



# Frontiers

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## Journey to tomorrow

Boeing's Phantom Ray hitches a ride on a 747 to its flight-test site in California's high desert

To the new members of the 112th Congress, we say

# Welcome.

Your arrival signals both a new Congress and new opportunities to move America forward. Boeing's 151,000 employees and more than 20,000 suppliers in all 50 states wish you courage, wisdom, and success in doing the people's business. More than 1.3 million Americans work with or for Boeing. We look forward to working together to help create a brighter future for the country.



## On the Cover

# 23 Lord of the wings

The Phantom Ray, an unmanned airborne system developed by Boeing's Phantom Works organization, will soon begin flight testing at the Dryden Flight Research Center at Edwards Air Force Base in California. Getting Phantom Ray there efficiently and safely was a challenge—one captured in this *Frontiers* photo essay. It was carried from St. Louis to Edwards in December on the back of a NASA 747 normally used to transport space shuttles. The six-hour flight was more than a year in planning.

**COVER IMAGE:** AT SUNSET IN THE HIGH DESERT AT EDWARDS AFB, THE PHANTOM RAY IS OUTLINED AGAINST THE CALIFORNIA SKY AFTER ITS FLIGHT FROM ST. LOUIS ON THE BACK OF A MODIFIED 747. BOB FERGUSON/BOEING

**PHOTO:** THE PHANTOM RAY ARRIVES AT EDWARDS AFB AFTER THE FLIGHT FROM ST. LOUIS. PHANTOM RAY AND ITS SPECIAL ADAPTER FOR TRANSPORTING IT ON THE BACK OF THE 747 WEIGHED ONLY ABOUT 30,000 POUNDS (13,600 KILOGRAMS)—MUCH LESS THAN THE SHUTTLE'S 220,000 POUNDS (99,800 KILOGRAMS) WHEN IT IS FERRIED ON THE NASA PLANE. BOB FERGUSON/BOEING



## Ad watch

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

*Inside cover:*



This ad was created to welcome the 112th U.S. Congress on behalf of Boeing's 151,000 U.S. employees and more than 20,000 suppliers from all 50 states. The print ad ran in *Politico*, *CQ Weekly*, *The Hill*, *National Journal* and

*Roll Call*. The campaign also featured a radio component.

*Page 6:*



This is one in a series of three new ads featuring Boeing's Performance Based Logistics capabilities. The ad highlights the success of the PBL program supporting the F/A-18 Super Hornet, reducing cost while increasing

readiness for its military customer. The campaign will run in military trade and congressional publications throughout the year.

*Back cover:*



Global corporate citizenship refers to the work Boeing does—both as a company and through its employees—to improve the world. This ad illustrates Boeing's commitment to promoting the well-being of communities worldwide.





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When a large model of a Boeing B-17 Flying Fortress was discovered in a warehouse, no one realized how valuable it was. Its true identity—the original wind-tunnel model used by Boeing engineers to develop the famous World War II bomber—was not discovered until after it was nearly destroyed in an accident. Volunteers have restored the model to its original condition.

PHOTO: HERB PHELAN



## Supplying change

The Boeing supply chain spans the world, and making sure it all runs smoothly is critical to the company's performance and success. Boeing has been working closely with its suppliers to reduce risks and make improvements as part of a new approach by the company's Supplier Management organization.

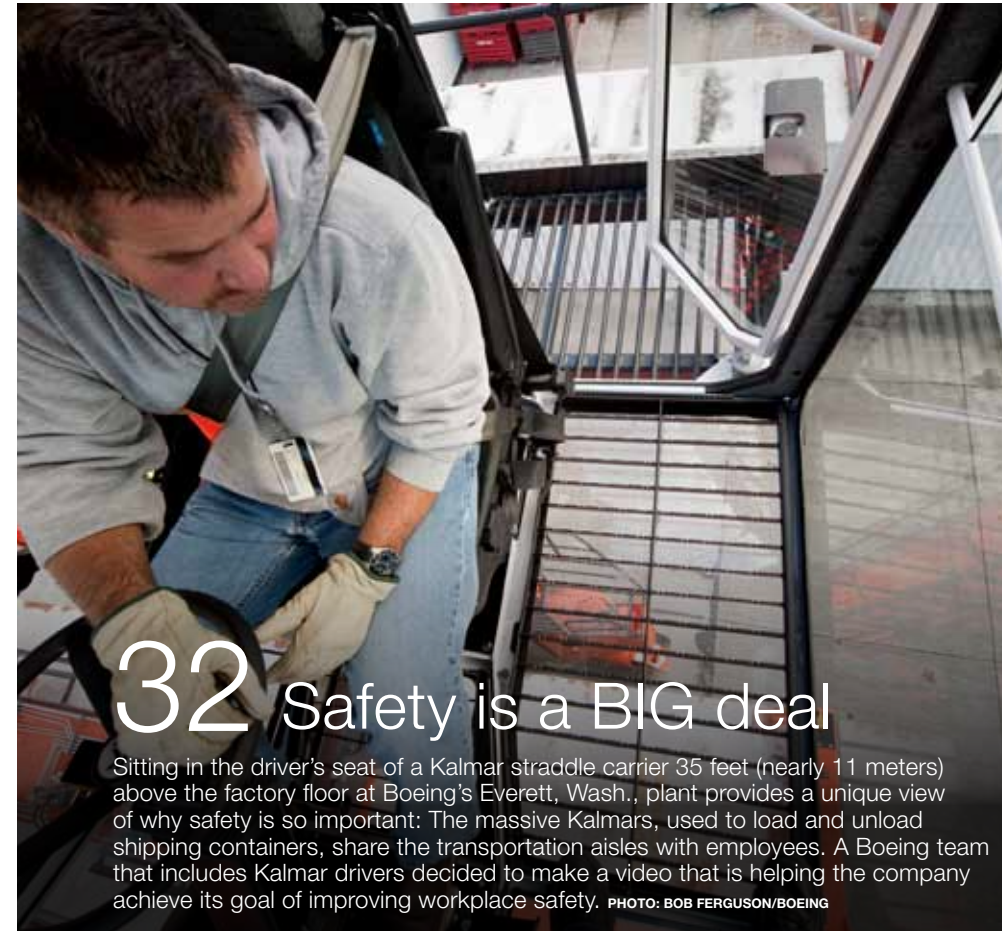
PHOTO: ED TURNER/BOEING



## Clear and simple

Fighter pilots can't afford to look through the windshield of their F/A-18 Super Hornet and see a manufacturing imperfection—a tiny spot that could be mistaken for an approaching unfriendly aircraft. Boeing engineers, with the help of a Boeing photographer and his Panoscan camera, have developed a way to find minute windshield defects before installation.

PHOTO: RICHARD RAU/BOEING



## 32 Safety is a BIG deal

Sitting in the driver's seat of a Kalmar straddle carrier 35 feet (nearly 11 meters) above the factory floor at Boeing's Everett, Wash., plant provides a unique view of why safety is so important: The massive Kalmars, used to load and unload shipping containers, share the transportation aisles with employees. A Boeing team that includes Kalmar drivers decided to make a video that is helping the company achieve its goal of improving workplace safety. PHOTO: BOB FERGUSON/BOEING



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When the International Space Station lost half of its cooling system after a key pump shut down, a Boeing team in Houston was ready to help find solutions. Its mission is to keep the station running smoothly and safely—especially during potentially serious events such as this one.

PHOTO: ELIZABETH MORRELL/BOEING

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In a Q&A with *Frontiers*, Boeing Chairman, President and CEO Jim McNerney discusses a range of issues, from the company's top strategic priorities in 2011 and beyond to how Boeing is applying lessons learned from some of its big development programs.

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# Competing for our future

Boeing's fundamental business is strong, but it faces tough new global competition and must keep getting better

In a Q&A with *Frontiers*, Boeing Chairman, President and CEO Jim McNerney discusses a range of issues important to employees, whom he considers "some of the most passionate, innovative and talented people I've ever met."

**Q: Jim, as we head into 2011, what do you see as the strategic business priorities for the company?**

**A:** First and foremost, it's to continue the outstanding performance of our core programs and our services businesses—and to maintain an enterprise focus on improving productivity and affordability for our customers. As everyone knows, we've had a tough time with some major development programs and there's still more work to be done there. We've been able to absorb the impact of those challenges and continue investing in other growth areas because of the phenomenal work our teams are doing on productivity and in core business performance. Those efforts have been our bedrock.

**Q: And our priorities beyond that?**

**A:** It's important we begin to face into some growing realities about the future and adjust our strategies to deal with them. For example, at Commercial Airplanes we have to prepare for the inevitability of more—and more aggressive—global competition from lower-cost, state-supported producers, including Canada, China, Russia and Brazil. These competitors (and their host nations) see the same massive economic opportunity in the commercial airplane market over the next 20 years that we and Airbus do. They're hungry, capable and they want their fair share of the action, which ultimately means taking some of ours.

