Delivery Center. Some of those employees are featured in this photo essay. ■

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Photos: (Top) David May, left, 767 functional test technician, and Hue Vo, systems design engineer, prepare system checks. **BOB FERGUSON | BOEING** (Left) The KC-46A tanker will feature advanced technology including a digital flight deck with Boeing 787 Dreamliner electronic pilot displays and a state-of-the-art air refueling operator station. **PAUL GORDON | BOEING**

Global air

C-17 production is winding down, but Boeing's versatile airlifter has a lot of runway ahead

BY JAMES WALLACE

This is the first of two *Frontiers* features about Boeing's C-17 Globemaster III. Next, a look at the C-17 production line in Long Beach, Calif.

As a new day begins to spill across the flight line at McChord Field near Tacoma, Wash., a half-dozen Boeing C-17 airlifters wait for their next missions for the U.S. Air Force. To the east, above the foothills of the Cascades, majestic Mount Rainier bathes in what will soon be a spectacular sunrise, unusual for this time of the year in the rainy and cloudy Pacific Northwest. Outlined against a deep crimson sky, the mountain's

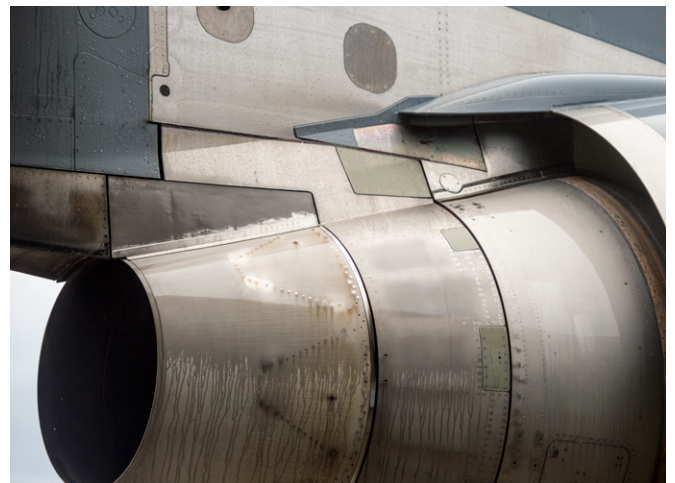
snow-covered flanks slowly change color, from black to deep purple to various shades of pink and blue, until finally the winter snow turns to white.

Across the T-tail of each C-17 is a green tail flash with "McChord" in white letters and a silhouette of the region's landmark mountain. Long before the 55-foot-high (17-meter) tails throw shadows on the flight line, aircrews are busy inside and outside one of the aircraft, preparing it for a

Photo: An Air Force C-17 on the flight line at Joint Base Lewis-McChord is readied for an early morning departure. BOB FERGUSON | BOEING

lift master





mission. Six Air Force Reserve pilots will be on the five-hour training flight this morning, air-refueling with a KC-135 Stratotanker and then practicing “assault” landings and takeoffs on a short airstrip at Moses Lake in Eastern Washington, on the other side of the Cascade mountain range. Making a steep approach and landing a half-million pounds (226,800 kilograms) of airplane on a runway only 3,500 feet (1,100 meters) long and 90 feet (30 meters) wide is the kind of challenge that C-17 pilots sometimes face, whether supporting U.S. and allied warfighters in places such as Afghanistan or airlifting medical help, supplies and equipment to areas devastated by natural disasters.

The aircraft commander is Maj. Peter Grossenbach, with the 728th Airlift Squadron at McChord, who has spent more than half of his 16 years in the Air Force Reserve flying C-17s and teaching others how to fly them. He’s an instructor pilot. In 2004, only a few hours after a powerful earthquake in the Indian Ocean triggered a tsunami that belted Indonesia, Thailand and other parts of South Asia on Dec. 26, killing more than 200,000 people and leaving several hundred thousand injured, Grossenbach, then a lieutenant, was on the first C-17 to deliver badly needed supplies to the devastated area.

For its size, with a maximum takeoff weight, fully loaded, of nearly 600,000 pounds (272,200 kilograms), the C-17 actually handles more like a sports car, Grossenbach says while describing the short-runway landings and takeoffs the flight crew will practice at the Moses Lake airstrip.

One of the other pilots on the training flight, Capt. Teycee Merritt, also with the 728th Airlift Squadron, describes the C-17 in much the same way. “It’s a big heavy airplane that really responds,” she says. “Just a great airplane, unique in its capabilities.”

A propulsive lift system allows the C-17 to make safe landings on very short



runways—so short they are better suited for a small, single-engine Cessna, not an aircraft that is big and strong enough to carry an M1 Abrams tank, the main battle tank of the U.S. Army that weighs in at about 129,000 pounds (58,500 kilograms) empty. The engine exhaust of the C-17 is directed onto large flaps, which extend into the exhaust stream. This allows the C-17 to fly a steep approach at a relatively low landing speed. It's one of the many innovations engineers with McDonnell Douglas, a Boeing heritage company, designed into the C-17 Globemaster III, the most versatile military airlifter ever built, according to those who fly and take care of it, on the ground and in the

air. It also can back up, even on a two-degree slope, using the directed-flow thrust reversers. And because it can back up, a fully loaded C-17 can turn in a small radius, making a 180-degree “star turn” in only 80 feet (25 meters).

