Mission accomplished
After completing the International Space Station and flying more than 130 missions, the space shuttle program draws to a close
In July 1972, NASA awarded North American Rockwell, a Boeing heritage company, a contract to build the first of the space shuttles. Today, nearly 40 years later and having blazed important trails in the exploration of space, the shuttle program is coming to an end. It has shaped many Boeing careers and left a remarkable record of accomplishment. Even though the journey is almost over for the shuttles, Boeing engineers are working on what could be next. This commemorative issue includes a pull-out poster featuring highlights of the program.
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## 38  Be safe out there

From a “zero gravity” mechanical arm that makes it easier for employees to sand paint on the underside of an airplane wing to a no-touch pressure washer that speeds the cleaning of Boeing facilities, new technology is being developed and deployed throughout Boeing to help reduce workplace injuries. Using ergonomic tools and processes, Boeing is improving the design—and efficiency—of work.  

*Photo: via Boeing/Aerospace*

## 40  Ready for the show

The world’s aerospace community this month heads to Paris and the biggest air show of them all, where a number of Boeing products will be on display. Making sure these get to the show on time and ready for safe public display is no small undertaking. This job falls to Boeing Test & Evaluation teams, who are responsible for everything from aircraft routing to providing a safe display area.

*Photo: via Boeing/Aerospace*

## 14  Reading, writing & robots

Student teams from around the globe design, test and then compete their robots in a Boeing-sponsored event that is not only fun but helps inspire young people to choose technical, scientific and engineering careers. The excitement of the competition is captured in this photo essay.

*Photo: via Boeing/Aerospace*

## 51  Leading by design

Since the Next-Generation 737 entered commercial service in the late 1990s, Boeing engineers have continued to find ways to increase its value to customers through greater efficiency, performance and reliability. It’s all part of the never-ending effort to make sure the workhorse 737 stays ahead of the pack.

*Photo: via Boeing/Aerospace*

## INSIDE

### 07  Leadership Message

The Paris Air Show takes place this month, and a number of advanced Boeing products are scheduled to be on display. These programs reflect Boeing’s ability to operate as a global company, one that is focused on innovation and collaboration and that embraces change, says Shep Hill, president of Boeing International and senior vice president of Business Development and Strategy.

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### CORRECTION

On Page 19 of the May issue, an employee volunteer in the Earth Day photo essay was misidentified. In the top left photo, the employee on the right is Bob Lull.
Embracing change

Boeing heads into the Paris Air Show focused on innovation, collaboration and productivity

Boeing and the aerospace industry are operating in an era of relentless change that is creating both global opportunity and competitive challenge. The scope and velocity of this change is transforming the way we live and the way we think about the future. And this change is not limited to aerospace. It took about 38 years for the radio to reach a market audience of 50 million people. Television needed just 13 years. The Internet took four years, and Facebook only two years. The speed, reach and impact of technology and innovation have raised expectations and aspirations around the world.

Boeing’s successes in both shaping and adapting to change will be on display during the biennial international Paris Air Show held in France this month. Innovative Boeing products we are scheduled to show include the new 787 and 747-8 Intercontinental jetliners; the world’s most advanced airlifter, the C-17; and the F-15 multi-role fighter, which Boeing continues to keep affordable and effective by optimizing its proven design with new technologies and systems.

These programs represent Boeing’s unique ability not only to adapt to market dynamics but to shape those dynamics as a single, integrated company. And our recent win on the KC-46A Tanker program for the U.S. Air Force demonstrates that a “One Boeing” approach is a competitive differentiator. This same approach of drawing on the talents and expertise of the enterprise, of partnering and collaborating globally, has accelerated success in the international marketplace for both Boeing Commercial Airplanes and Boeing Defense, Space & Security.

So where do we go from here? George Bernard Shaw said, “Progress is impossible without change.” As Boeing employees and leaders, we can and should embrace change and ensure it results in progress for our company and our world—as the company has done for 95 years. By adapting and collaborating we can drive innovation, enhance productivity, and create the breakthrough products and services that serve our customers and that have made us the best aerospace company in the world.

As you read through this issue of Frontiers you will see examples of Boeing’s innovative new products and services, and how we leverage the best of Boeing by operating as a single, cohesive global unit. Together, these efforts fuel our ongoing drive to be the strongest, best and best-integrated aerospace-based company in the world—for today and tomorrow.

L’avenir est entre nos mains—the future is what we make it.
Get comfortable
Focus on office ergonomics reduces injury risks and helps improve quality of life
By Judy Kimball

As a workplace safety administrator, Judy Kimball takes advantage of every opportunity to make a difference for employees in Everett, Wash. In this Frontiers series that profiles employees talking about their jobs, Kimball discusses her commitment, and that of her team, to reducing ergonomic risks for office workers.

work with a dedicated team of ergonomic evaluators and we’re all committed to helping employees feel better and preventing ergonomic injuries.

As a safety administrator in Everett with Environment, Health and Safety, I am responsible for the Office Safety and Office Ergonomic programs. I define ergonomics as the science of making things comfortable and efficient. Our team’s goal is to provide a comfortable working environment for employees.

Boeing has thousands of office workers in Everett, and our team assists any employee requiring our services. Our more than 40 ergonomic evaluators are all volunteers who participate in this program in addition to their full-time jobs. Their commitment and dedication is amazing.

Our program has helped reduce discomfort, injuries and fatigue—and has even increased productivity. Most of all, it can help give our employees a better quality of life.

Typical ergonomic concerns for office workers are aches, pains or strains in shoulders, backs, necks, wrists and arms.

Employees seeking an ergonomic evaluation start with the self-help checklist on the Boeing Enterprise Ergonomics System on the Boeing intranet. Last year, 2,682 employees in Everett completed the checklist, and we conducted 1,500 one-on-one ergonomic evaluations.

In the course of our work, team members partner with Site Services and Supplier Management to provide equipment such as office chairs, computer peripherals and adjusted work surfaces as quickly as possible. I also work with the Disability Management and Vocational Rehabilitation organizations for more complicated cases that sometimes go beyond equipment changes.

Receiving emails from employees saying things like, “This new equipment changed my life,” or “I no longer have pain in my wrist and arms,” gives our team members, and me, a great feeling—knowing that we have made a difference.

judy.a.kimball@boeing.com

Quotables

“She’s got a lot of life left in her, but that’s not meant to be.”
— NASA launch director Mike Leinbach, as quoted in a Reuters story about the final flight of Space Shuttle Endeavour on May 16. NASA’s shuttle fleet is being retired. For more on this remarkable program that spanned some four decades, see stories and photos beginning on Page 16.

“The WTO has rendered its final verdict, and now Europe must comply within six months.”
— Boeing Executive Vice President and General Counsel J. Michael Luttig in a May 18 Boeing news release about the final World Trade Organization ruling on illegal aircraft development subsidies.

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For Kathy Haynes, a production coordinator for the company’s satellite business in El Segundo, Calif., the Boeing on the Move physical activity challenge last year was a life-changing experience. It’s back for 2011. And Haynes, like many other Boeing employees around the globe, is eager to get started—again.

“I never considered just walking as a form of exercise to improve my health. I always thought you had to run,” said Haynes, who can’t run because she has prosthetics in both knees. Haynes said she benefited from last year’s program in two ways: She now walks at home in the evenings, and she walks more at work than she did before she signed up for Boeing on the Move in 2010.

“I highly recommend this program to all of our employees who want to work on preventive health lifestyle changes,” she said.

More than 40,000 employees participated in the six-week challenge in 2010, the first year it was offered. The goal is 50,000 participants this year. U.S. and international employees—and employees on international assignment—will participate concurrently.

“The company invests in programs like Boeing on the Move because getting more physically active is one of the best things we can do for our health and well-being,” said Rick Stephens, senior vice president, Human Resources and Administration. “The challenge offers a fun and easy way for employees to get moving and make physical activity a part of their daily routine. We hope even more employees will choose to move with Boeing on the Move this year, either as part of a team or on an individual basis.”