**Q: What do we need to do?**

**A:** Right now, from an overall product strategy standpoint, I'd say we've got several years' lead over the emerging competitors, and probably a three- to four-year lead over Airbus. However, our lead was larger before we ran into



"We can't assume we're entitled to market leadership just because we're Boeing; we have to earn it every day."

— Jim McNerney  
Boeing chairman, president and chief executive officer

PHOTOS: BOB FERGUSON/BOEING

## BOEING PBL: READINESS ACROSS THE LINE.

Performance-Based Logistics (PBL) are an effective solution in improving military readiness while saving billions. Under Boeing PBL programs, the F/A-18 Super Hornet has exceeded readiness targets by 17.5%, the Apache Longbow by 19.3%, while C-17 flying hour costs have been reduced by 24% since 2004. An AIA study estimates PBL savings to be \$25-\$30 billion per year. That's performance we can't afford to lose.







difficulties on the 787 and 747-8. Our priorities are to get those development programs done; ramp up production across all programs to burn down our 3,400-airplane backlog and open up more sales slots for customers (we don't want to steer them to our competitors because we don't have planes available when they need them); then, we need to take and extend our lead with either improvements to, or replacements of, our 737 and 777 families.

**“We made good progress in 2010, but we need to go faster because our competitors are not standing still. They’re reducing costs and making investments in their capabilities, too.”**

of reliable, proven and affordable products and services is a big advantage in tight budgetary times. With that in mind, our focus needs to stay on extending and growing our core businesses, winning an even larger share of international sales and services opportunities, and strengthening our capabilities in the higher-growth areas I just mentioned—through both internal investment and targeted acquisitions. We made good progress in 2010, but we need to go faster because our competitors are not standing still. They’re reducing costs and making investments in their capabilities, too.

companies have. But we've got to be much, much better executing development programs.

As we've discussed before, in hindsight our 787 plan was overly aggressive—incorporating too many firsts all at once—in the application of new technologies, in revolutionary design and build processes, in increased global sourcing of engineering and manufacturing content. And the systems and functional controls for monitoring progress and detecting problems early should have been stronger. On the 747-8, some early engineering work-scope and resource assumptions turned out to be wrong. We had similar issues on fixed-price development programs on the defense side.

We've made many changes along the way to get these programs back on track, such as strengthening leadership and organization structures, inserting ourselves deeper in the supply chain, and doing more manufacturing and engineering work at in-house Boeing locations.

We've also taken steps to address some more fundamental issues we uncovered—such as the reduction in the voice of engineering in key decisions (which we see as an unintended consequence of the evolution of integrated product teams), the need to restore the focus of engineering on technical excellence (in addition to people, processes and tools), and the need to be as technically excellent in supplier management as we are in engineering. Efforts to address these lessons are well under way and are being applied on other programs with good results so far.

just because we're Boeing; we have to earn it every day with our customers, leveraging the strengths of “One Boeing” and always operating with integrity.

**Q: Do you see similar realities for Defense, Space & Security?**

**A:** The reality we're facing on that side of the business is an extended period of flat to declining budgets in the United States and Europe, along with pressure on our profit margins as customers tighten the contracting environment to stretch their limited dollars further. We also foresee a continued growing emphasis on unmanned systems; intelligence, surveillance and reconnaissance; integrated logistics; and cybersecurity.

**Q: What does a “tight contracting environment” mean?**

**A:** In the simplest terms, our government customers are negotiating harder to get lower prices for what we sell them, which generally means we earn less profit on our work (unless we offset the lower prices with reduced cost). They are also shifting risk to us through fixed-price contracts. This is important because the cash and earnings we receive from the products and services we deliver to customers gets reinvested in future programs, pays for our employee benefits, and is returned to shareholders in the form of dividends.

**Q: Does all this mean our Defense, Space & Security business is bound to shrink?**

**A:** No. In fact, the markets we serve are large and they're global. In the Middle East and parts of Asia, for instance, defense spending is on the rise. And our broad portfolio

**Q: You have served as chairman, president and CEO for more than five years now. Has your view of the company and its people changed over that time?**

**A:** Yes, but my enthusiasm for Boeing and my appreciation for the caliber of our people have only gotten stronger. We're part of an important company that has a big impact on the world. I'm proud to be here, and I'm proud to work with some of the most passionate, innovative and talented people I've ever met. Yes, we are making changes where we need to make them, but our core businesses are strong and we are fundamentally a better company today than we were just a few years ago. As we look across the five-year run-up to our centennial in 2016, we see substantial growth potential. Many companies never make it that far, but I like to think we'll just be hitting our stride when Boeing turns 100. ■

**Q: As employees, what's the one thing we need to stay focused on for 2011?**

**A:** We have to keep improving—because our global competitors are getting better. Others can—and increasingly will—be able to do what until recently it seemed only we could do. While we may have the lead in many of our markets now, we have to work to keep it, and to regain it where we don't have it. We can't assume we're entitled to market leadership





**READY, CAMERA, ACTION ...**

A Boeing-produced AH-64D Apache helicopter maneuvers close to the Arizona desert near Mesa in early January during a demonstration flight for a 3-D video being produced by the Discovery Channel. Boeing and the U.S. Army worked together to showcase the Apache's capabilities for the cameras and explain how helicopters are assembled at the Boeing facility in Mesa. The video is scheduled to be broadcast later this year. PHOTO: BOB FERGUSON/BOEING

# Travels with 'BART'

Teamwork paves the way during cross-country trek with Boeing's traveling tanker demonstrator trailer **By Lisa Dunbar**

Larry Strube, a Business Development employee with Defense, Space & Security, spent much of the past year going around the country with BART, the traveling trailer that Boeing uses to demonstrate capabilities of its NewGen Tanker. In this *Frontiers* series that profiles employees talking about their jobs, Strube credits teamwork and a "One Boeing" approach for a successful road show.

PHOTO: JIM MUELLER/BOEING



**Quotables**

**"Don't spin it, don't polish it, just tell them the truth."**

— Commercial Airplanes Engineering Vice President Mike Delaney, talking about how to be straightforward with customers, at a Jan. 19 Excellence Hour in Everett, Wash.

**"We certainly are flying the wings off these aircraft."**

— Robert Guffey Jr., Boeing field support engineer for C-17s operating in and out of Afghanistan, on the worldwide fleet of 226 airlifters reaching 2 million flight-hours in December. The milestone equates to flying 1.13 billion nautical miles (1.3 billion miles, or 2.1 billion kilometers), or the equivalent of a C-17 flying to the moon and back 2,360 times.

**W**illie Nelson's "On the Road Again" is a song I can relate to—I trekked to 14 states last year to cover 33 events in support of the NewGen Tanker Boeing Aerial Refueling Technology, or BART, demonstrator. The purpose of BART is to show customers, media and the public the capabilities of Boeing's entry in the KC-X competition to supply 179 tankers to the U.S. Air Force.

From trade shows to supplier rallies to state capital visits, my team was there to set up, prepare and operate the trailer. From dawn to late at night, we conducted tours and demos that showed the NewGen Tanker's unique technology. The 80-foot, 64,000-pound (24-meter, 29,000-kilogram) BART trailer is emblazoned with an eye-catching rendering of the Boeing NewGen

Tanker. The inside is complete with a state-of-the-art, hands-on refueling demonstrator and an advanced flight-deck simulator.

The best part of the tanker trek was the people we met along the way. They included retired Air Force members who flew on the KC-135 (a Boeing-built tanker currently operated by the Air Force) when it debuted in 1956; federal, state and local officials; Boeing employees and suppliers; and many others who wanted to know what was inside the bright-colored trailer. Even Miss Iowa wanted a look!

The tanker trek went smoothly, and I credit that to many others beyond my own team. We had fantastic support from Creative Services, Communications, Government Relations, Flight Test and Business Development. And, of course,

there were our two drivers, who made the equivalent of five round trips between New York City and Los Angeles.

The trip of nearly 30,000 miles (48,000 kilometers) wrapped up in December. A decision on the KC-X competition is expected early this year. Regardless of the outcome, I am proud of the role my team and many others at Boeing had in demonstrating the company's unique tanker refueling capabilities. ■



# Lost and found

True identity—and value—of a 70-year-old B-17 wind-tunnel model hidden for decades is revealed after an accident nearly destroyed it

By Mike Lombardi

Most historical records and artifacts find their way into the safe-keeping of the Boeing Historical Archives, but there are instances where important pieces of Boeing history are nearly lost.

Consider what happened to a rare and valuable artifact from the early days of the B-17 program.

A few years back, a large wood and metal model of a Flying Fortress was discovered stored in a Boeing warehouse. It had been painted to roughly match the standard olive drab and medium-gray camouflage used on B-17s in the first part of World War II. It was not a remarkable paint job, but it did do a good job of camouflaging the model's true identity.

It was decided that the model may have some historical value and that it should be shipped to the Boeing Archives for further examination and storage. But the model never made it.

In some unfortunate mishap, the model was damaged. And it was mistakenly shipped to the Museum of Flight in Seattle.