“It’s awesome. We can land this baby even on dirt,” says Lt. Col. Derek Leckrone, with the 313th Airlift Squadron at McChord, another of the Reserve pilots on the Moses Lake training flight.

In April 2005, the same year Leckrone was flying C-17s in and out of Afghanistan, he took part in a much different kind of mission. Two of the McChord airlifters, with crews from active duty Air Force and the Reserve,

air-dropped 63 barrels of fuel, specially packaged in 55-gallon (208-liter) drums, to scientists with the National Science Foundation near the North Pole. The C-17s made the drop at 1,000 feet (300 meters) above the ice. It was the first Arctic airdrop by a C-17.

Lt. Col. Kevin Welin, operations

Photos: (Clockwise from far left) Airmen check a C-17 engine on the flight line at Joint Base Lewis-McChord; Capt. Teycee Merritt, an Air Force Reserve C-17 pilot with the 728th Airlift Squadron, prepares for a flight; U.S. Air Force major command logos on the side of a McChord C-17; a close-up of one of the C-17’s four Pratt & Whitney engines. **BOB FERGUSON | BOEING**





“It can do it all, anywhere in the world.”

—U.S. Air Force Capt. Travis Tompkins, C-17 aircraft commander with the 62nd Operations Group at Joint Base Lewis-McChord

director for the 728th Airlift Squadron and another of the Reserve pilots on the Moses Lake training hop, even has carried a firetruck on a C-17. The donated truck was transported to the Nicaraguan city of Condega so it could start its own volunteer fire department. The nearest fire department to that city is 45 minutes away.

Regardless of the mission, the C-17 has been the airlift workhorse of the U.S. Air Force, in wartime and in peace, for more than 20 years.

“It can do it all, anywhere in the world. Like FedEx, if it fits, it ships,” says Capt. Travis Tompkins, a C-17 aircraft commander with the 62nd Operations Group, an active duty unit at McChord.

Boeing delivered the first C-17 to

the Air Force on June 14, 1993, and the service took delivery of its 223rd and final C-17 in September 2013. In addition, C-17s are operated by the air forces of Australia, Canada, India, Kuwait, Qatar, the United Arab Emirates and the United Kingdom, and by the Strategic Airlift Capability, a consortium of 12 nations, 10 of which are member states of NATO, that share C-17s for their strategic airlift needs.

Although production of the C-17 in Long Beach, Calif., is ending—the

Photo: Thirteen C-17s fly over the Blue Ridge Mountains in Virginia during low-level tactical training in December 2013. The aircraft were based at Joint Base Charleston, S.C. **U.S. AIR FORCE**

last one is scheduled to roll out of the Boeing factory there later this year—this unique aircraft will continue to be the mainstay airlifter for the Air Force for many years. No new heavy-lift aircraft for the Air Force is on the horizon.

“This is going to be our bread and butter for a long, long time,” says retired Air Force Col. Thomas Jackson, deputy director of the 62nd Maintenance Group at McChord.

Jackson, who has been taking care of C-17s as a maintenance officer since he was a captain stationed at

Charleston Air Force Base in 1995, recounts the journey the Boeing jet has made, from its introduction into the Air Force inventory in 1993 as a replacement for the aging C-141 Starlifter. The C-17 was first employed in a major contingency beginning in December 1995, when U.S. and allied nations deployed peacekeeping forces to Bosnia in support of Operation Joint Endeavor. Later, C-17s were widely used in Operation Iraqi Freedom and Operation Enduring Freedom in Afghanistan. And they have delivered

hope and saved lives around the world on humanitarian missions, including the Indian Ocean tsunami in 2004, Hurricane Katrina in 2005, the earthquake in Haiti in 2010 and the Japanese tsunami in 2011. More recently, C-17s were used to carry supplies, equipment and troops in support of the U.S. military humanitarian missions to West Africa to help slow the spread of the Ebola virus.

“It proved itself years ago, and continues to do so,” Jackson says, standing under the wing of one of the