Last year, 57 percent of those who responded to Boeing’s online Health Assessment said they were not getting adequate amounts of physical activity. Boeing on the Move helped change that. So will its return.

“I’m so excited that it’s coming back!” said Vicky White, a delivery manager with Learning, Training and Development Engineering Training in Renton, Wash. “Boeing on the Move gave my exercise routine an added boost, which I didn’t realize I needed or was missing until I became part of a team.”

One of last year’s five winners was Lucy White, a Customer Relations specialist and meeting and event planner in Long Beach, Calif. “Boeing on the Move not only increased my physical activity,” she said. “More important, it enhanced my relationship with my daughters. I went from being a spectator to being a participant in their activities.”

For some employees, Boeing on the Move is an opportunity to help them drop unwanted pounds, as well as get healthier through activity.

“I have been on a weight-loss journey for the past three years, and participating in Boeing on the Move was the perfect way to garner support from others in the office,” said Kethe Jackson, a business and planning analyst in Oklahoma City. “We formed a team and walked together each day,” she said. “Even after the program ended, we continued to walk and use our pedometers. I think we are all feeling healthier and definitely plan to participate in the new Boeing on the Move challenge. I would recommend the program to all Boeing employees as a way to get moving, lose weight and make some new friends along the way!”

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“Boeing on the Move not only increased my physical activity. More important, it enhanced my relationship with my daughters.”

Lucy White, one of last year’s five winners of the Boeing on the Move challenge

Return engagement

Boeing on the Move will again be a fun way for employees to get moving—and get healthier! By Susan Birkholtz

DATES TO REMEMBER

JUNE 10: Registration ends. After registering, you will receive a pedometer to track your daily activity.

JUNE 20: Six-week challenge begins. Track activity daily using an online tracking tool on the Boeing on the Move website. Or use a downloadable spreadsheet from the site to keep track of activity daily by hand.

JUNE 26: Last day to change your personal goal, create a team or join an existing team.

JULY 31: Challenge ends.

AUG. 7: Last day to enter activity online.

For more information, visit Boeing TotalAccess and click “My Well Being” to access the Boeing on the Move website.

PHOTO: Lucy White, a Customer Relations specialist and meeting and event planner in Long Beach, Calif., is pictured here with her daughter, Payton.
REALIZING POTENTIAL. REWARDING SUCCESS.

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For four days in April, more than 10,000 of the smartest and most creative students from all over the world competed head to head in a most unusual arena.

But this was no academic or athletic competition, even though the atmosphere resembled a sporting event with cheering and sign waving from the sidelines.

Rather, the contest involved robots, designed and built by students under the guidance of mentors, performing set tasks in competition with other teams’ robots.

Eduardo Fernandez, a senior at Carl Hayden High School in Phoenix, was part of a student team mentored by Boeing employee Daniel Palomino and aptly summed up his experience: “FIRST is so fun. I plan to major in mechanical engineering. I want to do this the rest of my life!”

What is FIRST? It’s the nonprofit organization For Inspiration and Recognition of Science and Technology. FIRST’s worldwide robotic competitions for kids ages 14–18 is one way Boeing and its employees are providing young people with the inspiration and knowledge they need to become tomorrow’s technical workers—and candidates for Boeing’s future workforce.

“I believe we will see future Boeing engineers coming out of the FIRST program,” said Dennis Muilenburg, president and CEO of Defense, Space & Security. He attended the late April FIRST Robotics Championship in St. Louis.

Before the championships, more than 150 teams supported by Boeing grants and mentors participated in regional competitions across the United States. Twenty-nine of those teams earned a spot in the finals.

“Employees serving as mentors are helping prepare students to meet future challenges and shaping the future of innovation,” said Rick Stephens, senior vice president of Human Resources and Administration.

Boeing has long supported FIRST through grants and educational scholarships, and with volunteers.

“When you excite students with hands-on learning experiences, success soars.” Stephens added. “These young innovators will solve the problems we don’t even know exist yet.”

From these robotic competitions for students could come Boeing engineers of tomorrow

By Peter Pedraza and photos by Ron Bookout and Bob Ferguson

Day of the ROBOTS

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PHOTOS: (Far left) Boeing-mentored competitors Hayden Vrbka, Jeff Cottrell and Hayden Vrbka compete on the FIRST Robotics playing field with their robot, “Cahuna-Cat.” (Top insets, from left) Boeing Defense, Space & Security President and CEO Dennis Muilenburg talks with Eduardo Fernandez about the robot “Dulce’s Dream”; Nate Lindgren, left, and Boeing mentor Marc Sklar troubleshoot their robot, “2.0.” (Above insets) FIRST Robotics competitors add to the excitement with festive team costumes.

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The space shuttle program has had a remarkable run that has spanned more than three decades and helped shape many Boeing careers.

By Bill Seil

The space shuttle and its essential role in the assembly of the International Space Station have defined the Space Age for a full generation.

The first shuttle to orbit Earth, Columbia, was launched 30 years ago, on April 12, 1981. When Atlantis makes the final shuttle flight, tentatively scheduled for July, it will mark the end of a remarkable chapter in the history of space exploration and discovery—one that Boeing and its heritage companies helped write.

While lacking a dazzling climactic moment of success, such as the Apollo 11 moon landing, the space shuttle has gradually and forcefully transformed the ability of humans to live, build and respond to challenges in space. It has also set the stage for future lunar and interplanetary missions.

John Mulholland, vice president and program manager, Boeing Space Shuttle

“It’s going to go down as a remarkable achievement and its legacy will be very strong. It’s been inspirational to the nation, and its success has made an enormous contribution to our future in space.”

– John Mulholland, vice president and program manager, Boeing Space Shuttle Program

PHOTO: Columbia lifts off from Kennedy Space Center on the first shuttle flight into space in April 1981.
Program, said the shuttle has revolutionized human access to space. It has also created an important base of knowledge, he noted, in moving forward on programs such as Commercial Crew transportation and, eventually, exploration beyond low Earth orbit.

“The beautiful thing about the shuttle is its unique combination of crew and cargo access,” Muñoz said. “On mission after mission, it has demonstrated that human beings can perform tasks that can’t be done by robotics. The repair of the Hubble Space Telescope is a good example.”

Boeing is well-positioned to take a leadership role in both near-term and long-term space exploration, Muñoz said. In the near term, the International Space Station, or ISS, for which Boeing is the prime contractor, has years of useful service ahead. Boeing also is competing to build the Commercial Crew vehicle for NASA, which will transport astronauts to and from the ISS and other low Earth orbit destinations.

Mike Burghardt, manager of spacecraft development for Commercial Crew, said Boeing’s design would accommodate up to seven crew members and would be compatible with a variety of expendable launch vehicles. Depending on NASA’s final schedule, it could be ready to fly as early as 2015. “In some respects, it’s similar to the Apollo command and service modules, which were built by Boeing legacy company North American Rockwell,” Burghardt said. “But unlike Apollo, the Commercial Crew vehicle will carry astronauts, not cargo.”
Crew spacecraft will be reusable and carry a larger crew.”

In addition to working on Commercial Crew, Burghardt was part of the space shuttle team from 1987 until early 2010. He has mixed feelings about the shuttle program winding down. The shuttle was a magnificent vehicle with enormous capabilities, Burghardt said, but he’s excited about moving forward in developing new spacecraft.

Development of the space shuttle began in July 1972 when the National Aeronautics and Space Administration (NASA) awarded North American Rockwell the contract to build the first shuttle orbiter. Rockwell (which became Rockwell International the following year) went on to build the rest of the shuttle fleet. The shuttle program became part of The Boeing Company in 1996 when Boeing purchased Rockwell International’s aerospace and defense assets.

Construction of the space station was the shuttle’s most important accomplishment, but it completed many other complex assignments over the past three decades. Hubble, which the shuttle deployed on orbit in 1990, was a particularly delicate payload. The shuttle has also launched interplanetary space probes, such as the Galileo spacecraft, which was attached to a Boeing-developed Inertial Upper Stage with enough fuel to propel it on a gravity-assisted six-year trip to Jupiter.