The museum subsequently contacted Boeing Historical Services about a container received from Boeing with the remains of a large wood and metal model of a B-17. The damaged model appeared

beyond salvage. Even though some of the parts had been reduced to unrecognizable splinters, it was easy to determine by the paint that this was the same model from the Boeing warehouse.

Closer examination of the damaged model led to a startling discovery: Some of the broken parts had very distinct letter and number markings on their inside surfaces that matched those used by the Boeing Aerodynamics Laboratory in its early days to identify Boeing wind-tunnel models.

Further research on the numbers confirmed that the model was indeed the original B-17E/F wind-tunnel model first tested in November 1940 and used by Boeing during World War II to test modifications to the legendary bomber. The model also had slots in the outboard wings, which were not a feature of the B-17 but rather a modification applied to the Model 307 Stratoliner—a clue that this model had also been used in the important role of testing improvements to the Stratoliner wing.

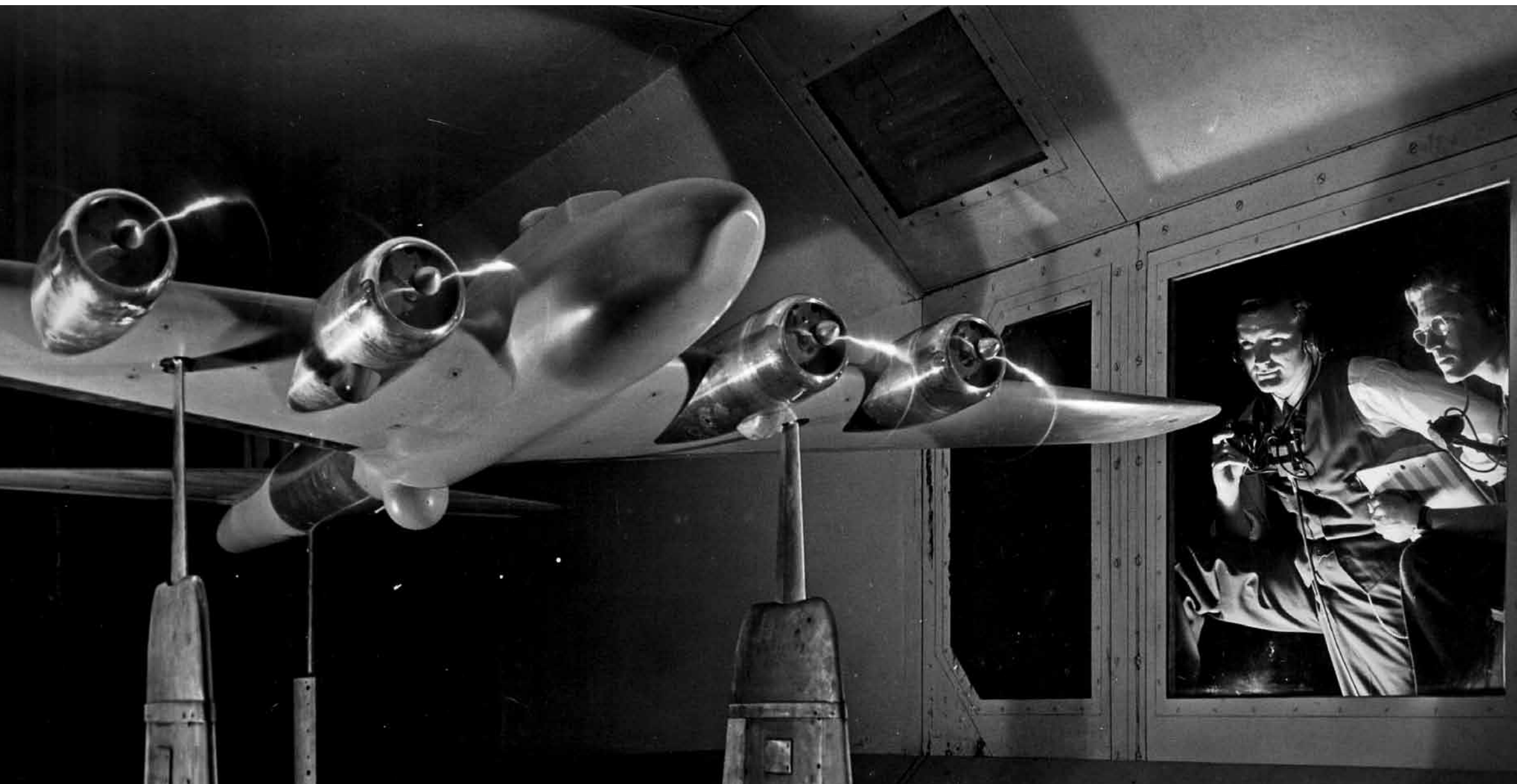
With the discovery that this was a rare artifact, a number of skilled artisans came to the rescue to help restore the model to its original condition.

Leading the effort was Herb Phelan, currently the crew chief on the Museum of Flight's B-17F. He organized a team of volunteers that included B-17 combat veterans Hank Henrickson, former pilot, Ralph McLaren, former top gunner, and Art Heino, former tail gunner. Help was also enlisted from the Boeing wind-tunnel model shop and the Operations group for the Aero Lab including Steve Cameron, Bob Kay, Bruce Kimball, Charlie Maddock, Mike Thoe, Steve Beatty and Kody Wilkes.

During a four-year restoration, wooden parts were glued, filled, sanded and varnished, metal and brass parts were smoothed and polished, and the electric motors were repaired. The restored model will soon be on loan to the Museum of Flight, where it will be displayed as part of the Boeing story in the historic Red Barn. ■

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*Guidance concerning the proper handling of historic items can be found in Boeing policy PRO-2062 or by contacting Boeing Historical Services. The donation of any historical artifact to an entity outside Boeing requires approval from the corporate historian.*



**A number of skilled artisans came to the rescue to help restore the model to its original condition.**

**PHOTOS: (Left)** In this March 1944 photo, Boeing engineers Verl Nelson (left) and Bob Withington observe a test of the B-17 model in the then-new Boeing wind tunnel at Plant 2 in Seattle. **BOEING ARCHIVES (Above)** The restored wind-tunnel model. **HERB PHELAN**





Sixty airlines and leasing companies have ordered the new Boeing Sky Interior for 1,689 of their airplanes. It is a standard feature on new orders placed for 737s delivered from the Renton, Wash., plant. Announced customers include:

- Air Berlin – Berlin
- Alaska Airlines – Seattle
- American Airlines – Dallas
- COPA Airlines – Panama City
- flydubai – Dubai, United Arab Emirates
- GOL Airlines – Sao Paulo
- Lion Air – Jakarta, Indonesia
- Luxair Luxembourg Airlines – Luxembourg
- Malaysia Airlines – Kuala Lumpur, Malaysia
- Norwegian Air Shuttle ASA – Fornebu, Norway
- Russian Technologies – Moscow
- Skymark Airlines Inc. – Tokyo
- Southwest – Dallas
- TUI Travel PLC – London
- Turkish Airlines – Istanbul
- United Airlines – Chicago

**PHOTOS: (Far left)** Norwegian Air Shuttle's new Boeing Sky Interior features a striking contrast between its dark seats and the light, open architecture. **MARIAN LOCKHART/BOEING**  
**(Insets)** The new interior features larger stowage bins (top); different cabin lighting scenes that flight attendants can choose (middle); and more intuitive placement of overhead controls (left). **ED TURNER/BOEING**

# Sky high

Innovative new interior for Next-Generation 737s reconnects passengers with the magic of flight  
**By Kathrine Beck**

For Norwegian Air Shuttle, the 23rd airplane it received from Boeing as part of an order for 80 737-800s was different on the inside—eliciting more than a few wows from those who saw it.

It was the first in the airline's order with the new Boeing Sky Interior, which is based on extensive passenger research.

"It's beautiful, and much more spacious," said Bjorn Kjos, chief executive of Norwegian Air Shuttle, one of several launch customers for the Boeing Sky Interior.

Curving architecture and coved ceilings give passengers that feeling of spaciousness. New window surrounds make the windows look bigger. Brighter and longer-lasting light-emitting diode, or LED, illumination replaces standard

lighting, and it can be programmed to provide a soft blue sky overhead or create different effects during the flight.

Larger stowage bins pivot down and out with the touch of the handle. Passengers are not the only ones who benefit from the new bin design. "We can load and unload much faster," Kjos explained. Quick turnaround times help keep airplanes in the air and making money.

The new interior has more intuitive touches as well. Passengers turning on their reading lights, for example, are less likely to inadvertently call a flight attendant because the buttons are farther apart and different in appearance. Cabin crews get a modernized, touch-screen attendant panel. It accommodates all existing cabin controls and adds

settings for the new cabin lighting.

Other airlines taking delivery of airplanes with the new interior have similar enthusiasm for the innovation and improvements.

"We're always appreciative of Boeing making a great airplane better, and the new interior fits right into that category," said Ron Baur, vice president of fleet planning for United Airlines.