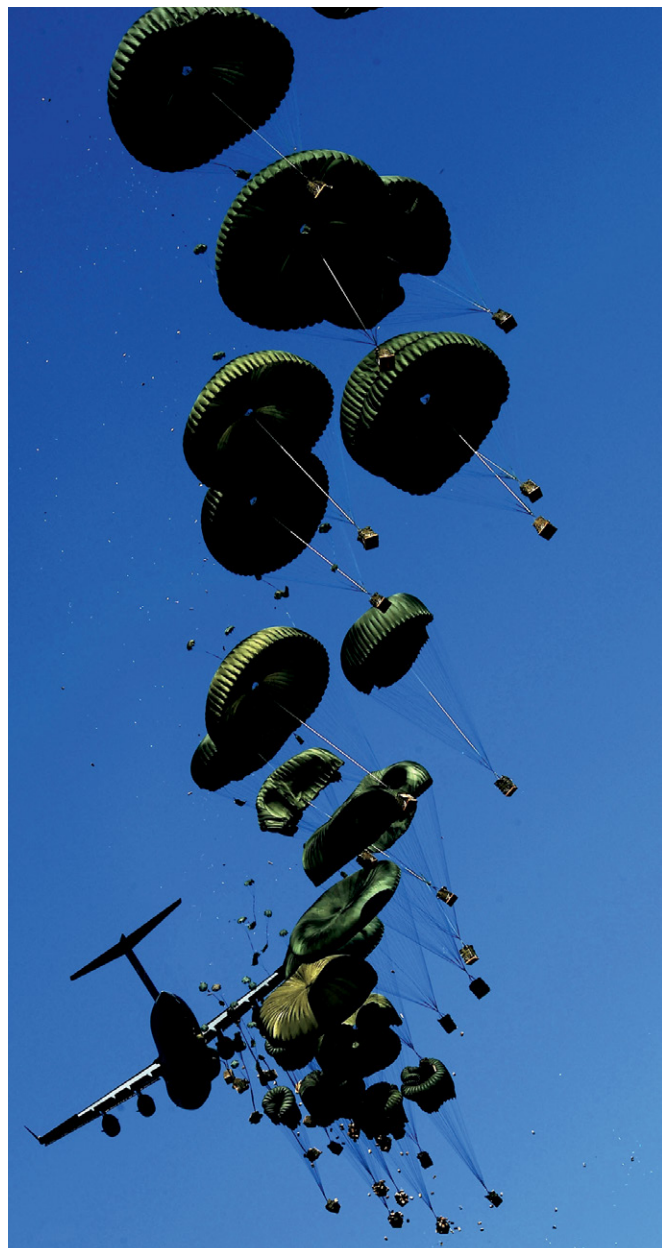
airlifters that is undergoing routine maintenance in Hangar 3 at McChord.

Hangar 3 also is used on occasion to get C-17s ready to send to the Boeing San Antonio site in Texas, which performs depot-level maintenance for both U.S. and international C-17 customers. The McChord hangar has seen its share of aircraft over the years, including Boeing's B-17 bomber during World War II. It is one of four hangars built in 1939 shortly after 900 acres (365 hectares) was deeded to the War Department for a military base that

would be named McChord Field. Later, it became McChord Air Force Base. In early 2010, the base was consolidated with its next-door neighbor, the U.S. Army's Fort Lewis, and both designated Joint Base Lewis-McChord.

McChord Field, as it is still called, received its first C-17 in July 1999 and would eventually get 52, most of them delivered directly from Boeing's Long Beach factory. That only a half-dozen or so were on the flight line during a recent two-day visit underscores just how often C-17s are away, performing

Photos: (Opposite page, clockwise from top) Passengers depart a C-17 in October 2014 after landing at McMurdo Station, Antarctica; a C-17 is directed after landing at Fort Polk, La., during a field training exercise last year; a C-17 from Joint Base Charleston, S.C., releases flares over the Atlantic Ocean during a 2006 training mission. **U.S. AIR FORCE** (This page, from left) More than 600 people sit on board a C-17 before an evacuation to Manila after Super Typhoon Haiyan hit the Philippines in November 2013; a C-17 out of Joint Base Charleston airdrops approximately 14,000 bottles of water and food in January 2010 to the outlying area of Port-au-Prince, Haiti, after an earthquake. **U.S. AIR FORCE**







a variety of missions for both the Air Force and the Reserve.

“At first, I thought they were kind of goofy-looking, just a big cargo airplane,” says Staff Sgt. Anthony Fagalde, avionics technician with the 62nd Aircraft Maintenance Squadron, who has spent most of his six years in the Air Force at McChord. “But after several deployments, I see just how much they put these planes through. There is no rest for these planes. To withstand that kind of use is pretty impressive.”

His deployments have included Iraq and Afghanistan as well as Asia, where Fagalde worked on C-17s on the ground, taking care of the aircraft’s electronics, including flight controls, computers and the navigation system. But Fagalde is training to become a flying C-17 crew chief, which would enable him to fly on the aircraft on a regular basis. That’s his goal—and his dream.

McChord is home to the 62nd Airlift Wing of the Air Force’s Air Mobility Command, which includes the Maintenance Group. It is also home to the 446th Airlift Wing of the Air Force Reserve Command that includes the 97th, 728th and 313th airlift squadrons.

Some 24 hours after the Reserve training flight to Moses Lake, another C-17 on the McChord flight line is being readied for a much different kind of mission for the 62nd Airlift Wing, and in much different weather. Mount Rainier will never show itself on this day. As rain and wind lash the flight line in the pre-dawn darkness, ground crews are removing heavy armor protection from the C-17’s flight deck and radome, as well as from the loadmaster’s station at the front of the mammoth cargo compartment. The aircraft won’t need such protection from enemy fire where it is going, and the extra weight would cut down on range—and this C-17 has a long way to fly. It is about to take part in Operation Deep Freeze, the Air Force’s annual effort to support the National Science Foundation by supplying research outposts in Antarctica. The crew will fly to Christchurch, New

Zealand, then make several trips to ferry scientists, equipment and supplies more than 2,000 miles (3,200 kilometers) to McMurdo Station, a supply and passenger hub for Antarctica.