The shuttle, in addition to launching satellites from its cargo bay, captured and repaired existing satellites that had failed in orbit. In some cases,
satellites were captured and returned to Earth for more complex repairs. The shuttle also hosted a number of scientific experiments that required zero gravity or other conditions unique to space.

After winning the contract, Rockwell named George Jeffs, who had been heading the Apollo program, to become the first space shuttle program manager. Jeffs, who later became president of Space and Energy Operations, said Rockwell’s performance, processes and relationships with NASA, which had been developed during Apollo, played an important part in Rockwell winning the shuttle contract.

“It was a major challenge to develop the space shuttle, which is truly a marvel of hypersonic flight,” Jeffs said. “The orbiter was the first vehicle of its type, and there were major aerodynamic, flight control, thermodynamic and software problems to solve. It was a hill to climb; there’s no question about that.”

Jeffs, who ran the shuttle program from 1972 to 1982, said the shuttle was the first spacecraft that could “land with dignity,” like an aircraft on a runway. During the Gemini program, Jeffs led the development of a parachute system to bring that spacecraft down on land, but NASA opted for splashing down in the ocean. For Jeffs, the shuttle was a dream come true.

Bob Minor, who headed the shuttle program from 1988 to 1997, started work on the program in 1970 when he was a manager on the original team that prepared Rockwell’s bid for the shuttle contract. Once the contract was won, he went to work on the design.

“Designing the shuttle was a daunting task, but it is a privilege that we all shared,” Minor said. “We had a bunch of engineers who were just fantastic. And NASA was a great customer.”

Minor, who retired in 1999, said the challenge of developing the shuttle’s thermal protection system was “a sporty one,” something that had never been done before. The system of tiles that protect the shuttle during the high heat of re-entry was particularly difficult. He said the team spent many late evenings and weekends developing procedures for installing the tiles and ensuring that they would remain in place during liftoff.

And the shuttle’s unique role—a space vehicle that could

PHOTOS: (Near right) A technician checks the thermal protection tiles on the bottom left wing of Atlantis after it returned from a mission. (Insets) The first shuttle, Enterprise, which was not designed to fly into space, is shown at the plant in Palmdale, Calif. Employees built the forward fuselage, crew module and aft fuselage of the shuttles at Downey, Calif., was

“We working at Downey, Calif., during the space shuttle program was an experience. Huge paint flakes on the inside walls looked like they could fall off and hurt you—most memorably above a door to the outside used daily by hundreds of employees. The roof leaked, so we had varying processes for catching and diverting water when it rained. But we didn’t complain because we sensed that magic was happening, and we knew the whole world was watching us.”

— Anita Gale, Associate Technical Fellow and senior project engineer, Space Shuttle Payload & Cargo Integration
land like a glider—required diverse technical talent involving both aviation and space expertise.

The company’s Downey, Calif., facility served as the design center for the space shuttle program. It also manufactured major sections of the shuttle.

Downey employees manufactured the forward fuselage, the crew module and the aft fuselage. These sections were transported to the company’s nearby Palmdale, Calif., plant, where Palmdale employees assembled the orbiters.

“It was fantastic, and things were busy every day,” said Dwight Woolhouse, recalling his early days at Downey. He joined the shuttle program in 1972 and currently serves as program manager for Orbiter Design. “Drawings were being released as the design of the shuttle matured and various tests were going on. There was always something new.”

The first orbiter to be completed, Enterprise, rolled out at Palmdale on Sept. 17, 1976. Enterprise was not designed to be flown in space. Instead, it was used in approach and landing tests to confirm that the orbiter could fly in Earth’s atmosphere and land like a glider. These tests were conducted at the Dryden Flight Research Center at Edwards Air Force Base in 1977. Enterprise was attached to the top of a specially modified Boeing 747 and released over Edwards. The tests were a success.

“To me, the real heroes of the space shuttle program are the people who validated the Enterprise,” said Bob Kahl, shuttle program manager at Palmdale. “That first separation flight—with the Enterprise lifting off the back of a 747, then gliding down—had to be the most incredible thing I’ve ever witnessed. The astronauts who performed those tasks

“this mating of two large vehicles was highly unusual, and there were concerns over how well it would work. But the first flight went perfectly. After we gained confidence, we began our approach and landing tests.”

– Bob Minor, former vice president and general manager, Boeing Space Systems division, talking about the crucial test flights of Enterprise after it was carried aloft on the back of a modified 747

PHOTO: Enterprise is released from the back of a modified 747 and subsequently glided to a landing at Edwards Air Force Base, Calif., Feb. 18, 1977. This critical early test flight proved the shuttle could fly and land like a glider. NASA
played a vital role in getting us to where we are today.”


During the history of the program, dignitaries, celebrities and public officials visited the Downey and Palmdale facilities. In 1982, some 6,000 employees welcomed President Ronald Reagan as he toured the plant and delivered a speech on America’s future in space. In 1983, England’s Queen Elizabeth II and Prince Philip visited the Downey plant. Jeffs led the queen on a tour and helped her to “fly” the space shuttle simulator.

The shuttle program enjoyed great success during the more than 130 missions. But there was also tragedy. On Jan. 28, 1986, Challenger exploded 73 seconds after liftoff, killing its seven-member crew. On Feb. 1, 2003, Columbia’s seven astronauts died when the vehicle broke up over Texas during re-entry. In both cases, lengthy investigations took place and a number of program changes were made before the fleet returned to flight.

Mulholland recalled that when Columbia was lost, Boeing employees didn’t hesitate to step forward to offer assistance. “It wasn’t 24 hours after the accident,” he said, “that we were getting calls from throughout Boeing offering expertise that proved to be vital, not only in reconstructing what had happened, but in making the changes necessary to return to flight.”

Mulholland said his two greatest memories of leading the shuttle program center around having a remarkable, history-making product, and working with an exceptionally talented, dedicated and loyal team.

“We’ve been very lucky, because there are very few programs that have spanned the amount of time that this one has,” Mulholland said. “And it’s just amazing how many people have stuck with it—in some cases, for their entire careers.”

PHOTO: It was a rare sight—two space shuttles on launch pads at Kennedy Space Center at the same time. But it happened in 2009 when Atlantis, foreground, waited on Launch Pad 39A for the final mission to service the Hubble Space Telescope, while Endeavour was on Launch Pad B. Once Atlantis lifted off, on May 11, Endeavour was moved to Pad 39A for the STS-136 mission to the space station. The two orbiters would subsequently make the final flights of the space shuttle program in 2011. NASA
Over the past three decades, the space shuttles hauled a variety of items into space—from small science experiments to major sections of the International Space Station.

“The space shuttle was designed primarily to operate like a truck, taking cargo into orbit and, in some cases, bringing things back,” said former shuttle astronaut Steve Oswald. “But I don’t think any of us imagined the full versatility of this vehicle and the kinds of payloads it would carry over the program’s 30-year history.”

Oswald, now chief operating officer, Information Solutions, Boeing Network & Space Systems, piloted two missions aboard Discovery in 1992 and 1993 and commanded Endeavour in March 1995. All three missions were primarily scientific. Oswald served as vice president and program manager of the Boeing Space Shuttle Program from 2001 to 2007.

Anita Gale, Associate Technical Fellow and senior project engineer, Space Shuttle Payload & Cargo Integration, said major shuttle payloads have included interplanetary probes, like the Galileo spacecraft in 1989, and a number of satellites.

One particularly challenging mission occurred in 1984, when Discovery retrieved two communications satellites that had been launched to the wrong orbits. Another major project was the deployment of the Hubble Space Telescope.

“Hubble was a huge, amazing integration process,” Gale said. “We worked for years to accommodate that one.”

The shuttle also was used to carry classified military payloads.