Before the merger of Continental and United, Continental became the first U.S. launch customer for the new Boeing Sky Interior, which was delivered in December. But the airline didn't approve the purchase until the interior passed muster with cabin crews. Continental sent flight attendants from Houston to check out the new interior mock-up at the Customer Experience

Center in Renton, Wash. They arrived with an assortment of carry-on luggage in different weights and went to work hoisting bags in and out of the new overhead bins. The airline wanted to make sure that the pivot bins were easily opened and closed by flight attendants and passengers alike.

Their verdict: "Very positive," said Baur. "We liked the added benefit and convenience with no increase in the weight of the aircraft."

Malaysia Airlines, a launch customer in Asia, also was enthusiastic when its 737-800 with the new interior arrived in Kuala Lumpur in November. Rashidi Saidin, senior vice president of quality at the airline, recalled an event attended by dignitaries, including U.S. Secretary of State Hillary Clinton.

"We showcased the LED lighting," Saidin said, "going from a morning ceiling light through mealtime lighting to darkness. There was a lot of 'Wow!' and 'Ooh!' and 'Ah!'"

That's exactly what Boeing's Kent Craver hopes to hear from customers. As regional director of Passenger Satisfaction and Revenue, Commercial Airplanes, it's his job to help airlines understand the business case for products such as the new interior.

But Craver also wants the airlines to know that passengers are getting something else: They're "reconnecting to the magic of flight." ■

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# Special delivery

Team charts course for environmentally responsible shipping **By Bill Seil and photos by Mike Goettings**

*This is another in a series of articles focusing on how Boeing employees across the enterprise are supporting the company's wide-ranging commitment to environmental stewardship.*

**T**he idea came from a team of employees known to friends and colleagues as the Green Hornets.

And it changed how shipping companies do business with Boeing. Environmental criteria now are part of the bidding process for shipping contracts.

In the past, "when we reviewed past bids for carriers and freight forwarders, we noticed that nowhere within our criteria did we request information on environmentally responsible business practices," said Rob Bohr, a Supply Chain Logistics manager for Shared Services in Mesa, Ariz., who led the project.

"There was nothing to indicate whether the bidder was involved in renewable energy, recycling or similar activities."

Bohr is a member of the enterprisewide Supply Chain Logistics employee environmental team, which was formed in late 2009. It quickly identified the shipping issue as one of its primary projects.

The idea of including environmental criteria was clearly a good one, Bohr said, noting that it supports the company's five-year environmental targets. The challenge came in finding a way to measure a bidder's environmental practices, allowing fair and accurate comparisons.

In researching the issue, team members soon found that they needed to expand their base of expertise. That led to help from volunteers from Global Trade Controls and Supplier Management.

The team started by building a spreadsheet that listed criteria it could use to evaluate bidders on the basis of their environmental capabilities. "We came up with about 15 different categories," Bohr said. "We then went on to 'data-mine' the categories to determine how they could be measured."

At the end of this process, the team found one seemingly insurmountable problem: Was there a practical way to ensure that a bidder was, in fact, following the environmental practices described in the bid?

Further study led to an effective and relatively simple solution. Bidders would be asked to prove certification under the SmartWay Transport Partnership, a collaboration between the U.S. Environmental Protection Agency and the freight industry. It focuses on reducing air pollution and greenhouse gas emissions and improving fuel efficiency. Like all Boeing suppliers, bidders also are asked to prove they have an environmental management system appropriate for their business.

The expanded team took the idea to Contracts Management, which agreed to include the criteria in future contracts bid packages. Although contract awards still will be decided on the basis of cost and other business requirements, these environmental credentials can be a factor in instances where final bids are close.

Environmentally responsible practices are already applied to many Boeing shipments. The new criteria were just introduced, so it will take time to calculate the impact of the change. But it could be substantial, since Boeing is involved in nearly 2 million shipments each year.

Recently, a special shipping configuration designed by Mesa Supply Chain Logistics and the environmental team allowed the transport of four AH-64D Apache helicopters from Mesa to an international customer on one Russian AN-124 cargo aircraft. By sending them all on one aircraft instead of delivering each one on a separate flight, the environmental impact and transport costs were reduced by about 75 percent. ■

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**PHOTOS: (Above)** One of four AH-64D Apache helicopters headed to an international customer is staged for loading into an Antonov AN-124 cargo aircraft in Mesa, Ariz.

**(Insets)** The view from inside the freighter during loading of the AH-64D Apaches. Sending all four helicopters on one trip instead of shipping them on separate flights helped reduce transport costs and environmental impact.





# New beginnings

Boeing's support for nonprofit programs helps women around the world make a fresh start



**“Boeing hasn’t shied away from the complexities of human trauma.”**

— Agnes Lam, a Hagar International representative in Vietnam



**PHOTOS: (From far left)** Artwork from a recent Hagar International graduate in Vietnam who found a renewed optimism toward life through the program; Skip Boyce, president, Boeing Southeast Asia, presents certificates to recent graduates of the program; displaying one of her paintings, a woman explains how the program helped her build confidence. **HAGAR INTERNATIONAL**

It's a disturbing and chilling statistic—and a sobering reminder of the human condition.

One in every three women will experience some form of violence in her lifetime, according to the United Nations Development Fund for Women. Meanwhile, the trafficking of women for sexual exploitation continues in every society around the world.

Boeing is committed to helping, and making a difference.

The company's support for nonprofits throughout the world—such as Hagar International in Vietnam, the Japan Women's Shelter Network in Tokyo and the East Valley Fresh Start Women's Foundation in Arizona—is helping victims of human trafficking and domestic violence

recover and gain life-changing job training and coping skills.

“Boeing hasn't shied away from the complexities of human trauma,” said Agnes Lam, a Hagar International representative in Vietnam.

“Boeing courageously opened its heart to walk alongside Hagar and our clients, supporting many individual journeys of recovery and transforming the lives of Vietnamese women,” she added. “We cannot, nor do we want to, do this without Boeing's support.”

The company supports these programs as part of its focus on health and human services. Through charitable investments, business sponsorships, employee giving and volunteering, women, men and children around the globe are

given a chance at a new beginning.

“Strong communities are important to Boeing, and all individuals need to feel safe in order to be contributing members of their community,” said Anne Roosevelt, vice president, Boeing Global Corporate Citizenship.

“While we can't solve the world's problems by ourselves, Boeing is proud to join with other corporate colleagues to support community-based organizations like Hagar International that have significant impact on communities and set an example of innovative methods for addressing issues of well-being and health.”

In Japan, where police say domestic violence rose to an all-time high in 2009, the Japan Women's Shelter Network has a similar mission to Hagar International.

This group provides shelter to women, sponsors educational campaigns to create awareness and develops policy recommendations urging more effective laws to protect victims of domestic violence.

Boeing's support helps the organization provide services and training to 250 women, according to the nonprofit.

In Mesa, Ariz., counselors for the East Valley Fresh Start Women's Foundation help women work through a variety of issues, including abuse, divorce, loss of a job and single parenting. With support from Boeing, the foundation recently opened another office to meet the needs of dozens more women each month. Boeing also introduced career development services to help women assess their job skills and position them for a job search.

“These women come back into the community with a new career, a new direction and a new outlook on life,” said Dara Gibson, East Valley Fresh Start manager.

On the other side of the world, Hagar International has focused its work in Vietnam, Cambodia and Afghanistan—developing a model of care that combines comprehensive psychosocial support with sustainable livelihood development. Boeing has supported the work of Hagar International since 2008.

“Hagar's innovative program has delivered tangible results, providing jobs to disadvantaged individuals in areas including soy milk production, apparel and accessories manufacturing, and food services,” said Skip Boyce, president, Boeing Southeast

Asia. “Via its programs and collaboration with other groups, Hagar has taught these individuals how to be independent, empowered, strong and healthy.”

One Hagar client, from Vietnam, found new strength and confidence through her artwork. It now supports her family.

“I have never stopped thinking about the inspiration that I received through the art activities at Hagar,” this woman said. “In the program, we learned how to share and open our hearts to others.

“Sometimes we have hope, but sometimes we have challenges and deep depressions,” she said. “What is important is that we learn to stand on our feet and be open to what life can offer us.” ■

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# Chain reaction

Boeing's Supplier Management works to be more effective, more efficient—and reduce risks

By Eric Fetters-Walp

More than 5,000 production facilities employ a half-million people worldwide producing parts for Boeing.

It's a massive supply chain. Making sure it all runs smoothly is crucial for a company that's in the business of assembling large products that contain millions of fasteners and parts. That's why Supplier Management is working across Boeing to share resources, improve communications with suppliers and minimize risks in the supply chain.

"What we've asked of our suppliers has changed over time. As Boeing has changed, so have our suppliers," said Ray Conner, vice president and general manager of Commercial Airplanes Supply Chain Management and Operations and Boeing's Supplier Management enterprise leader.

"In order to successfully drive performance and manage this evolving supply chain, we must be strategic and speak with one Boeing voice and have one approach with our suppliers," he said.

The Engineering, Operations & Technology organization has helped integrate Supplier Management teams across Boeing and provided tools, making it easier for the company and its suppliers to do business with one another.