The mission, which is expected to last less than 30 days, is challenging, and requires landing the four-engine C-17 on an ice field that serves as the runway at McMurdo Station. The round-trip flights from Christchurch to McMurdo Station typically take about 10 hours, with another hour or so spent unloading and sometimes loading the aircraft on the ice field.

Among the aircrew is Staff Sgt. Mick Johnson, with the 62nd Aircraft Maintenance Squadron. It will be his first trip to New Zealand and McMurdo Station. And he’s excited.

“I’ve been to six continents. But I’ve never been to New Zealand or Antarctica,” Johnson says, standing in the C-17 cargo compartment, which is 88 feet (26.8 meters) long, 18 feet (5.5 meters) wide and 12.4 feet (3.8 meters) high. The massive aft cargo ramp is open as rain pelts the flight line and Johnson and other crew members prepare the aircraft for the trip to the bottom of the world.

“I’m excited that I get to do something like this for the mission and the military,” he says.

Johnson, who has been in the Air Force for 10 years, the past three maintaining C-17s at McChord, is a jet engine mechanic and takes care of the airlifter’s four Pratt & Whitney engines that each produce about 40,440 pounds (180 kilonewtons) of thrust. The engines, with some modifications, are the same as the Pratt engines that power Boeing’s 757 commercial jetliner.

Until this mission, Johnson’s favorite on a C-17 was an airdrop of supplies

Photos: A U.S. Air Force C-17 is refueled by a KC-135 tanker over the Arizona desert.

BOB FERGUSON | BOEING In addition to the U.S. Air Force, a number of international customers operate C-17s, including Canada (top right) and the United Kingdom (bottom).

DND-MDN CANADA; ROYAL AIR FORCE

to a forward U.S. Army operating base in Afghanistan. The rear ramp of the C-17 opens at altitude and the supplies and equipment go zipping out the back of the aircraft, pulled by parachute. Special operations warfighters also can jump off the ramp when it opens, even above 30,000 feet (9,150 meters), for what's known as a HALO (high-altitude, low-opening) parachute jump.

A C-17 typically has a basic crew of only three—two pilots and a loadmaster—but more routinely they fly with three pilots and two loadmasters, because of the long-duty days and intricate cargo configurations. This flight to Antarctica will include Air Force enlisted personnel like Johnson who quickly can troubleshoot and fix problems that might be encountered in taking the aircraft into such an extreme environment, where low clouds, snow and ice storms are not uncommon. Even ice buildup on the aircraft's landing gear during the short stay at McMurdo Station can become an issue.

"From a maintenance standpoint, we want to make sure that when the aircrew takes the aircraft into that environment—which has a whole list of inherent risks—the one challenge they don't face is maintenance," explains Chief Master Sgt. Cameron Pence, an Aircraft Maintenance Unit superintendent with the 446th Aircraft Maintenance Squadron at McChord.

"They must be able to deal with any challenge quickly, effectively and correctly—and on the first time—so the mission can happen," he adds.

At McChord Field, the C-17 is the star, and it is well taken care of. In addition to the aircrews, most personnel at the base are involved in maintaining or supporting the aircraft, as well as the Air Force active duty and Reserve C-17 missions, in one way or another.

Although production is ending, Boeing will continue to maintain and sustain the worldwide fleet of C-17s for the Air Force and other customers.

"We have supported the entire C-17 fleet since the delivery of the very first aircraft, in 1993 to Charleston. That is something we are extremely proud of and we are looking forward to continuing

to maintain the U.S. Air Force's C-17s at their highest levels of aircraft readiness for years to come," said Gus Urzua, vice president and program manager for Boeing's C-17 Globemaster Integrated Sustainment Program.

About 80 Boeing employees work at McChord Field, supporting the Air Force customer, according to Don Gallion, Boeing base manager for McChord with Global Services & Support, part of Defense, Space & Security. He also has overall management responsibility for Boeing operations at Air Force bases including Elmendorf in Alaska, Travis in California, Altus in Oklahoma and Hickam in Hawaii, as well as March Reserve Base in California.

Boeing employees at McChord include field service representatives and field engineers, as well as employees who provide spares support and maintenance and modification expertise. Boeing also is the liaison between the Air Force and C-17 engine-maker Pratt & Whitney. And some full-time Boeing employees serve in the Air Force Reserve at McChord.

Airman 1st Class Alexander Seiz, a reservist with the 446th Airlift Wing for about a year, is a quality control inspector with Boeing Fabrication in Auburn, Wash., and has worked as an inspector on the 787 line in Everett during his nearly three years with Boeing.

But one weekend a month at McChord, Seiz learns about C-17s by working on actual aircraft with some of his fellow reservists. He's training to be a C-17 crew chief, but he can't be the crew chief on an actual C-17 flight or mission until he reaches a level 5 (or journeyman) skill qualification. (Air Force enlisted

Photos: (Clockwise, from top left) Capt. Travis Tompkins, a C-17 aircraft commander with the 62nd Operations Group at McChord; the loadmaster's station on a C-17, at the front of the cargo compartment, with steps just to the left of where the loadmaster sits that lead to the flight deck; Airman 1st Class Alexander Seiz, a reservist with the 446th Airlift Wing at Joint Base Lewis-McChord, is a quality control inspector with Boeing Fabrication in Auburn, Wash. **BOB FERGUSON | BOEING**









personnel skill levels are 1, 3, 5, 7 and 9.) Pence says reservists such as Seiz bring important civilian skills to their jobs with the Air Force Reserve.