Don Stieler is the payload mechanical engineer- ing lead on the final space shuttle mission, STS-135, Atlantis, which is scheduled for July. He has supported shuttle flights at Kennedy Space Center since the beginning, missing only the first space shuttle launch in 1981.

“There’s a lot of emotion involved in preparing for this final flight,” Stieler said. “Everybody is keeping their focus. We want this mission to be the best.”

Mike Kinslow, a Boeing payloads flow manager at Kennedy Space Center, said payloads are generally loaded on the launch pad to allow late changes when needed. Some of the most challenging, he said, were orbiting observatories, which have sensitive sensors and optics, and interplanetary probes, which have their own fuel supply.

Scientific experiments contain living specimens, such as plants, insects or rodents. They have to be changed out if a mission is scrubbed.

“One team I supported had been working on a module for 20 years,” Kinslow said. “It’s been exciting to work with each of these teams and to be part of such an important program.”

PHOTOS: (Near right) Boeing employees Kevin Jackson, left, and Donald Stieler at Kennedy Space Center prepare a container packed with supplies that Atlantis will carry to the International Space Station on what will be the final flight of a space shuttle, a mission tentatively scheduled for July. (Middle) They are joined by Kevin Koby, shown at bottom of photo. (Far right) Stieler, from left, Koby and Jackson. BOB FERGUSON/BOEING

FROM MICE TO SPACE PROBES

Space shuttles hauled a variety of cargo into orbit—and sometimes back to Earth.

Over the past three decades, the space shuttles hauled a variety of items into space—from small science experiments to major sections of the International Space Station.

“The space shuttle was designed primarily to operate like a truck, taking cargo into orbit and, in some cases, bringing things back,” said former shuttle astronaut Steve Oswald. “But I don’t think any of us imagined the full versatility of this vehicle and the kinds of payloads it would carry over the program’s 30-year history.”

Oswald, now chief operating officer, Information Solutions, Boeing Network & Space Systems, piloted two missions aboard Discovery in 1992 and 1993 and commanded Endeavour in March 1995. All three missions were primarily scientific. Oswald served as vice president and program manager of the Boeing Space Shuttle Program from 2001 to 2007.

Anita Gale, Associate Technical Fellow and senior project engineer, Space Shuttle Payload & Cargo Integration, said major shuttle payloads have included interplanetary probes, like the Galileo spacecraft in 1989, and a number of satellites.

One particularly challenging mission occurred in 1984, when Discovery retrieved two communications satellites that had been launched to the wrong orbits. Another major project was the deployment of the Hubble Space Telescope.

“Hubble was a huge, amazing integration process,” Gale said. “We worked for years to accommodate that one.”

The shuttle also was used to carry classified military payloads.
From Enterprise to Atlantis

Key dates in the U.S. shuttle program

July 20, 1969 – Neil Armstrong and Edwin Aldrin land the Apollo 11 lunar module on the surface of the moon.

Jan. 5, 1972 – An advisory panel appointed by the president recommends the development of a new space transportation capability.

Aug. 29, 1979 – Discovery is launched on its first mission.

Aug. 27, 1985 – Challenger launches on its first mission.

Jan. 28, 1986 – Challenger explodes 73 seconds after liftoff; 7 astronauts lose their lives.


April 12, 1981 – Columbia becomes the first space shuttle to orbit Earth.


July 23, 1999 – Columbia launches from Kennedy Space Center with the Chandra X-ray Observatory. It becomes the third observatory to be deployed by a shuttle, beginning with the Hubble Space Telescope in 1990.

Feb. 7, 2001 – Atlantis launches on its 16th flight, the longest shuttle mission to the International Space Station to date.

Oct. 11, 2008 – Endeavour begins a 16-day flight, the longest shuttle mission to the International Space Station to date.

July 20, 2009 – Space Shuttle Atlantis on Approach to the International Space Station.


June 29, 1995 – Atlantis docks with the Russian space station Mir, marking the first time the two nations docked in space since the 1975 Apollo-Soyuz project.


April 14, 1990 – The Hubble Space Telescope is deployed from Space Shuttle Discovery.

April 25, 1990 – The Hubble Space Telescope is deployed from Space Shuttle Discovery.

Dec. 1, 1990 – Endeavour launches for the first time. It includes a number of technical improvements, including the first use of a drag chute during landing.

April 17, 1993 – Apollo launches, carrying with it the Galileo/Jupiter Spacecraft and the Inertial Upper Stage. Galileo is sent on a six-year trip to Jupiter.

July 26, 2005 – The space shuttle program returns to flight with the launch of Atlantis.

March 11, 2008 – Endeavour launches on a 16-day flight, the longest shuttle mission to the International Space Station to date.

May 15, 2009 – The crew of Atlantis returns to Earth on the shuttle’s 12th mission to the International Space Station.

Oct. 10, 2008 – Endeavour launches on a 16-day flight, the longest shuttle mission to the International Space Station to date.

Oct. 19, 2009 – Endeavour launches on a 16-day flight. The flight is delayed due to extended weather delays.

Jan. 14, 2004 – President George W. Bush announces a new Vision for Space Exploration. The shuttle’s chief purpose will be to help finish the assembly of the International Space Station. Afterward, the shuttle fleet will be retired.

Feb. 1, 2003 – Columbia and its seven astronauts are lost when the space shuttle breaks up over Texas during re-entry.

March 11, 2008 – Endeavour launches on a 16-day flight, the longest shuttle mission to the International Space Station to date.

June 29, 2009 – The space shuttle program returns to flight with the launch of Endeavour.

July 26, 2005 – The shuttle program returns to flight with the launch of Atlantis.

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**The right stuff**

Space shuttle fleet opened new frontiers for space exploration

**Enterprise**

It was not designed to go into space—but the shuttle carrier rocket that launched several space shuttles was itself a rocket. Enterprise’s first flight off Pad A at Kennedy Space Center on May 25, 1977,000 feet into space and then gliding to a safe landing. The jet-powered shuttle could fly and land like a glider, in preparation to demonstrate the orbiter’s flight characteristics. It brought the dream to life that is the space shuttle program, a mission tentatively scheduled for July 1983. Named after a British naval research vessel that sailed the Atlantic and Pacific oceans in the 1870s, Enterprise was the first of the shuttles to carry Spacelab—a medical research lab that allowed astronauts to conduct experiments in the space shuttle’s cargo hold—in orbit, in June 1991. Columbia was destroyed and its crew of seven was destroyed and its crew of seven died when the shuttle broke up while re-entering Earth’s atmosphere for landing on Feb. 1, 2003.

**Columbia**

The first shuttle to be launched, on April 12, 1981, Columbia was named after the American ship that explored the South Atlantic and the Pacific. Enterprise was always amazed at how well the machine the orbiter really was.”

**Challenger**

Endeavour

“The fifth and last of the shuttles, Endeavour was built as a replacement for the Challenger when it was not to be新建的。Endeavour first flew into space on April 4, 1984. Named after a British ship that sailed the Pacific and the Indian oceans in the 16th century, Endeavour carried on the back of a 747 and released above Edwards Air Force Base, Calif., Oct. 30, 1984. One of its most notable missions came in November 1985 when it deployed into orbit the Hubble Space Telescope. Endeavour was the last of the shuttles to land at Kennedy Space Center and the first to land at Edwards Air Force Base.

**Discovery**

On Feb. 18, 1977, Discovery was the first shuttle to be launched and to land at Kennedy Space Center. It was the second orbiter to join the shuttle fleet, Challenger first flew into space on April 4, 1983. Named after a British ship that sailed the Indian Ocean, Discovery carried on the back of a 747 and released above Edwards Air Force Base, Calif., Aug. 30, 1984. One of its most notable missions came in April 1988 when it deployed into orbit the Hubble Space Telescope.

**Atlantis**

Endeavour’s first flight to the International Space Station, when it carried the Boeing-built Unity node into orbit in December 1998. The node was attached by astronauts to a Russian-built module. Columbia was the first of the shuttles to carry Spacelab—a medical research lab that allowed astronauts to conduct experiments in the space shuttle’s cargo hold, in June 1991. Columbia was destroyed and its crew of seven died when the shuttle broke up after re-entering Earth’s atmosphere for landing on Feb. 1, 2003.