The various Supplier Management departments across Boeing's business units were aligned under a single strategy in 2007. As these departments and their 5,000 employees have integrated their activities, they've implemented changes and process improvements, said John Byrne, Commercial Airplanes director of Purchased Outside Production

and Common Commodities.

"Since I've been here, we've looked at leveraging the enterprise to help with supplier management," Byrne said. "We've moved forward on that a lot. And now, with all of us [in Supplier Management teams across Boeing] working together, we are beginning to break down barriers and improve business execution. For example, if we have a shared supplier, we need to ask why both organizations are managing that supplier independently."

Employees involved with Supplier Management share cost information and other data across different programs. Data-sharing tools developed by Engineering, Operations & Technology include Supplier Insight Control, which goes further by sharing essential data from both Boeing's and suppliers' business systems.

However, sharing critical information between Boeing and its suppliers requires more collaboration than the traditional supplier-customer relationship.

Twice a year, suppliers have an opportunity to attend the Supplier Management Production System Summit held by Commercial Airplanes. The events usually draw representatives from more than 100 suppliers, who spend a day going over business planning and data sharing.

Jerell Smith, production system consultant at the Commercial Airplanes Supplier Support Center, said he's working to foster trust and respect with suppliers in order to advance Supplier Management's new approach.

To accomplish that, he must first let suppliers know that Boeing is changing how it does things. Many suppliers say

working with Boeing can be a challenge at times, he admits. Suppliers, especially those new to working with Boeing, can struggle with clearly understanding technical requirements and expectations.

But many suppliers have been receptive to sharing their data and working more closely with Boeing on supply chain issues, Smith said. The collaboration is mutually beneficial. In some cases, he helps suppliers increase production capacity or resolve other problems. The benefit for Boeing is a more stable supplier that has a better idea of how Boeing does business.

"There's the technical knowledge and sharing involved with all this, but there's also the human side," Smith said. "The foundation for a strong supply chain and production system is based on mutual

"We need to continue finding ... what we can do together to better leverage the buying power of Boeing."

— Tom Peterson, director of Systems & Tools Operational Excellence for Boeing Defense, Space & Security



**PHOTO:** The 787 Dreamliner's fuselage is one of several key airplane structures delivered by the Dreamlifter, a modified 747-400 that flies between Boeing and key supplier facilities in the United States, Italy and Japan. Global Logistics, a part of 787 Supplier Management, manages the Dreamlifter fleet. ED TURNER/BOEING



trust, respect and understanding of each others' capabilities."

Tom Peterson, director of Systems & Tools Operational Excellence for Boeing Defense, Space & Security, said efforts to improve Supplier Management functions demonstrate the new understanding that such activities go well beyond simple procurement—or the buying and selling of parts.

"As the world changes, the work force and processes of Supplier Management need to evolve, too," Peterson said. "We need to continue finding the path of what we can do together to better leverage the buying power of Boeing."

While Peterson, Byrne and others on the Supplier Management team come

from different business units in Boeing, each with its unique challenges, they meet regularly to compare notes and look for more ways to work together. For example, in addition to buying common parts across programs, work has progressed to create simpler, standardized wording for contract terms that Boeing can use in all of its supplier contracts.

Smith said the feedback he has gotten from the suppliers he works with has generally been positive.

"In the end," Byrne added, "the best judge I have is the suppliers who say, 'Wow, you're really operating differently, and what can we do to keep thriving in this environment?'" ■

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Employees can find more information about Supplier Management tools and processes at <http://smp.ca.boeing.com> or <http://sm.ids.web.boeing.com> on the Boeing intranet. More information about Engineering, Operations & Technology's Supplier Management tools, including Supplier Insight Control, or SINC, can be found at <http://smfunction.ca.boeing.com/index.html>.

**PHOTO:** The view from inside the Dreamlifter as 787 wings are loaded. The wings are manufactured by Mitsubishi Heavy Industries in Japan and transported in the Dreamlifter to Boeing's 787 final assembly factory in Everett. JOHN ALFREJD/BOEING

# Phantom rider

By Chris Haddox and photos by Bob Ferguson and NASA

Pioneers once headed west from St. Louis on journeys of discovery and exploration. So it was fitting that the city was the starting place in December for another westward journey to explore new frontiers—in aerospace.

This 1,800-mile (2,900-kilometer) trip was made on the back of a modified 747.

The NASA-owned jumbo jet was giving a lift to an unmanned, futuristic-looking Boeing craft known as Phantom Ray to the Dryden Flight Research Center at Edwards Air Force Base in California for flight testing.

Phantom Ray couldn't make the flight on its own, because the Federal Aviation Administration won't permit unmanned airborne systems to fly in controlled airspace. The arrangement with NASA allowed Boeing to transport the aircraft fully assembled on one of the two NASA Shuttle Carrier Aircraft (SCA) instead of shipping it cross-country and then reassembling it at Edwards, keeping Phantom Ray on schedule for its first flight.

The modified 747 has been used for 30 years to transport space shuttles, but this was the first time it carried an aircraft other than a shuttle.

"I have to admit that when the idea of using the SCA to transport Phantom Ray was first proposed, there was some level of apprehension on my part," said Craig Brown, Phantom Ray program manager. "However, once the idea started to take shape and we began meeting with NASA, my apprehension quickly turned to excitement."

Developed by Boeing's Phantom Works organization, Phantom Ray will use its own power at the Dryden center to perform a series of test flights, further advancing unmanned airborne systems technology and demonstrating Boeing's commitment to be a leader in this new frontier.

What follows is a photo essay of that journey and of the Boeing and NASA employees and others who helped make it happen. ■

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**PHOTOS: (Below)** In St. Louis on Dec. 11, Boeing and NASA employees position Phantom Ray before it is lifted onto the back of the 747. The 11,000-pound (4,990-kilogram) adapter to hold the Phantom Ray for the flight was designed by Boeing Phantom Works engineer Randy DeVore. "The flight was a year in the making, and designing the adapter and having it built was stressful and exciting, so it was one of those peak memorable life events, comparable to becoming a father," said DeVore, the father of two.

**(Inset close-ups, from left)** Boeing's Tom McMullen unlatches Phantom Ray from its flatbed truck transporter; holding one of the lines while Phantom Ray is positioned on the 747 are Rick Shutt, Boeing system safety engineer, Rick Brewer, NASA team lead for 747 maintenance, and Bill Cole, Boeing flight mechanic electrician; Don Harris, Boeing flight mechanic, listens for instructions during loading.





**PHOTO:** During the flight from St. Louis on Dec. 14, the NASA 747 carrying Phantom Ray passed over Arkansas, Oklahoma, Texas, New Mexico and Arizona before landing at Edwards Air Force Base in California. NASA







**PHOTOS: (Below)** Boeing and NASA engineers inspect Phantom Ray after it is unloaded from the 747 at Edwards Air Force Base, Calif. The unmanned air vehicle's landing gear was removed before the flight to allow the special mounting adapter to be attached. "It was a six-hour flight that saved two to three months of work," compared with disassembling and shipping by land, said Craig Brown, Phantom Ray program manager. "It wasn't easy, but it was worth it."

**(Inset close-ups, from left)** Cory Saathoff, NASA mechanic, and Boeing's Dennis Maddock keep a close eye on Phantom Ray as it's unloaded at Edwards; Boeing flight mechanics Don Harris and Bob Tepe get a big smile from Teri Finchamp, center, Phantom Ray manufacturing lead, for a job well done.





# Burn notice

Boeing works with the FAA to standardize airplane flammability testing requirements

By Dina Weiss and photos by Jessica Oyanagi

**W**hat could have been a sticking point between Boeing and the U.S. Federal Aviation Administration has turned into a collaborative effort to develop standardized test methods that ensure Boeing products—and those of other airplane manufacturers—are safe.

The issue first sparked about a year and a half ago when members of the Commercial Airplanes flammability group discovered an adhesive used in all commercial airplanes over the past two decades did not perform the way the U.S. regulatory agency's rules required.