"It really benefits us to have people, such as someone in Fabrication, with that knowledge base," Pence says. "It can really pay off in his job as an aircraft crew chief. He brings a skill set to us that we may not have."

Meanwhile, Seiz says he can't wait until he finally gets to fly on a C-17 as a crew chief—and for the first time.

"I'm dying to," he says as he walks up metal stairs at the front of the cargo compartment to reach the flight deck above. Just behind the flight deck, on the side of the fuselage, is the Boeing logo. It's embedded in the metal during the manufacturing process.

"It fills me with pride to see that logo and know I'm part of both organizations," Seiz says, referring to Boeing and the Air Force Reserve.

His dad, a Boeing painter at the Everett plant, was a McDonnell Douglas mechanic on the C-17 line in Long Beach, and his grandfather worked for McDonnell Douglas. When McDonnell Douglas was designing the C-17 in the early 1980s, its engineers worked closely with the Air Force to make sure they delivered a world-class airlifter with the special capabilities the customer needed.

"It's a cool design," Tompkins, the C-17 aircraft commander with the 62nd Operations Group, says while standing near several C-17s on the McChord flight line. In the distance, a C-17 is approaching the base runway.

Pointing to the C-17 that's about to land, Tompkins says: "Some of these aircraft are 20 years old now and just look at that. You see it flying and landing and it still looks like something out of the future." With the high T-tail and winglets at the tip of each wing, the graceful airlifter certainly doesn't look its age.

Tompkins grew up in the Tacoma area not far from McChord and wanted to be a pilot since he was inspired watching air shows as a youngster at the base with his family. He joined the Air Force in 2005. Before arriving at

McChord about a year ago, Tompkins was a T-6A instructor pilot at Laughlin Air Force Base in Texas. He has flown a variety of C-17 missions, including ones into Iraq and later Afghanistan, transporting troops, equipment and even Apache helicopters. On a few of those missions, he carried wounded warfighters out—to the U.S. military hospital at Ramstein Air Base in Germany, with an entire medical team in the back of his aircraft saving lives.

Air Force medical officers have called the C-17 a "lifesaver" and a "game changer" for aeromedical evacuation. It was the first Air Force airlifter that quickly could be converted into a flying hospital. Litters for wounded soldiers can be removed from the sides of the cargo compartment and set up on the floor. The cargo compartment is stable, roomy and well lit, allowing for emergency operations with places to plug in medical equipment and oxygen and even temperature controls. On a long flight to a hospital, say from Afghanistan to Germany, controlling temperature can be critical to saving a life.

It's a unique and sobering experience, transporting wounded warfighters, Tompkins says. "That's when it feels like you have really done something ... It also makes you reflect on your own service."

But the missions he enjoys most are those where his C-17 carries military personnel back from a deployment, regardless of where it might have been.

"You get to take them home," he says. "That's pretty special."

Tompkins says he made the right choice 10 years ago when he finished Air Force pilot training school and requested C-17s. "It's very reliable," he says of the Boeing airlifter. "I trust it. I know it's going to get me there and back. And it has. Every time." ■

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Photo: The massive cargo compartment of a C-17, with the rear cargo door open, on the flight line at Joint Base Lewis-McChord.

BOB FERGUSON | BOEING



VICTOR



With an automotive racing theme, the Pit Crew Academy helps 787 mechanics complete training faster

BY DAN RALEY
PHOTOS BY BOB FERGUSON

Inside the Design Build Center in Everett, Wash., aviation meets automotive. A 787 Dreamliner cabin mock-up is surrounded by NASCAR reminders in the cavernous building; among them are racing-team banners, stock-car spoiler prototypes, a racing-shop toolroom and even a section of fenced-in bleacher seating.

Known as the Pit Crew Academy, it's where airplane mechanics and technicians learn how to swap out 787 interior parts,

Y LAP



sharing in auto racing–themed training that stresses speed and efficiency, just like during a NASCAR pit stop.

It's a very busy place. Last year the center hosted 143 workshops involving 4,400 people, and in 2012 it welcomed another 122 events and 3,800 visitors. Six airlines have enrolled maintenance employees in the classes.

Seven Boeing South Carolina cabin-interior specialists, preceded by nine Air Canada mechanics and aircraft maintenance engineers, recently were added to the roll call, bringing Air Canada's total number of training participants to 70. Each group spent two intense days with Pit Crew instructors.

They were taught how to replace interior airplane parts in such a

rapid-fire manner that even the most demanding NASCAR driver would have offered a thumbs-up.

"It's all about teamwork, getting it right the first time," said Timothy Moxley, a Boeing South Carolina fabrication specialist and four-year Boeing employee. "In NASCAR, you might be in first place, you mess up, it costs you a few seconds and you end up in 10th. It's simplified here. They want it simple. I get that."