**Challenger**


**Atlantis**

Atlantis was launched on its first mission on Aug. 30, 1985. One of its most notable missions was in 1986 when Discovery was assigned to the Atlantis flight after the Challenger explosion. In November 1985, when he discovered the Hawaiian Islands.

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**Challenger**

“We’re just on the cusp of revolutionizing human access to space. What I’m really excited about is the next 50 years and what we’re going to be able to achieve. I believe it’s going to be as remarkable as the achievements of the past 50 years.”

– John Mulholland, vice president and program manager, Boeing Space Shuttle Program
When Europeans consider a holiday, whether it’s a luxury cruise, Antarctic expedition or anything in between, chances are they turn to TUI Travel or one of its subsidiaries for a comprehensive package that not only takes them where they want to go but also takes care of all their needs when they get there.

Operating in 180 countries and headquartered in the United Kingdom, TUI Travel is the world’s leading international leisure travel company, offering every sort of vacation a consumer can dream up. Heavily concentrated in Europe, TUI Travel serves more than 30 million customers a year in 27 key markets. The only leisure travel firm listed on the London Stock Exchange, the company employs 49,000 people.

The TUI Travel umbrella includes seven airlines, all of which operate Boeing airplanes. In the U.K., one of its largest markets, the company operates under the Thomson brand, offering every facet of a vacation, including air transportation on Thomson Airways.

“A traveler’s holiday starts the moment they step on the airplane,” said Chris Browne, managing director of Thomson Airways, the U.K.’s largest charter airline and third-largest airline.

Fundamental to the company’s continued success, Browne said, is its relationship with Boeing.

“We are joined at the hip,” she said. Thomson Airways operates 737 and 757 Boeing airplanes and has ordered the 787 Dreamliner.

“Having the 787 in our fleet will allow us to expand our offerings to more exotic locations, given the 787’s range, capacity and scale,” Browne said. “It will take our customers where they want to go.”

TUI Travel was an early customer for the 787 and has 13 Dreamliners on order for four of its seven airlines: Thomson Airways; TUIfly Nordic, representing the Scandinavian region; Jetairfly, based in Belgium; and Arkefly in the Netherlands. Other airlines operated by TUI Travel are Corsairfly in France; Jet4you.com in Morocco; and TUIfly Germany.

Browne said she has been a fan of the 787 since it was on the drawing board and that it offers unrivaled qualities and will be less expensive to operate. “With higher fuel costs, it is even more compelling to have the 787,” she said.

TUI Travel also is launch customer for Boeing’s GoldCare maintenance, repair and support services program for the 787.

“We’ve put our faith and trust in Boeing with the 787 and that Boeing is the best one to look after the aircraft,” Browne said.

TUI Travel’s standards for customer service, value and responsibility push its suppliers, including Boeing, to perform at their highest levels, according to Debra Santos, Boeing sales director for the group.

“They deliver the best possible product to their customers, and our products are a means to do this. They work extremely hard, always try to find a way and have very high expectations. If we didn’t always deliver the highest-quality products, they would not work with us.”

That working-together collaborative spirit, Santos said, results in benefits for both companies.

“They made a commitment with the 787 and have stayed with us,” Santos said of TUI Travel. “They look to Boeing for lifelong products and services with the 787 and GoldCare.”

Successful partnerships mean understanding each other’s business, Browne added.

“Boeing understands our business better than anyone else,” she said. “We’re a holiday carrier, not a scheduled carrier, and that is a big difference.”

Marcy Woodhull

The world’s leading international leisure travel company enjoys a special relationship with Boeing—and its jets.

By Marcy Woodhull

“Having the 787 in our fleet will allow us to expand our offerings to more exotic locations, given the 787’s range, capacity and scale. It will take our customers where they want to go.”
– Chris Browne, managing director of Thomson Airways

PHOTO: Chris Browne, managing director of Thomson Airways, at last year’s Farnborough International Airshow in the United Kingdom.

PHOTO ILLUSTRATION: A 787 Dreamliner, shown here in Thomson livery.

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PHOTO: Thomson Airways, shown here in 787 Dreamliner livery.

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“Nothing worked adequately.”
But Amell and his colleagues eventually found a solution by working with a company that manufactures a “zero gravity” mechanical arm.

“It’s like a pressure washer, and is far more effective than manual cleaning,” Osborne said.

The machine not only cuts the work time by a third but also reduces risk factors associated with repetitive motion, awkward movements, bending and lifting heavy buckets. It also reduces costs for chemicals and equipment.

“And, most important, it does an amazing job,” Osborne said. “We’ve had so many compliments on the cleanliness of the restrooms, and we’ve had more than 175 days without a lost workday due to injury. The staff goes home feeling more energetic and not aching after a day at work.”

While new technology is making it easier for employees to do their jobs, it’s also important to have a better understanding of where technology can help make a difference.

At the Everett, Wash., site, for example, advanced data-visualization software is being used to understand the relationship between injury data and production data. “This is allowing us to understand where we have the highest risk of injury,” said Melissa Findlay, a Boeing Research & Technology ergonomist who leads implementation of this software. “We are able to mitigate risk and prevent injuries by focusing our resources on solutions in the areas at highest risk for injury.”

For those Boeing wing sanders, the solution was a mechanical arm that allows them to maneuver objects as if they were weightless. Working with the company that created the tool, Amell and his Boeing colleagues developed an attachment for the mechanical arm to hold the sander. It’s easy to grip, and employees can maintain better posture when sanding with far less shoulder stress and exposure to vibration. Boeing Research & Technology is looking at opportunities to replicate this solution throughout Boeing manufacturing processes.

“We’re always working,” Amell said, “on better tools and design processes to help people do their jobs without injuries.”

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To learn more about Boeing efforts to improve workplace safety and find improvement resources, visit the Safety Now website at http://safetynow.web.boeing.com on the Boeing intranet.

PHOTOS: (From far left) In Everett, Wash., Chuck Olinzock uses a mechanical “arm” for safer sanding of a 787. In Renton, Wash., Factory Services’ Chandelle Osborne uses an indoor pressure washer that reduces the risk of ergonomic injury. In Everett, Wash., 747 Final Assembly mechanic Scott DeLack uses a rivet squeezer that is ergonomically safer than a rivet gun.
Preparing Boeing aircraft for the Paris Air Show is like making a movie—with a cast of many.

By Terri Christofferson and photos by Jim Anderson

Like pilots who fly the aircraft, this Boeing team has its own “checklist” that must be completed in order to make the show.

As in the Paris Air Show, grandaddy of all the international air shows, which takes place this month in France. Long before air-show visitors have the opportunity to get up close to the aircraft, a team of Boeing Test & Evaluation employees has crafted detailed plans to get Boeing products to the show—and get them on display safely. It is part of the broad range of duties the test organization handles to provide high-quality services that support the company’s many business programs.

The test director has a master plan for the entire trip, similar to a script for a movie. Jasper Corleis, a lead Flight Test Operations engineer and test director, described the effort as a well-orchestrated event that involves dozens of people behind the scenes.

Boeing is working to bring several products for static display during this year’s air show. From fuel loading to the route taken, from weather checks to security on the ground, Flight Test Operations is responsible for coordinating all the necessary pieces.

“We are only a part of a larger team that works together to make things happen,” Corleis said. “We have the airport technology experts who tell us the surface strength of runways, weight and balance experts who tell us how much the airplane weighs, and countless others who make this possible.”

Prior to departure, Flight Test Operations will conduct a readiness review, which includes the pilots as well as representatives from Dispatch, Weights & Balance, Test Integration, Ground Operations, Quality, Manufacturing, International Security Activity, Global Trade Control, Test Program Management, and Instrumentation.