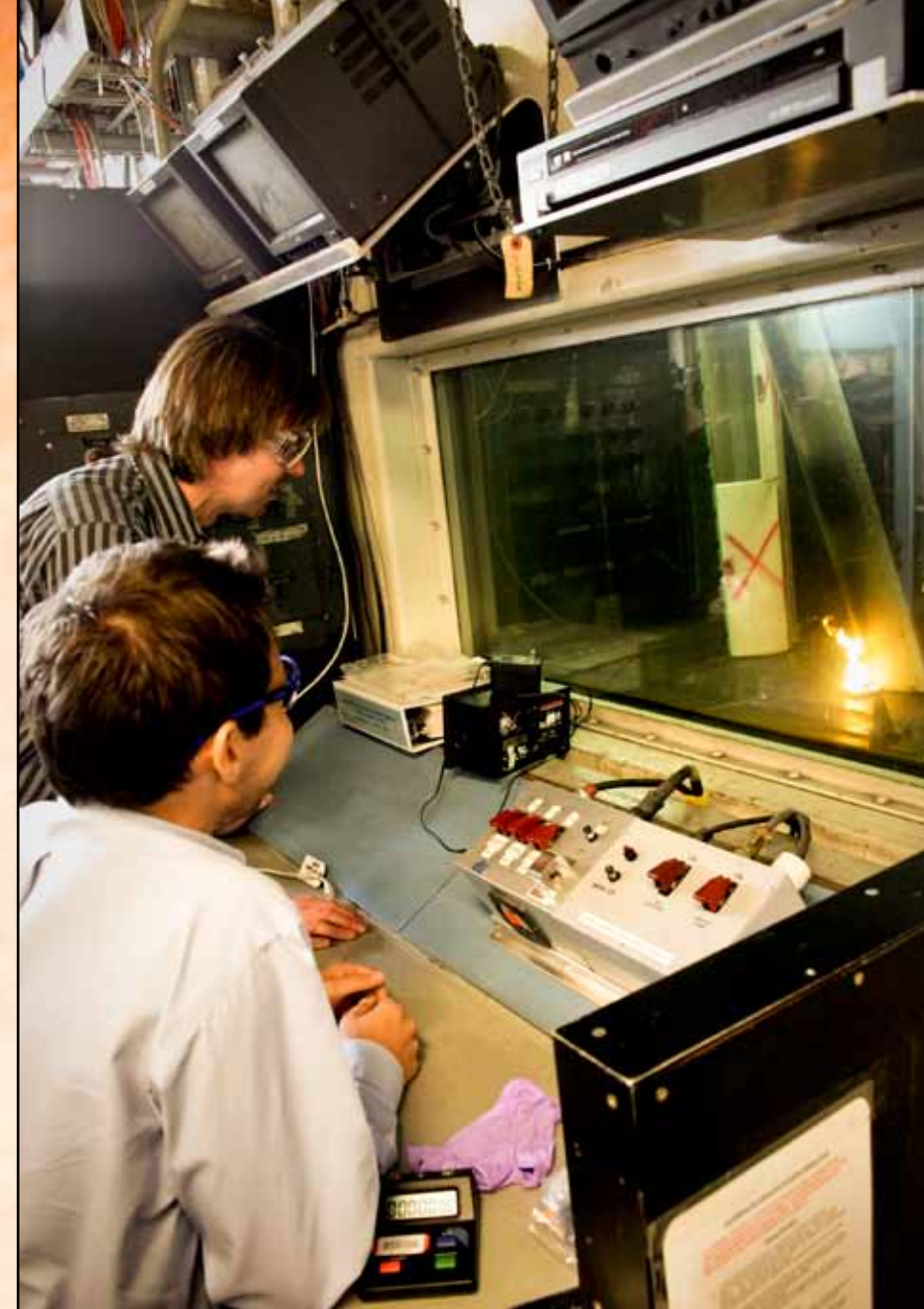
Using the testing process outlined in FAA rules, team members found that the adhesive passed all but one of the requirements laid out in the regulation.

"When lit with a Bunsen burner, the flaming adhesive didn't self-extinguish within the allotted time," said Dan Freeman, manager of the Commercial Airplanes flammability group.

Failing this requirement threatened to immediately halt delivery of all commercial airplanes, everywhere.

"We're currently working with manufacturers to develop an adhesive that will comply with the regulation," Freeman said. "In the meantime, we've teamed with the FAA to develop a new test method, which both parties agree is an equivalent way to show compliance and at the same time show the parts we've been installing on airplanes for decades are safe."

The new method is called the foam-block test. Instead of lighting a small piece of



**"Our journey with the FAA to develop this new test method has led to us working together on our compliance process as a whole."**

*– Dan Freeman, manager of the Commercial Airplanes flammability group*

material containing the adhesive, a piece of urethane foam is lit and placed under a full-sized stowage bin that has the adhesive in the joints. This is a much more realistic way of representing an in-flight fire, according to Freeman and the FAA.

"Our journey with the FAA to develop this new test method has led to us working together on our compliance process as a whole," Freeman said. "We knew that if we weren't aware of the FAA's flammability requirements for this adhesive, other aerospace companies using the same type of material probably weren't either. We wanted to make sure the same standards were being applied to everyone, including our suppliers."

"Working through this process has definitely improved our relationship with the FAA," said Doug Lane, director, Airplane Certification and Regulatory Affairs.

Allen Kenitzer, FAA communications manager, agrees that working together on the flammability issue has improved the relationship between Boeing and the regulatory agency.

"It's enhanced our ability to work with Boeing in a collaborative and standardized manner as we continue with our mission to maintain and improve safety in all technical areas, including the flammability area," Kenitzer said.

Back at the lab, Freeman and his team are using these lessons learned as they conduct flammability testing on Boeing's development program airplanes.

"The collaborative approach we've developed with the FAA," he said, "will continue to help us reach our common goal of ensuring the compliance of Boeing airplanes." ■

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**PHOTOS: (Far left)** Performing the new foam block-based flammability test are, from left, Dan Slaton, Flammability Safety & Airworthiness engineer, Boeing Commercial Airplanes; kneeling, John Vance, Propulsion Test Lab engineer, Boeing Test & Evaluation, and Matthew Anglin, 767, 777 and 787 Flammability engineer; and, in background, Dan Freeman, Airplane Programs Flammability Integrator, Commercial Airplanes. **(Above)** Observing the test burn through safety glass are John Vance, foreground, and Matthew Anglin.



# BIG!

Workplace safety is a 'big' deal for the members of this Everett tooling team

By Joanna Pickup

Everything at the Everett site in Washington state is big, from the sprawling factory to the huge sections of twin-aisle airplanes assembled there.

But from the perspective of employees such as Gary Tamura, Shane George and Jerry Loreen, it can all look pretty small.

They drive Kalmar straddle carriers, from seats 35 feet (nearly 11 meters) above the ground.

"Being that high up, we see everything," Tamura said. "But everything is very small. Our challenge is that we share the same roads and transportation aisles with everyone else in Everett. We can't make quick turns or fast stops, and there's a risk of tipping over."

Safety is a priority—so much so that the team took the initiative to produce a safety video that is helping Boeing achieve its goal of improving workplace safety 25 percent by 2013, as measured by workdays lost due to injuries.

As members of the Everett Rotating Tools Employee Involvement Team, Tamura and his teammates deliver major assemblies for the 747, 767 and 777 programs from railroad cars and return fixtures to the vendors using the Kalmar. In just under two hours, they load and unload shipping containers. Each month the team moves more than 100 loads across the Everett site.

"Essentially, we begin the production process," said fellow Kalmar driver George.

Along with the Large Cargo Loader, which is used to move 787 parts from the

## BY THE NUMBERS

### 35

Number of feet (nearly 11 meters) the Kalmar cab sits above the ground

### 62

Weight of the Kalmar in tons (56 metric tons) when empty

### 14 by 40

Dimensions in feet of the Kalmar (4 meters by 12 meters)

### 100 by 22

Dimensions in feet of the Large Cargo Loader (30 meters by 7 meters)

PHOTO: BOB FERGUSON/BOEING



PHOTO: Jerry Loreen, left, Gary Tamura, in background, and Shane George deliver major assemblies for the 747, 767 and 777 programs using the Kalmar. BOB FERGUSON/BOEING



**PHOTO:** Another big player at the Everett, Wash., site, the Large Cargo Loader moves 787 parts delivered by the Dreamlifter from the flight line to the factory. ED TURNER/BOEING



*“Although our team prides itself on delivering the major assemblies on time, safety is the most important part of our job.”*

**– Chuck Burton, Rotating Tools team lead, Boeing Commercial Airplanes**

Dreamlifter on the flight line to the factory, the Rotating Tools team is responsible for delivering all of the 777 airplane parts to the production line in the factory.

“Moving cargo across the Everett site can be dangerous. We have to be aware of everyone around us—pedestrians, people on bikes, even other vehicles and equipment operators,” said Chuck Burton, the Rotating Tools safety team lead. “Although our team prides itself on delivering the major assemblies on time, safety is the most important part of our job. We knew we had to do something to educate all employees about the potential safety hazards.”

The team members wanted to create a video to help spread their safety message. But lacking a budget, they had to find another way. They took advantage of an Environment, Health and Safety fair in 2009 to develop and distribute a PowerPoint presentation to more than 200 employees who attended.

“We couldn’t pass them out fast enough,” said Diane Kauffman, a member of the team. “It was great to see how enthusiastic and involved everyone was to hear our message.”

Not long after, the team noticed an improvement in safety and employee situational awareness around the big vehicles. Still, it knew more needed to be done—and continued to pursue the idea of creating a video. After more than a year, the team’s dedication finally paid off with approval from senior management to produce the video.

“I’m glad we never gave up,” Burton said. The team’s video now is used in monthly crew meetings across the Everett site.

“The team’s efforts are a great example of how it doesn’t cost a fortune to help everyone stay safe,” said Atsuo Miyake, director of Environment, Health and Safety for Commercial Airplanes. “Getting personally engaged like this team did is so crucial. ... We all need to realize we can make a difference in the safety of our workplace.” ■

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Employees can view the safety video at <http://boeingnews.web.boeing.com/frontiers/video/big.html> on the Boeing intranet.