The National Association for Stock Car Auto Racing (NASCAR) is the largest governing body of stock car racing in the United States and sanctions races in many states, particularly in the South.

In fast-moving sessions, the Boeing South Carolina and Air Canada crews were shown how to replace floor panels

and overhead bins. They traded out windows. They pulled up carpet. They worked on galleys. They learned how to install business-class seats in as little as

Photos: (Far left) Clockwise from center, Boeing South Carolina fabrication specialists Sean Brazil, Mark Hendrix and Trent Hervey, Pit Crew Academy leader Nancy McCutchin, and Pit Crew instructor Carlos Ojeda replace an interior window in a 787 Dreamliner mock-up. (Middle) Clockwise from left: Clint Dunagan, foreground, cabin systems manager, and Ryan Reynolds, fabrication specialist, inspect a luggage bin; fabrication specialists Hendrix, from left, Hervey and Timothy Moxley work on a rear bin; fabrication specialists Ashten Cantonwine, foreground, and Brazil install a window. (Right) Ojeda, left, and Cantonwine install an interior window.

20 minutes, whereas on other planes it can take an hour and a half. They did much of this work without tools, simply fastening and unfastening 787 composite pieces.

With a combined 210 years of airline maintenance experience, the Air Canada workers from Toronto and Vancouver were full of questions and seemed pleased by the Pit Crew Academy answers. Their jobs, they concluded, would become less stressful with the added knowledge.

“Since I started, this is by far the best training I’ve ever had,” said Steve Cullen, a 16-year interior technician for Air Canada from Toronto. “As mechanics, we’re hands-on with everything. The best way to learn is hands-on.”

The Pit Crew Academy evolved from a conversation in 2001. Following a program request for a 50 percent cut in recurring maintenance costs,

Bill Greene, then a structures team manager and avowed fan of driver Dale Earnhardt and now a 787 engineering leader, suggested a NASCAR pit-stop approach as a possible solution.

There were skeptics: Auto racing and airplanes? Yet the more people looked into it, the more it made sense. Soon a Boeing contingent was traveling to the South to obtain firsthand pit-crew knowledge.

“We went to see Roush Fenway Racing in North Carolina to understand what they do, how the time in the pits is a competitive advantage, how the car is built to support that,” said Nancy McCutchin, Boeing engineering manager, who oversaw her final Pit Crew workshop in November and retired after 27 years at Boeing. “It clicked with us. Bill Greene’s casual comment started the whole thing and we ran with it.”

By 2004, McCutchin and her team were holding workshop sessions and, playing to the NASCAR theme, calling them “race days.” Pit Crew Academy T-shirts were handed out to the earliest attendees. Participants still receive academy certificates as keepsakes.

Design engineers and suppliers were the first involved. They were asked to develop 787 parts that were easier to install, the same as NASCAR requires in the heat of competition. Prototypes were built out of foam or cardboard. Traditional designs were scrapped in favor of efficiency. Stopwatches were used to measure installation times, which initially dropped 75 to 80 percent, McCutchin said.

In 2008, 787 final assembly employees were brought in for installation training on the Dreamliner. Two years ago,



the academy was opened to airline customers and their maintenance teams, with Qatar Airways the first to send a crew to Everett. The racing analogies keep things simple for everyone.

Formula One racing, with similar pit stops, is popular in Europe and Asia.

"This airplane is about finesse," Carlos Ojeda, one of the Pit Crew instructors, told a class. "Slow down, take your time—and it will be faster."

On the intricacies of replacing an inner cabin window, fellow instructor Jeff Kelsey told the class, "It's sort of like changing a tire."

Kelsey and Ojeda are former 777 mechanics.

Boeing South Carolina and Air Canada maintenance workers at times received their briefings in bleachers erected at the rear of the 787 cabin

mock-up, sitting on cushions that read "Boeing Racing." It wasn't quite like the famous Talladega or Daytona racetracks, but Everett was just fine with them. They had their own finish line to cross.

"This is a necessary tool," said Mark Hendrix, a Boeing South Carolina team member who has been with the company for nearly three years. "This helps me tremendously with cabin interiors. When I have to do something, I take it apart. Here, I get to see it put together. I know this stuff, but there's a lot I don't know."

The Boeing South Carolina interior workers have maintenance specialties. Some perform vinyl repair. Others are mechanics. Yet as the last line of cabin quality control before 787 deliveries are made, each is required to know how to repair everything on the inside, cabins system manager Clint Dunagan said.

Before joining Boeing three years ago, Ashten Cantonwine worked on Boeing's B-52 bomber in the military. She climbed through fuel tanks. She made tools. Now she escorts Boeing customers through the Dreamliner cabin as she would a home buyer on final inspection, and performs touch-ups on request. She said the Pit Crew Academy training will make her customer interaction in North Charleston more effective.

"If there's a customer complaint about a scratch, nine times out of 10 I'm happy to fix things on the spot," Cantonwine said, explaining that some jobs take longer. "This place helps with that a lot."

Air Canada workers previously watched videos or were trained by someone from the airline on cabin maintenance, but without a test run. Their biggest concern was dealing with a complicated issue for the first time with a jet waiting to depart. The Pit Crew Academy removes a lot of uncertainty, said Pierre Nadeau, a 15-year Toronto interiors technician.