The safety of the people and the airplane come first; mission objectives, second. Safety preparations for the show include checking that the site has adequate facilities and required tools, and ensuring that security personnel, both local and from Boeing, are in place. Coordination also is needed with catering and scheduling to make sure the flight team is fed and well-rested before and during the flight.

The planning heavily involves Ground Operations, which has two main responsibilities: managing test airplane configuration and serving as onboard cabin safety representatives during testing and general operations. A two-day class is mandatory for Ground Operations and focuses on aviation safety, from treating minor injuries to evacuation exercises.

During the training, the team responds to simulated emergencies—fire, power outages and injuries. In a swimming pool, fully clothed participants learn techniques for floating, moving around the cabin, especially when casual observers are present.

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Ground Operations determines areas of the airplane that are safe for general access, taking into consideration hot or cold surfaces, test installations, and more. The team makes sure everyone is safe moving around the cabin, especially when casual observers are present.

“We are only a part of a larger team that works together to make things happen."

— Jasper Corleis, a lead Flight Test Operations engineer and test director

PHOTOS: (Left) Jasper Corleis, left, and Willie Matthewson are part of the team that creates and executes plans to get Boeing products to key public gatherings such as this month’s Paris Air Show. (Above) Rodney Tong, from left, Mike Rosenzweig, Becki Neel, Janice Denard and Charles Hartshorne inspect safety gear that’s put on aircraft appearing at air shows.

Hatches, which allow access to the lower part of the airplane, are secured during static display and sharp edges are shielded to prevent injuries. Willie Matthewson, a lead Ground Operations engineer, is a cabin safety expert for Experimental Flight Test programs.

“In a public venue,” he said, “the airplane can be touched, toured or have restricted access. We’ve got to be ready for all the options.”

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Creating the right culture is key to reducing workplace injuries

By Marcy Woodhull

A n Apache Longbow team in Mesa, Ariz., was on a mission: how to install 140-pound (64-kilogram) seats in the AH-64D model while reducing the risk of potential injury or pain from back, shoulder, arm and leg strain … or worse.

But when a seat-loading machine arrived at the Apache helicopter production site in Mesa, it didn’t solve the problem.

Not only was it “tremendously heavy,” but the machine lacked sufficient clearance for the helicopter’s rotor blades, said David Renteria, a production flight-test technical inspector.

“We tried to make it work,” he said, “but ended up not using it and it just sat there collecting dust.”

Challenged to make the seat loader usable, Renteria and his Employee Involvement team worked with Oscar Mortera of Boeing Research & Technology and conducted an ergonomic assessment and analysis.

“With each person’s input, we sent our improvements to have the seat loader right-sized,” Renteria said.

The result: “Any individual of any size can now load a seat into the helicopter,” he said.

The experience not only made the local Moonshine Shop (a Lean+ activity that focuses on how processes can be improved) helpful employees come up with a hydraulic system for adjusting worktables to an employee’s height. Workers began asking for more ergonomic tools and the company responded. “I used to use air-powered tools with fittings that didn’t flex,” Marquardt said. “Now they move with my wrist.”

Marquardt said management’s commitment to safety and well-being has created an environment in the Auburn Machining and Emergent Operations organization where employees are engaged, their input is valued, and they are listened to by management.

“Our processes are constantly being revisited and tweaked,” she said. “People understand and believe that our organization and Boeing care about our health and well-being.”

Open communication, leaders who set the example and employee recognition are critical to a culture that promotes safety, according to Stephen Boone, leader of Environment, Health and Safety at the Boeing site in San Antonio, which provides maintenance and modification services for large aircraft.

“Safety and well-being are about more than ergonomics and processes,” Boone said. “They are based in people and their relationships with one another. … The motivation extends far beyond injuries. We truly care about employees not only staying safe and injury-free at work but also that they enjoy their personal time without pain or injury.”

There are many examples around Boeing where the culture has significantly contributed to improved workplace safety.

When Geri Marquardt arrived at the Commercial Airplanes Fabrication site in Auburn, Wash., in 1997 as a machined-parts finisher, employees were expected to work with the tools they were given. Workers began asking for more ergonomic tools and the company responded. “I used to use air-powered tools with fittings that didn’t flex,” Marquardt said. “Now they move with my wrist.”

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To learn more about Boeing efforts to improve workplace safety and to find improvement resources, visit the Safety Now website at http://safetynow.web.boeing.com or on the Boeing intranet.

“Management and employees are working together, sharing the value of safety, listening to each other and caring about each other’s welfare.”

– David Renteria, production flight-test technical inspector, Boeing Defense, Space & Security

PHOTOS: (Far left) David Renteria, left, and Oscar Mortera inspect a machine that loads seats into the AH-64D Apache Longbow attack helicopter. (Left) In Auburn, Wash., machined-parts finisher Geri Marquardt uses a tool with a fitting that swivels as her wrist moves, so she can comfortably guide the tool around small parts used on Boeing commercial jetliners. (Middle) Boeing Defense, Space & Security – Marcy Woodhull/Boeing

For more information on the Boeing process, visit the Safety Now website at http://safetynow.web.boeing.com or on the Boeing intranet.
Boeing’s international strategy focuses on mutually beneficial partnerships

By Bill Seil

Around the globe, Boeing is developing partnerships that benefit its customers, business partners and local economies. In return, the company is strengthened by growing sales and tapping the best technologies the world has to offer.

In 2010, sales outside the United States accounted for 41 percent of Boeing’s revenue. That number is expected to increase significantly over the next few years.

More than 80 percent of the Boeing Commercial Airplanes’ backlog is for jetliners ordered by non-U.S. customers. And international sales are rapidly increasing as a portion of Boeing Defense, Space & Security’s total revenue.

Shep Hill, president, Boeing International, said Boeing has long focused on providing the best and most innovative products and services at affordable prices. The company also has worked to meet the specific needs of individual customers and regions.

“Doing business in today’s global economy also means differentiating ourselves in terms of the partnerships we establish within each country,” he said. “That includes local suppliers, universities, research talent and charitable institutions. It’s all about having a meaningful, mutually beneficial presence.”

Boeing’s international strategy supports the strategies of its business units and aligns with the expectations and aspirations of the countries in which it operates. In doing so, the company values diversity and is sensitive to local laws and customs.

Boeing is enhancing its presence internationally by hiring local talent and deploying U.S. employees at key locations around the world. More than 8,500 of Boeing’s 164,000 employees work outside the United States.

This strategy also involves establishing and strengthening research and development partnerships worldwide, as international markets fuel R&D growth.

The amount spent worldwide on research and development grew from $790 billion in 2002 to $1.15 trillion in 2007, according to the United Nations Educational, Scientific and Cultural Organization. This is the most recent figure available and reflects increased activity in Asia.

Boeing’s expansive portfolio of global research and development partnerships includes entities from 35 nations for research in diverse areas including biofuels, manufacturing processes, structures and robotics.

“Because there’s more than $1 trillion of investment in technology development around the world, it’s in Boeing’s interest to develop mutually beneficial research partnerships with institutions across the globe to leverage those investments for the sake of our customers,” said John Tracy, Boeing chief technology officer and senior vice president, Engineering, Operations & Technology. “These partnerships provide us access to advanced technologies that can improve our products and make us more competitive,” he added. “And by working with these institutions and establishing international research sites, we demonstrate that we’re committed to building a long-term presence in important markets.”

In addition to providing the best, most advanced products, the company is continually increasing its ability to provide outstanding customer service, quickly and effectively, throughout the world.

Read more about the global strategies for Boeing Commercial Airplanes and Defense, Space & Security on the following pages.

PHOTOS: Boeing’s partnerships around the world are fueling growth in research and development and making the company more competitive.

(Clockwise, from top left) Composites research in the United Kingdom; new manufacturing methods in Spain; the 787 Dreamliner; research in unmanned airborne systems; aerodynamic testing using wind tunnels; and superconducting applications.