# Hands on

A heads-up observation helps Seattle lab technicians be more efficient

By Adam Tischler

Looking at Craig Henningsen's hands side by side, it's easy to tell which one has been shaped by years of carefully preparing surfaces for the tiny gages used to measure structural loads on test aircraft.

He's spent innumerable hours clutching hand sanders and sharp Exacto knives to pry material out of hard-to-reach places to implant the gages.

The gages Henningsen installs are typically about the size of a postage stamp. It is delicate work and "you gotta be like a surgeon," said Henningsen, a Boeing Test & Evaluation technician in the Seattle area. "Everything has to go right."

All around him in the Strain Gage Lab, technicians are in various stages of meticulously melding the metallic test instruments into various test materials. But thanks to something Henningsen spotted at another Boeing facility, the Strain Gage Lab team found a way to do this work much more quickly and ergonomically. It's an example of what Boeing employees are doing to help the company run more efficiently—and ergonomically.

The unexpected discovery came when Henningsen took a temporary assignment to help out in Boeing's Seattle-based Wind Tunnel Lab for several weeks.

"I snooped around looking at all their tools," he quipped. His interest was piqued when he saw a dental sander in use. A dental sander is used to sand and shape dentures rather than clean a patient's teeth. Much like a hand-held rotary shop tool, it has a small replaceable bit and a high degree of speed variability for precision work in tight spaces.

Henningsen immediately called Robert Moshcatel, his team lead at the Strain Gage Lab. The two had previously experimented with other tools to improve the strain gage application process—with little success. But the dental sander had the characteristics they had spent years searching for.

"It was really slick," Henningsen said.

With the dental sander back in the Strain Gage Lab, the benefits were measurable. The average time saved on installing an individual gage was about 65 seconds, but on components that can measure 10 feet by 5 feet (3 meters by 1.5 meters), with hundreds of gages, the time saved was measured in days.

Once mounted, strain gages are wired to a computer that records the effects of stress on materials. The electromechanical gages test everything from the extreme pressure of strenuous flight maneuvers to the force a flight attendant puts on a cabin door's hinges while opening or closing it.

The Strain Gage Lab works closely with Boeing Test & Evaluation's Structures Test Lab to test materials that will eventually make their way onto Boeing products. Every measurement is critical and there is no room for error in the labs.

Strain gage installation used to require real physical exertion: "You'd take an Exacto and go like this," Moshcatel explained, simulating the scraping motion across a composite test material. That was the old way, before the discovery of the dental sander. Now, lab technicians flip a switch and in short order carefully and mechanically remove just enough surface to implant a strain gage on a surface.

The little sander has made the lab work easier and faster and produced significant savings—saving wear and tear on Boeing people as well. ■

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*It is delicate work—  
“you gotta be like  
a surgeon.”*

— Craig Henningsen, Boeing Test & Evaluation technician

**PHOTOS:** Boeing Test & Evaluation lab technician Craig Henningsen employs a dental sander to prepare a panel on which dozens of strain gages will be mounted. The process used to take days; now technicians in the Strain Gage Lab can do it in hours. MARIAN LOCKHART/BOEING



# Orbital care

When a cooling problem threatened the space station, Boeing teams worked together to help find solutions

By Sean Elizabeth Wilson

The problem last July on the International Space Station (ISS) was potentially serious.

A power spike had tripped a circuit breaker for one of the liquid ammonia pumps for the station's cooling system. The pump, one of two on board, shut down as planned, which knocked out half the station's cooling system.

"The ISS was in a very risky posture," said Felipe Saucedo of Boeing's Vehicle Integrated Performance and Resources (VIPeR) team in Houston. Astronauts would have to replace the pump during several unplanned spacewalks.

Sixteen days after the ammonia pump shut down, the repair job was done. Emergency resolved.

Space exploration is a risky

business, and that includes living and working in the International Space Station some 220 miles (190 nautical miles, or 400 kilometers) above the earth. Helping to keep the station running smoothly and safely is the job of Boeing's VIPeR team.

Four subteams are responsible for such things as the station's flight attitudes, solar array management, mass properties, power and thermal resources, as well as its propulsion systems. As situations arise, including a spacewalk or rendezvous and docking of a visiting vehicle, the teams lead the analysis that ensures uninterrupted performance of the station.

"We have to ensure the entire space station operation sequence works," said Ivan Berrios, manager of Boeing's VIPeR team.

Each of the teams has a specific area of expertise and focus; the teams don't often address common issues. But when the ammonia coolant pump module located outside the station failed last summer, the teams worked together to ensure the safety of the station and those on board, according to Saucedo, lead for the VIPeR team.

Team members worked around the clock during the emergency in NASA's ISS Mission Evaluation Room, advising operations personnel on minimizing the risks involved.

"The VIPeR team looked at temperatures and identified equipment that could remain functioning without violating operations temperatures," Saucedo said. "We got the solar array constraints

together to provide robust plans so the arrays didn't have to be moved during the events and made sure thermal limits would stay within nominal parameters."

The safety of the astronauts during the three spacewalks was another important consideration.

"For the spacewalkers to be safe outside of the station, we analyzed fault tolerances to mitigate the risk of propellant leakage or inadvertent thruster firings ...," said Ulhas Kamath, lead for the Propulsion team.

Because the failed ammonia pump module was so large, it had to be temporarily stowed on the station's Mobile Transporter to make room for the crew to install the new pump. Placing such a large piece of equipment in a new location on the station's structure meant the team needed to develop new mass properties for the station.

"The mass of the structure shifted," said Greg Ray, team lead for the Mass Properties team.

During the spacewalks, ammonia and nitrogen were vented from the ammonia pump lines. In the vacuum of space, these gases turn into hard particles that can cause significant damage if they hit the station.

"We provided potential vent location information and flight attitudes to the

## "The ISS was in a very risky posture."

— Felipe Saucedo of Boeing's Vehicle Integrated Performance and Resources team

engineering and operations community," said Shawn Conerly, engineer for the VIPeR team. "The analysis showed that once these particles were ejected, they didn't re-contact with the station or damage any external hardware."

The performance of the Boeing ISS teams during the emergency earned them recognition from Boeing leadership, as well as a team award from the space station crew they supported.

But the best reward for the team is daily providing their specialized support to the space station program.

"It is very satisfying to know we have a big input to what the operations community has to do every day," Saucedo said. "It is always very dynamic." ■

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**PHOTOS: (Left)** Astronaut Doug Wheelock emerges from the space station for the second of three spacewalks last August to remove a failed ammonia coolant pump module on the station's S1 truss. **NASA (Below)** Boeing VIPeR team members Mark Krajchovich (left) and Suzanne Oliason are ready with Boeing support in NASA's International Space Station Mission Evaluation Room. **ELIZABETH MORRELL/BOEING**





# The crowded sky

Boeing is emerging as a major player in air traffic management

By Junu Kim and Daryl Stephenson



In 20 years, expect to see a lot more airplanes than today. Boeing's 2010 Current Market Outlook forecasts the world's fleet of commercial airplanes will grow from 18,890 in 2009 to 36,300 in 2029.

Government agencies realize the need to prepare the sky's infrastructure for this surge in air traffic. Last year, Boeing was one of three companies to receive a U.S. Federal Aviation Administration contract relating to an upgraded U.S. air traffic management system. Boeing's 10-year pact, worth up to \$1.7 billion, was the biggest of the three and covers research and development on technologies that could appear in an improved system.

To discuss the company's current activity in this market, three leaders in this business recently spoke with *Frontiers*: Greg Deiter, Boeing Defense, Space & Security vice president of Defense & Government Services; Neil Planzer, Commercial Aviation Services' vice president of Global ATM Solutions; and Gene Hayman, the manager of this program, known as SE2020.

**There's been interest in upgrading the U.S. air traffic management system for some time. What's different now?**

**Hayman:** For starters, the FAA has made an unprecedented commitment to invest in an upgraded system. The combined three contracts are the biggest contracts the agency has ever issued, and they put the FAA in position to accelerate the implementation of [Next-Generation Air Transportation System] concepts and technologies. And with Boeing as a prime contractor and as an awardee of the biggest NextGen R&D contract, we're square at the top as a major player, because this is where all the NextGen R&D work over the next 10 years will be performed.

**Deiter:** Also, we're bringing a broad and powerful team to this task. This is a textbook case of how leveraging the best of Boeing leads to business success. Defense, Space & Security brings tremendous experience in architecture and networks experience, which are underpinnings of a NextGen system, as well as experience in managing large, complex contracts. Boeing Research & Technology performs the advanced R&D. And Commercial Airplanes has not just the avionics team that's tied tightly to the airplane programs but also Commercial

Aviation Services, which brings a tremendous amount of capabilities and expertise. And remember that our team also includes major players in the industry, like Lockheed Martin, Honeywell, Airbus and Cessna.