"The best thing is getting the experience to fix something here as opposed to reading a manual that will take me hours and hours," Nadeau said. "Just show me once and I'm better at it."

The Boeing South Carolina and Air Canada cabin specialists agreed that the Pit Crew Academy provides a clever and productive approach to training. They gave it a checkered flag, signaling a winner. Yet they understood they still had to separate the straightaway from the runway.

"In an actual pit crew, you're tearing down and building up—that's what you're doing here," said Dean Reavie, a 14-year Air Canada interior technician from Toronto and serious NASCAR fan. "These guys are great. They make it a lot of fun. But at the end of the day, it's pay attention to this: We are working on an aircraft." ■

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Photo: Boeing South Carolina fabrication specialists Sean Brazil, left, and Trent Hervey install a wall panel on a 787 Dreamliner mock-up.



Ready for takeoff

China is a significant partner with Boeing in many areas—and the relationship is growing

BY ASHLEY JOHNSON

Marianne Wu calls it a “special feeling” for Boeing that started when she stepped onto the company’s Flight Services campus in Seattle while working for Air China more than 20 years ago. The magnitude of the facility and the professionalism of the instructors, she said, left such an impression that when a job opportunity as an interpreter at Boeing China came up, she applied.

In the time that followed, China’s aviation market has experienced rapid

growth—since 2007, not only has the passenger traffic doubled but also the country’s commercial fleet. Seeing that, Wu, a native of China, recently made a strategic career move to the Flight Services Sales team in China, part of Commercial Aviation Services.

“I saw a big training market in China,” Wu recalled. “Boeing’s product services are seen by customers as the best quality, so the operators in China actually look to Boeing’s own training.”

China’s need for aviation services and training reflects a larger trend as

Photo: A row of 737s at Boeing Field near Seattle await delivery to Chinese customers. About a quarter of 737s built in Renton, Wash., are delivered to China. **JIM ANDERSON | BOEING**



the world's most-populous country is poised to also become the largest domestic aviation market and one of Boeing's largest customers by 2033, according to Boeing's *Current Market Outlook*. Already, China is home to some of the world's biggest airlines in terms of revenue and passenger traffic. With more than 1.3 billion people, China has one of the fastest-growing economies and an expanding middle class looking to travel. To meet that need, Boeing forecasts China will need 6,020 new airplanes over the next two decades, accounting for 17 percent of worldwide demand for new airplanes, totaling a staggering \$870 billion.

"The potential growth there and what it means to our commercial business is unquestioned," said Shep Hill, president of Boeing International and senior vice president of Business Development and Strategy. "But we also have partnered with China in a significant way."

The partnership includes Chinese suppliers, which Hill noted play a meaningful role in every one of Boeing's commercial models, as well as significant research and development efforts. Through Boeing Research & Technology-China, Boeing works with more than 50 research institutions and local universities on projects aimed at supporting the sustainable growth of China's aviation market. At the same time, Boeing Global Corporate Citizenship helps advance aviation education among children through the "Soaring with Your Dream" program.

The range of activities reflects Boeing's strategy of aligning its activities with the aspirations of the countries in which it operates, Hill said.

And while targeted to the Chinese aviation sector, the solutions that come from the long-standing partnership may have wider applicability in other markets, added Ian Thomas, Boeing China president.

"Our own objectives to be a more competitive global enterprise by tapping into pools of talent and capital and technology and market access around the world dovetail quite neatly with China's consistent requirements that its

partners be doing just that in China," Thomas said. "So this is really about mutual benefit and creating a win-win for both parties for the long term."

Boeing's involvement with China's aerospace industry dates back to 1972, when President Richard Nixon arrived there in a Boeing 707 and the Civil Aviation Administration of China subsequently purchased 10 of the airplanes, Thomas explained.

Today, Airbus is a fierce competitor in China, and Chinese airlines operate about an equal number of Boeing and Airbus commercial jetliners. However, Thomas said that while China is a key market for both airplane-makers, Boeing has set itself apart by becoming part of China's industrial fabric through its widespread collaboration.

Approximately one in every four 737 deliveries goes to Chinese customers. According to Hssane Mounir, vice president of Northeast Asia Sales, Commercial Airplanes, the 737 is well-suited to the needs of the emerging low-cost-carrier market with its high efficiency and low operating cost. He pointed to 9 Air, a relatively new low-cost carrier that last year committed to 50 737s—the first of which completed its inaugural commercial flight in December.

"That was a major win for us," he said, because 9 Air is a subsidiary of Juneyao Airlines, an all-Airbus operator.

Other milestones in 2014 include China Eastern's purchase of 80 737s, the largest order in terms of units ever placed by a single airline in China. Following Hainan Airlines and China Southern Airlines, Xiamen Airlines also took delivery of its first 787.

The supplier relationship looks to be just as promising, according to Ian Chang, vice president of China Operations and Business Development, Boeing Commercial Airplanes. More than 8,000 Boeing airplanes flying around

Photo: Soaring with Your Dream continues to expand its footprint to benefit more students. More than 75,000 students and 2,050 teachers from more than 1,280 schools have participated in the program. **BOEING**



Flight aptitude

Launching model airplanes brings aerodynamics to life for schoolchildren in Soaring with Your Dream, a Global Corporate Citizenship program in China that Boeing has supported since 2009.