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Expanding its international business is critical to the growth of Boeing Defense, Space & Security

By Paul Lewis

The clock back to 2005 and international sales generated little more than 7 percent of overall revenue for Boeing’s defense business. Sales at that time were overwhelmingly driven by domestic demand, while countries such as Brazil, India or Qatar were faraway places few knew little about.

Fast-forward to today and the picture is very different. Output of Boeing-built fighters, airlifters and surveillance systems is increasingly reliant on orders from the Middle East, South Asia and the Far East. Look no further than the delivery ramps in St. Louis, Long Beach, Calif., or Boeing Field in Seattle, where there are F-15S destined for South Korea, C-17As for the United Arab Emirates or 737 Airborne Early Warning & Control aircraft for Australia, to name just a few of Boeing’s lengthening list of international clientele.

Export sales last year accounted for almost 18 percent of Boeing Defense, Space & Security’s nearly $31.9 billion in revenue, and this impressive rate of growth is not expected to level off anytime soon.

Dennis Muilenburg, president and CEO of Boeing Defense, Space & Security, has flagged international growth as one of five strategic objectives for Accelerated Change, and in January he raised the bar for export sales to 25 percent or more of overall revenue by 2013.

The task of finding this new business falls to the International Business Development organization in Defense, Space & Security. Mark Kronenberg, vice president of International Business Development, said the challenge is not just reaching 25 percent or more but sustaining that level of activity over the long haul.

“There are overwhelming evidence of global markets fueled by demand to recapitalize fighter aircraft, potential new partners,” Kronenberg said.

Leveraging “One Boeing” has proved especially important in those markets new to Defense, Space & Security but where Commercial Airlines has enjoyed a long-standing presence. India is a good example. Until recently India was inaccessible to Defense, Space & Security and other U.S. defense companies, whereas Commercial Airlines has enjoyed a 70-year history.

When in 2005 the doors to Delhi began to open to U.S. contractors, Defense, Space & Security quickly established a presence, thanks to Commercial Airlines. Success came in 2009 with an Indian Navy order for eight P-8I maritime patrol aircraft.

To be successful in today’s highly competitive international environment, it is increasingly important to partner with both local companies and other global players. Teamwork brings access to markets that might otherwise be off-limits, potential new technology and talent, as well as opportunities for industrial participation.

Over the past 30 years, Boeing has successfully implemented programs in nearly 40 countries, delivering benefits of more than $41 billion on time or ahead of schedule.

Such programs go by many names: industrial cooperation, industrial benefits and offsets, to name a few. Whichever the name, the overall goal is the same: to fuel economic flow-back to a customer country as a result of that government’s procurement of goods and services from Boeing.

Boeing currently has 53 active industrial programs worth more than $17 billion in 22 countries, representing more than 15 Boeing products. In the next five years, Defense, Space & Security alone is looking at another $34 billion in potential industrial programs as it pursues expanded international sales.

“We draw on the breadth and depth of Boeing to tailor each program to meet the specific requirements of the customer and to address the industrial development objectives of that country,” said Gwen Kopsie, director of the organization working across Boeing businesses to shape how and whom the company works with globally to best support the growth strategy for Defense, Space & Security.

Boeing already boasts a chain of long-standing alliances around the world with well-known players. Japanese industry over the years has built a large number of Boeing programs under license such as the F-15J, CH-47J Chinook and Apache. Korea Aerospace Industries produces major assemblies for the AH-64 Apache, A-10 and F-15 programs, while Boeing recently teamed with Italy’s Finmeccanica to win a major training contract in Singapore.

The emergence of new growth markets brings with it potential new partners.

“The Middle East is now one of BDS’ fastest-growing markets fueled by demand to recapitalize fighter aircraft, a more robust portfolio of exportable products and, perhaps the most critical of all for ensuring repeat business, enhancing customer satisfaction.

A first step has been the reorganization of International Business Development and a significant strengthening of the team.

Critical, too, is staying closely aligned with Boeing Commercial Airlines, which today draws 80 percent of its business from overseas, and harnessing the reach of Boeing International and its worldwide network of country presidents.

“We must work across the enterprise as a single team if we are to succeed,” Kronenberg said.

“We must strive to be a truly global company if we’re going to be successful.”

– Mark Kronenberg, vice president of International Business Development
“Being able to nurture and harness local know-how and creativity through partnering is key to broadening BDS offerings and sustaining international growth in the long term.”

— Gwen Kopsie, director of International Strategic Partnerships, Boeing Defense, Space & Security

airlift, rotorcraft and airborne surveillance capabilities,” said Paul Oliver, International Business Development regional director for the Middle East and Africa.

Today, Defense, Space & Security has some 2,600 employees based in 30 countries, the largest number of which work for Boeing Defence UK and Boeing Defence Australia. (See March 2011 Frontiers, Page 38.)

Boeing’s global footprint continues to grow and broaden into other markets.

In the past 12 months, Defense, Space & Security established a presence in Qatar and added to its worldwide network of analysis modeling, simulation and experimentation centers with a new facility in Bengaluru, India.

“Being able to nurture and harness local know-how and creativity through partnering is key to broadening BDS offerings and sustaining international growth in the long term,” Kopsie said.

The acquisition of companies such as Insitu, Narus, Argon ST and Tapestry Solutions has also served to provide greater depth and breadth. With these additions has come access to new and previously untapped international markets like cybersecurity, logistics command and control, and networked and unmanned systems.

For Defense, Space & Security to sustain 25 percent plus of international revenue over the long haul, customer satisfaction is an indispensable component.

“The impression we make, the trust we build and the promises we keep,” Kronenberg said, “are the most important elements to ensuring our customers and industry partners keep coming back to BDS.”

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PHOTOS: (Above, from left) A Peace Eye Airborne Early Warning & Control aircraft for the Republic of Korea is shown in flight.

PHOTOS: (Above, from left) Under license, Japanese industry builds the CH-47J Chinook. 

PHOTOS: (Above, from left) New fuel-efficient and quieter GEnx engines boost performance of the 747-8 Intercontinental on long-haul international routes. (Glen Ryan/Boeing) The Boeing Commercial Airplanes Operations Center answers urgent service requests around-the-clock from airlines operating more than 12,000 Boeing airplanes globally. (Richard Ling/Boeing)

PHOTOS: (Above, from left) Japa

FORWARD DEPLOYMENT

Close relationships with global customers is key to Commercial Airplanes’ success

By Bill Seil

The more than 12,000 Boeing commercial jetliners in service around the world bring people together and help shape the global economy.

Boeing Commercial Airplanes has a global network that supports the maintenance and operation of these airplanes. It also has sales representatives based throughout the world who help airline customers to expand and upgrade their fleets and make their operations run more efficiently. In addition, the company has a worldwide network that works with its international suppliers.

Boeing’s Current Market Outlook report, which forecasts growth over the next 20 years, projects that the number of commercial airplanes worldwide will nearly double by 2029—increasing from 18,890 airplanes to 36,300. During that period, airplane deliveries for fleet growth and replacement of aging airplanes is expected to total around 30,900. In addition, Boeing forecasts that over the next 20 years the world’s airlines will need nearly a half-million new pilots and nearly 600,000 new technicians to support that growth.

Marlin Dailey, senior vice president, Sales & Marketing, said Commercial Airplanes is advancing a strategy of forward deployment—basing sales representatives near airline customers around the world. This has already taken place in Europe, the Middle East, Australia, China and throughout Asia. It helps the sales teams to get an even closer understanding of customers’ complex needs, build deeper relationships, and leverage company resources to more effectively support customers’ business objectives.

“We tend to be most effective in areas where we live with our customers,” Dailey said. “The more time we spend with our customers and become embedded with their businesses, the more successful we’re likely to be.”

The company is also making a greater effort to add local hires to its sales force around the world.

While the international market is currently outperforming U.S. sales, Dailey noted that markets fluctuate and U.S. sales will spring back.

“Today’s market is very dynamic and can change very quickly,” Dailey said. “So our ability to be nimble and be responsive will be increasingly important as we move forward.”