**What technologies will this system have?**

**Planzer:** There's still much to be determined, which is why the FAA's focus is on a comprehensive R&D program. On the other hand, we know that the core element to a successful NextGen system is to use satellite positioning and to move away from radars.

Some of these technologies are available today or are about ready for testing, so you could reasonably expect to see them be part of a new system.

And airplanes will be equipped with a system called ADS-B, or Automatic Dependent Surveillance-Broadcast, that will enable them to use GPS satellite signals to more accurately identify where they are. Also, voice communication between controllers and flight crews will give way to data links that will transmit data between a flight management computer in the airplane and a computer on the ground.

**How soon will the new system be implemented?**

**Planzer:** Well, as new airplanes come off the line, they will be equipped with these new technologies. But there's no quick, affordable fix that will retrofit all older airplanes to let them use all these features. But Boeing understands that. And we have the ability to help government agencies flesh out and move as rapidly as possible with enhancements to safety and environmental efficiency at the same time. No one else has the capability of doing that.

**Deiter:** Modernizing our existing ATM infrastructure while continuing to serve the traveling public is a complex problem that requires a company that understands air travel, the airline business model, FAA policies, and the process of developing innovative, cost-effective solutions. Who better than Boeing to help lead this transformation? ■

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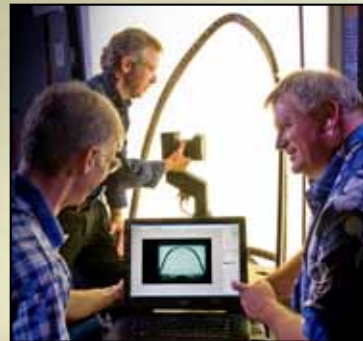
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**“This is a textbook case of how leveraging the best of Boeing leads to business success.”**

— Greg Deiter, Boeing Defense, Space & Security vice president of Defense & Government Services



# Clear vision



Teamwork and a special camera help Boeing deliver flawless jet-fighter windshields

By Liz Lane and Mick Boroughs

Through the cockpit windshield of an F/A-18, the pilot spots an unidentified object that appears to be approaching the jet fighter.

The object moves in unison with the pilot's own maneuvers. Then, with the sun's rays at just the right angle, the pilot realizes it's not another aircraft but a tiny defect in the windshield.

It's a scenario no fighter pilot wants to experience, especially in combat.

"A distortion-free, defect-free optical windshield is absolutely essential to tactical aviation," said Dave Desmond, Boeing chief test pilot for Military Tactical Flight Operations.

A minor inclusion—a defect the size of a small dot—can catch a pilot's peripheral vision and be mistaken for an approaching

aircraft. But as a result of the work of a Boeing-led team and a Panoscan digital camera, windshield defects are being found on the ground, not by pilots in the air.

For Boeing engineers Mike Gleason and Matt Thomas, solving production riddles such as windshield defects is their mission. When the pair faced this recurring manufacturing issue on the F/A-18 production line in St. Louis, they began a collaborative quest to find a solution.

Polycarbonate, a tough thermoplastic, forms the structural backbone of jet windshields. Occasionally, small amounts of black carbon particulate, a byproduct of the fabrication process, end up in the polycarbonate. When that happens, black specks can litter the windshield.

To screen out defective windshields before installation, Boeing inspectors painstakingly eyeball every one but can overlook particles sized at 60 thousandths of an inch (0.1524 centimeters). During flight tests, these tiny flaws can show up when they are illuminated by sunlight streaming through the windshield. But the affected aircraft must then be returned to production for windshield replacement—a costly outcome that delays delivery and disrupts the supply chain.

Gleason and Thomas had an idea. Perhaps a shadow-based imaging tech-

nique could spot these windshield defects early on? They contacted Ron Bookout of Shared Services Group's Creative Services Photography team. Together, they began a two-year collaboration to transform and automate the F/A-18 windshield inspection process using a Panoscan digital camera that has the capability to capture a series of images in minute detail.

This effort resulted in a system with two patents pending. It features a portable light panel for windshield photography and a digital scanning technique to locate, size and flag all specks. It's a simple process. Workers put the windshield and camera into a fixture and run a three-minute scan to reveal any defects.

The process, which will save rework, expense and time, is the result of strong

"This is a fine example of what you can achieve using cross-disciplinary efforts."

— Matt Thomas, Boeing engineer

**PHOTOS: (Left)** A new process being patented by Boeing more efficiently spots windshield defects on the F/A-18E Super Hornet, shown here, before the windshield is installed on the aircraft. **U.S. NAVY (Inset)** Creative Services photographer Ron Bookout (background) adjusts a Panoscan camera that will detect defects in the F/A-18 windshield while engineers Matt Thomas, left, and Mike Gleason review Digital Scan results. **RICH RAU/BOEING**

collaboration. Dan Pulcher, Doug Reed and Tony Roberts of Boeing Defense, Space & Security constructed the light panel; a team at Washington University in St. Louis tackled the image processing; and Bookout suggested the light-table solution and determined optimal camera settings to expedite photo generation.

"This is a fine example of what you can achieve using cross-disciplinary efforts," Thomas said. "We've never had a photographer take such an active role in developing a high-tech solution as Ron did."

Bookout's input earned him a signature spot, alongside other team members, on one of the patent applications.

"Partnerships can produce dramatic results," Bookout said. "This shows

what we can achieve when we put our heads together."

The goal is to integrate the screening system into the manufacturing process and screen every windshield before installation using the Panoscan system. This process also will be used for quality inspections at Boeing's St. Louis plant.

The results have been promising. "We just aren't seeing the defects we used to see before Panoscan," Desmond said. ■

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# A simple plan



**“Our brands are based on the philosophy of simplicity and value as our foundation.”** – Erik Venter, joint CEO of Comair PHOTO: COMAIR DESIGN STUDIO

South Africa’s Comair has had a remarkable run of success—and a long relationship with Boeing **By Adam Morgan**

**F**or one South African airline, a simple philosophy has been the cornerstone of its success.

Comair Limited, South Africa’s longest-operating airline after the national carrier, believes in keeping things simple and consistent. And with 65-plus years of operating with a profit, the airline’s record speaks for itself.

“Our brands are based on the philosophy of simplicity and value as our foundation,” said Erik Venter, joint CEO of Comair. “It should come as no surprise we operate Boeing 737 airplanes—the most efficient airplane in its class. The 737 is cheaper to

operate and uses less fuel than anything else out there, which makes the economics simple—these airplanes add value.”

Comair’s current fleet consists of seven 737-400s and two Next-Generation 737-800s. The airline recently announced an order for eight more 737-800s, nearly doubling its fleet.

“These new airplanes also seat approximately 20 more passengers than our current fleet, which means they will help us accommodate more passengers during the busy summer months—and help us achieve our growth targets throughout the year,” Venter said.

Most notably recognized for the airplane liveries under its kulula.com brand, the airline has made its name for its funky paint schemes, easy booking process, and the lighthearted, matter-of-fact experience it offers on the airplane. Simplicity is at the core of its brand—down to the name *kulula*, which means “easily” in Zulu. Its website, kulula.com, has been operating since 2001 and has become one of Africa’s largest online retailers, generating nearly \$365 million (more than 2.5 billion South African rand) per year.

“By creating one of the simplest airline experiences in the market—from booking to paying to affordability—we have opened the skies to so many people that wouldn’t

otherwise have the opportunity to travel,” said Venter, noting that kulula.com is Africa’s first low-fare airline.

Comair Limited also operates as a franchise partner with British Airways in the region as a premium, full-service airline to routes in Southern Africa. Comair has been operating these local and regional flights for British Airways for the past 12 years.

The airline started in 1946 as Commercial Air Services with a charter flight from Rand Airport in Germiston, in the northern interior of South Africa, to Durban, on the nation’s east coast. In 1992, the airline introduced the Boeing 737-200 and a Fokker aircraft to its fleet and carried nearly 100,000 passengers that year. Today, it averages 1.8 million passengers a year.

“The success of our brand has been built on consistently providing products and services of value, which makes Comair and Boeing similar in many ways,” Venter said. “What has grown from a small charter service into carrying nearly 2 million passengers was done in part with Boeing products—Boeing products and services that also consistently provide value.” ■

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**PHOTO:** Comair’s kulula.com is known for its funky liveries, such as the one on this Next-Generation 737-800. G.A.S. MEDIA



## SUNSET FLIGHT

Sixteen GR MK9 and Two Seat T-MK12 Harrier jets fly a final formation over the United Kingdom on Dec. 15 to mark the retirement of the country's fleet of 70 Harrier jets from military service following budget cuts. The Harrier is a short-takeoff and vertical landing, or STOVL, aircraft. For the U.K. jets, McDonnell Douglas, now part of Boeing, built the forward fuselage and wing, and BAE Systems of the U.K. built the center and aft fuselage and performed final assembly. McDonnell Douglas also assembled AV-8B Harriers in St. Louis for the U.S. Marine Corps. Boeing continues to provide engineering, maintenance training, and material and logistics support to the AV-8 Harrier fleets of the Marines, Italy and Spain. PHOTO: UK MINISTRY OF DEFENCE







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