

# Q'ed up for SUCCESS

Doing the job right the first time drives productivity and cuts costs, and it is one of the simplest things you can do to make Boeing more competitive

By Kathy Cook

It's easy to measure quality in common products like a cup of coffee or a blockbuster movie. We're willing to pay three or four, even five dollars for a full-flavored, smooth and delicious brew. And \$100 million spent at the box office is a valid measure of success for a good film.

But how is quality evidenced in a global company as sophisticated as Boeing, with its diverse output of products and services?

Customers' willingness to repeatedly invest in Boeing products certainly suggests a high degree of excellence built into those products, as do consistently high rankings in customer satisfaction surveys and contractor rating systems. That many older models of Boeing aircraft are still flying—long after other aircraft have been retired—is a testament to their integrity.

Then there are the informal accolades from users of Boeing products. Republic of Korea pilot Lt. Col. Joo Il Kim recently attributed his achievement of 1,000 flight hours to the "superb performance" of the Boeing-built F-15K jet fighter.

## GOOD HABITS, FROM THE TOP

Boeing employees build gravity-defying machines that transport millions around the globe every day, that burst through the Earth's atmosphere to distant orbits, that protect countries against potential attacks. They also provide services that support customers in critical ways such as aircraft maintenance, pilot training and satellite operations. People's lives very often depend upon Boeing services and products.

Accordingly, quality can't just be an occasional act; it has to be a habit. Boeing leadership is committed to ensuring this is the case.

"Our Lean+ initiative provides us real opportunities to help our customers, reduce costs, improve productivity and free up money to invest in our future. First-time quality—which is the ultimate in efficiency—is what we're after," said Jim McNerney, Boeing chairman, president and CEO. "It means we don't create defects, we don't accept them, and we don't pass them on to anyone else. First-time quality makes winners of us all. It makes our company and our supplier-partners more competitive, because fundamentally it makes our customers more competitive."



"First-time quality ...  
is what we're after."

— Jim McNerney, Boeing chairman, president and CEO



**PHOTOS: (TOP)** Satisfying customer expectations for quality at Commercial Airplanes' Renton, Wash., factory includes kitting tools and parts, foreign object debris prevention and regular internal audits. **JIM COLEY/BOEING**

**(ABOVE)** The F-15K, shown above at 2008 Red Flag exercises at Nellis Air Force Base, Nev., is considered a superb performer by Republic of Korea pilots. **PETER GEORGE/BOEING**

“Every time we deliver a service or a product to a customer, our commitment is [to] perfection,” said Jim Albaugh, Integrated Defense Systems president and CEO. “Nothing less is acceptable. Our reputation depends on it, and more important, lives depend on it.”

“Our customers—and their passengers—depend on us daily for quality products and services,” said Scott Carson, Commercial Airplanes president and CEO. “So, of course, quality is a critical focus area across Commercial Airplanes. Quality also is directly linked to productivity. You can’t have one without the other. Driving quality is a necessary step toward improving productivity.”

## BUILT-IN STANDARDS

Also in place across the company are Quality organizations responsible for helping employees, teams, programs and businesses infuse quality into every part of Boeing. They are charged with identifying and deploying processes and tools for ensuring first-time quality.

In 2006, the Engineering, Operations & Technology organization was formed, creating enterprise Operations/Quality, Engineering and Supplier Management functions to better focus on improved integration and quality across Boeing. The organization’s senior vice president, John Tracy, is charged with attaining and maintaining technical and functional

excellence companywide. “To maintain our reputation and competitive edge, our products must be engineered with first-time quality, supplied with first-time quality and produced with first-time quality—all in a highly integrated manner,” Tracy said.

Leveraging this integrated approach is the Boeing Operations Leadership Team (BOLT), comprising Commercial Airplanes, IDS, EO&T and Shared Services Group executives in Manufacturing; Quality; Engineering; Supplier Management; Research & Technology; and Environment, Health and Safety. Through BOLT-supported Process Action Teams, employees identify and drive improved Operations/Quality processes, systems and replication across the company to achieve higher quality and significant savings.

Boeing has also played a leadership role in creating and improving AS9100, a widely adopted and standardized quality management system for the aerospace industry.

## MANY PEOPLE, ONE FACE

All of these efforts have one goal: Satisfy customers with first-time quality—which in turn not only affects the company’s bottom line but also makes Boeing an organization that people want to be a part of.

Tracy recently visited the Everett, Wash., factory, where the 747, 767, 777 and 787 are built. “We are an enterprise that creates the world’s most sophisticated and complex products, with reliability and safety records second to none,” he wrote on his employee blog after the visit. “The products, airplanes in this case, have been so successful that they have literally changed the way the world works by connecting people face to face. And the most exciting thing, even as good as the products are, [is that] we still aren’t satisfied with the quality, the reliability, the cost, the performance, etc. Everyone is focused on making things better and better. I feel very lucky to be working for such a great company, with such talented people, who make such incredible products.” ■

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“Quality is having pride in the work you do and ensuring that the work you’ve done at every level of the process gives our customers what they need ... because they depend on it. Producing a quality product is essential because there are a lot of people whose lives depend on what we do right here in the factory. A job done half right is all wrong.”