Supporting the existing worldwide fleet of Boeing jetliners is a complex task. A division of Boeing Commercial Airplanes,
Commercial Aviation Services, or CAS, offers a portfolio of products, services and support aimed at helping airlines maximize the lifetime value of their fleets and operations, providing them with a competitive edge in their markets.

“We have aligned our business with the way our customers operate,” said Lou Mancini, senior vice president, Commercial Aviation Services. “Services that are vital to airline operations are located as close to the customer as possible.”

He pointed out that Commercial Aviation Services has eight spare-part distribution locations in the United States, Europe, the Middle East and Asia. They are staffed around-the-clock with an inventory of roughly 500,000 different types of parts.

In addition to day-to-day services, Commercial Aviation Services has pioneered digital tools to help speed airplane troubleshooting and manage the entire maintenance process of an airplane. One such tool, Airplane Health Management, is an integrated family of information products and services that collects, monitors and analyzes real-time airplane performance data, helping identify future maintenance needs.

Commercial Aviation Services oversees subsidiaries Aviall, AeroInfo, Continental DataGraphics, Inventory Locator Service and Jeppesen, as well as joint ventures Aviation Partners Boeing and Boeing Shanghai Aviation Services.

Assembly of Boeing jetliners is supported by an extensive global supply chain. At an enterprise level, Boeing leads 5,400 direct supplier manufacturing sites worldwide. Supplier management representatives are based both regionally and on-site to ensure integration and alignment throughout the Commercial Airplanes’ value stream.

“The success of our supply chain is directly related to the success of Boeing,” said Ray Conner, vice president and general manager, Supply Chain Management & Operations. “Strong relationships with our suppliers are just as important as our relationships with our customers. We are all linked, so it’s really in our best interest to work seamlessly together to execute the same plan and strategy.”

— Ray Conner, vice president and general manager,
Supply Chain Management & Operations

PHOTOS: (Above, from left) An employee of Boeing subsidiary Aviall uses a bar code scanner to verify a shipment to one of the company’s 40 global stocking locations. | Below: A Boeing Shanghai technician works on an aircraft engine at the maintenance, repair and overhaul facility.

“The sky’s the limit

The story of the Next-Generation 737 is one of continuous improvement

By Dawselee Griffin and photos by Bob Ferguson

At first glance, the airplane landing at Boeing Field in Seattle doesn’t look any different from other 737-800s. But this airplane, fully fueled, can fly farther than any 737 before it, thanks to the engine and aerodynamic improvements it is testing.

The most visible sign that this airplane is different is the new, more teardrop-shaped anti-collision light. The streamlined light is more aerodynamic than the familiar pillbox shape—something that looks like it belongs on a police cruiser.

Other improvements on the test airplane include alterations to the airframe to reduce drag, as well as enhancements to the CFM engine.

This performance improvement package gives operators about 2 percent better
performance than the current models,” said John Hamilton, 737 chief project engineer.

That wasn't sound like much, but it could add up to $12,000 a year in fuel savings, depending on the cost of fuel, according to Hamilton. And 2 percent equals 470 tons (430 metric tons) less carbon emitted per airplane annually.

There are just the latest improvements Boeing has made to its Next-Generation 737 family.

Hamilton calls it “investing in the product.”

That investment began shortly after the Next-Generation 737 entered service. Over the past 13 years, improvements have ranged from performance improvements to a new interior to improved reliability and enhanced navigation aids—always pushing the boundaries to find ways to increase value for the customer.

“We want to make our product even better going forward,” Hamilton said. “We share the results of our studies and procedures that enable pilots to make more direct approaches, to improve efficiencies in the air traffic system, and improving national costs in other ways, working with airlines and regulators.

“Other improvements developed since 2000 include the 737 Next-Generation family more efficient than its rivals, according to Hamilton. “And the company is working with airlines on navigation boundaries to find ways to increase value for the customer.}

“We’re improving the product every year since the Next-Generation went into service,” Hamilton said.

One of the first innovations came in 2002 when Boeing introduced what it calls the “737 Next-Generation.”

But performance improvements are only one area where Boeing is heading. As Boeing is to the airplanes, Hamilton said. “We share the results of our studies and get feedback from our customers about improvements they’d like to see.”

Some of those are included in the new 737 Boeing Sky Interior, with its open, roomy look. Boeing also continues to make improvements and cut operational costs in other ways, working with airlines and regulators to improve efficiencies in the air traffic system, and improving product quality on its already-efficient production line.

And the company is working with airlines on navigation procedures that enable pilots to make more direct approaches, and landing.

“In line with our legacy of continuously improving our products,” Hamilton said, “we’ll keep figuring out how we want to make our product even better going forward.”

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**SERVICE AWARDS:** Boeing recognizes the following employees in June for their years of service.

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**Milestones**

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**BOEING FRONTIERS / MILESTONES**

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**PHOTO:** Winglets, introduced in 2002, were one of the first performance improvements for the Next-Generation 737. Now, about 95 percent of the planes at the Renton, Wash., factory have winglets.

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**53BOEING FRONTIERS**

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IN MEMORIAM:
The Boeing Company offers condolences to the families and friends of the following employees:

Jesus Aranda, electric technician; service date Oct. 9, 2009; died May 10
James Davis, inspector; service date April 3, 1988; died May 12
Phillip De Teresi, security specialist; service date Dec. 10, 1993; died May 16
Robert Evans, system support technician; service date Sept. 2, 1980; died May 17
Craig Fetherby, painter; service date Oct. 1, 1984; died May 10
Deborah Gary, material processor; service date Jan. 27, 1989; died April 20
Larry Johnson, painter; service date Feb. 10, 1986; died April 24
Thomas Kane, mechanical system engineer; service date Oct. 13, 1995; died April 19
Dwayne Lien, painter; service date April 29, 1985; died May 3
Terry Marconi, material processor; service date July 4, 1993; died May 10

Kris Mathews, supplier program manager; service date Oct. 15, 1979; died April 27
John Murphy, logistics representative; service date Sept. 15, 1980; died April 22
William Owens, crane mechanic; service date Jan. 5, 1982; died May 1
Jake Piercy, employee development specialist; service date Feb. 27, 1990; died April 29
Michael Sandler, manufacturing planner; service date Sept. 24, 1981; died April 15
Claude Schnetzer, assembler mechanic; Dec. 28, 2009; died May 15
Norman Schober, toolmaker; service date June 14, 1979; died May 16
David Stephens, engineer; service date Feb. 11, 1985; died May 16
Judith Stickle, manufacturing planner; service date March 13, 1996; died May 1
Tom Thomas, air structure mechanic; service date April 28, 1986; died May 6

ETHICS QUESTIONS?
You can reach the Office of Ethics & Business Conduct at 888-970-7171; fax: 888-970-5330; website: http://ethics.whq.boeing.com

IAM PROMOTIONS
No promotions listed for periods ending April 29 and May 6, 13 and 20.

RETIREE QUESTIONS?
Call Boeing TotalAccess at 888-473-2016 and enter your BEMS ID or Social Security number. When asked, “How can I help you today?” say “Health & Insurance” or “Savings” or “Pension” and enter your TotalAccess password. If you do not know your password, say “Password Administration” and follow the instructions. Hearing-impaired callers with a telephone typewriter can access TotalAccess TTY/TDD service at 800-755-6383.

EYE AND THE NEEDLE
The giant radar vessel developed by Boeing for the U.S. Missile Defense Agency is a dramatic sight against the nighttime Seattle skyline and its famous Space Needle tower as the converted oil platform navigated last month to a local shipyard for maintenance. The Sea-based X-band Radar, or SBX, towers more than 280 feet (85 meters), from its keel to the top of the huge white radome. Designed to identify, track and assess the flight characteristics of ballistic missile threats, the sensor is a key component of the Ground-based Midcourse Defense system for which Boeing is prime contractor. Boeing won a $27.1 million contract to perform SBX maintenance and upgrades. PHOTO: DAVE HATSELL/BOEING