Aviation education teacher Wang Qinian plays a key role in developing textbooks and conducting courses for the students and teachers in the program. He said participating in hands-on activities such as model airplane contests allows students to apply their creativity and may spur interest in aviation and aerospace careers.

The program also can help boost self-confidence, Wang said, citing letters from teachers saying their students' demeanor had changed after participating in the program.

More than 75,000 students across China have participated in Soaring with Your Dream. Other education-related activity in China includes the FIRST Robotics program, for which Boeing sponsors 40 teams from multiple schools, as well as partnerships with universities to provide scholarships and support aviation clubs. All are helping China develop an ample and trained workforce to support its rapidly growing aviation sector.

Ian Thomas, president of Boeing China, said the programs show Boeing is a genuine partner to China, which “meets with our own strategic objectives as a global enterprise because we want to create value around the world.”

The reach of Soaring with Your Dream is not limited to students in the program. Wang noted they share what they learn with their family, friends and neighbors. With Boeing models displayed during lessons and company milestones discussed as part of aviation history, students likely will have a connection to aerospace—and the company—that lasts beyond their participation. ■



“Compete and collaborate is the new mantra.”

—Ian Thomas, Boeing China president

the world contain components made in China, according to company figures. China, for example, builds horizontal stabilizers, vertical fins and other parts for the 737; horizontal stabilizers, vertical fins and various moving control surfaces for the 747-8; and rudders and other

composite parts for the 787. Additionally, Taikoo Aircraft Engineering was the first location for converting retired 747-400 passenger airplanes into freighters.

In November, Aviation Industry Corp. of China signed a contract to make composite tail parts for the 777 beginning in 2017. Boeing already sources parts from AVIC, the largest state-owned aviation company in China, and the two established a Manufacturing Innovation Center in 2012 to provide technical and project management training to employees. Another center is slated to open this year.

These growing relationships are crucial to help increase capability and capacity as Boeing ramps up production of the 737 to 52 airplanes a month in 2018, Chang said.

He emphasized that Chinese suppliers are an integrated part of Boeing's production system. “Our strategy is to



have frequent engagement at all levels and have open communication with suppliers,” he said. “It will enhance relationships, which will translate to better quality, schedule and cost performance.”

Since 1992, Boeing has provided training to more than 50,000 Chinese aviation professionals, and Hill called Boeing’s leadership in that area a differentiator.

“China wants to develop its people, wants to develop everybody from leaders to managers to technicians, maintenance people and pilots,” Hill said. “We’ve done it so well for so long in China the Chinese government looks to that as something that is uniquely beneficial in partnering with Boeing.”

Although a significant partner today, China also is a potential competitor, with Commercial Aircraft Corp. of China (COMAC) developing the C919, a single-aisle airplane that will compete with the

737. However, Thomas stressed that Boeing is comfortable with that dichotomy.

“Compete and collaborate is the new mantra,” he said. “As a global enterprise, we welcome and we respect competition. It makes us a better company. It will make us a better competitor here in China; it will make us a better global competitor. And certainly we’re not going to sit still—we’re going to out-innovate all comers.”

At the same time, Boeing and COMAC work together in key research areas and recently opened a demonstration facility in Hangzhou that will turn waste cooking oil into biofuels. Other projects are focused on air traffic management, given China’s already congested airspace.

Dong Yang Wu, managing director of Boeing Research & Technology–China, said the projects are important to enabling future fleet growth. As she put it, “We can make the best aircraft, but we need a vibrant market and a healthy

market for us to sell the aircraft in.”

Looking to that future market, Mounir emphasized the interconnectedness of safety, efficiency and capacity, and fuel-efficient jets such as Boeing’s 787 and 737 MAX to help China accommodate its passenger growth.

“That will drive a lot of value for our customers, especially for the many startup airlines we are seeing in the marketplace,” Mounir said. “The overall impact will positively benefit many of our stakeholders in the industry and will ultimately allow us over time to place all of these thousands of airplanes that we want to place in the market.” ■

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Photos: (Far left) A Boeing 787-8 Dreamliner for China Southern. **BOEING** (Below) Air China’s first Boeing 747-8 Intercontinental was delivered last year. **TIM STAKE/BOEING**



MILESTONES



IN FOCUS

Gas 'n' go

Boeing F-15C Eagles from the Massachusetts Air National Guard's 104th Fighter Wing, based at Barnes Air National Guard Base in Westfield, Mass., prepare to refuel from a KC-10 tanker late last year as part of a training mission over New England. The tanker is based at McGuire Air Force Base, N.J., and part of the 305th Air Mobility Wing.

PHOTO: JIM HASELTINE | HIGH-G PRODUCTIONS





UNIQUELY READY, MINUTE BY MINUTE.

From the inception of America's Minuteman program, Boeing has worked side by side with the United States Air Force to ensure the system's readiness. Today, Boeing brings its unique institutional expertise, innovation and an enduring commitment to modernize the Minuteman force, so it remains a safe, secure and effective deterrent.

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