– Ed Kupsick, V-22 electrician,  
Rotorcraft Systems, Ridley Park, Pa.

FRED TROILO/BOEING



“My personal definition of quality includes the following words: honesty, integrity, workmanship, high standards and set processes. A quality product includes all of these traits. One thing that I have heard most of my career is ‘do by the book or change the book.’ This seems to be a good philosophy to live by.”

– Cyndi Ruble, assembly inspector,  
Material Review Board, Quality  
Assurance, St. Louis

PETER GEORGE/BOEING

# First-pass success

Integrated Defense Systems and Commercial Airplanes drive P-8A Poseidon quality starting at initial design

Although they come from different Boeing business units, Quality engineers Craig Brooks of Commercial Airplanes and Doug Bowers of Integrated Defense Systems share the same philosophy: A focus on quality early in a process will lead to greater success at the end.

So from the beginning of the program, Brooks, Bowers and their teammates have led a campaign to build quality into the earliest stages of designing the P-8A Poseidon, the U.S. Navy's new long-range anti-submarine warfare, anti-surface warfare, intelligence, surveillance and reconnaissance aircraft.

Their effort is one of the many reasons behind the success of the program to date, which is on plan for designing, building and testing the first five test aircraft. The Navy plans to purchase 117 P-8As to replace its fleet of P-3C aircraft. Initial operational capability is planned for 2013.

"Our idea was that if you inject the quality aspect upfront when you do the design, you won't have to deal with it out in the factory," said Brooks, who also has worked in Industrial Engineering and Manufacturing Engineering.

A substantial number of parts for the P-8A differ from those on the 737-800, its commercial sibling—including 75 percent of the structural parts. To reduce complexity, all structural features unique to the P-8A are incorporated in sequence during fabrication and assembly. In previous military derivative aircraft programs, Commercial Airplanes



**PHOTOS: (TOP)** T-2, the second P-8A flight-test airplane and the first to be painted in the U.S. Navy livery, soars through skies over the Pacific Northwest during its first flight on June 5. **WILEY NICHOLS/BOEING (ABOVE)** Quality engineers Craig Brooks (left) of Commercial Airplanes and Doug Bowers of Integrated Defense Systems worked together to build quality into the earliest stages of designing the P-8A, the U.S. Navy's new long-range anti-submarine warfare, anti-surface warfare, intelligence, surveillance and reconnaissance aircraft. **JIM ANDERON/BOEING**

## Factory mechanics participated in the review and provided great feedback.

– Doug Bowers, Quality engineer, Integrated Defense Systems

**PHOTOS:** By building quality into the earliest stages of designing the P-8A Poseidon, the program has been able to remain on plan designing, building and testing the first five test aircraft. The U.S. Navy plans to purchase 117 P-8As to replace its fleet of P-3C aircraft. **JIM ANDERSON/BOEING**

delivered a “green,” or newly completed aircraft without exterior paint and interior, to IDS, which would then have to tear it apart to make modifications.

“This relationship between Commercial Airplanes and IDS definitely has a different flavor than the modification programs I’ve been on in the past,” said Bowers, who worked on 767 AWACS and AEW&C (Airborne Warning and Control System and Airborne Early Warning and Control, respectively) aircraft programs. “It was great to have this kind of access to the design from the very beginning, and everyone knows we are doing the right thing in not tearing an airplane apart.”

The Quality teams from the two business units formed a “working together” team soon after the P-8 system development and demonstration contract was awarded in 2004. Team members leveraged best practices and lessons learned from defense and commercial programs. They mapped their processes and developed plans to bridge any gaps.

“We knew there was potential for issues because we had products and data crossing business unit boundaries,” Bowers said. “We did some dry runs, performed gap analyses and documented everything. Basically, by the time things started happening, we already had it solved.”

In addition, design processes were put in place that ensure programwide concurrence upfront. Meetings between Design Engineering, Manufacturing Engineering and Quality Engineering are required to

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– Craig Brooks, Quality engineer, Commercial Airplanes



review designs, and designs are scored objectively on a five-point scale. Those that score below 2.5 are returned for rework or a mitigation plan.

“Early in the program, about half our designs were making it through on first pass—now that’s up to about 95 percent,” Brooks said.

Factory mechanics also participated in the reviews.

“They provided great feedback,” Bowers said. “They’d tell us we had a good idea or that they had concerns.”

The years-long, working-together relationship in Quality has not only benefitted

the P-8A program, it also has increased knowledge and improved understanding for Quality teammates from both business units.

“We try to learn from them, and they try to learn from us and develop best practices,” Brooks said. “We’re all in this together, and we want to be successful. We stop worrying about which business unit we’re from and put our Boeing hats on.”

“We’re all just Quality,” Bowers said, “and that is all that really matters.”

– Dan Ivanis

# On the road to zero debris

Commercial Airplanes and Integrated Defense Systems share a goal: control of foreign object debris, or FOD, in the manufacturing process and its elimination from delivered airplanes or aircraft, every time.

“Our goal is to reach anyone who touches the airplane with ways to prevent FOD,” said Dan Swanburg, Commercial Airplanes’ FOD team leader.

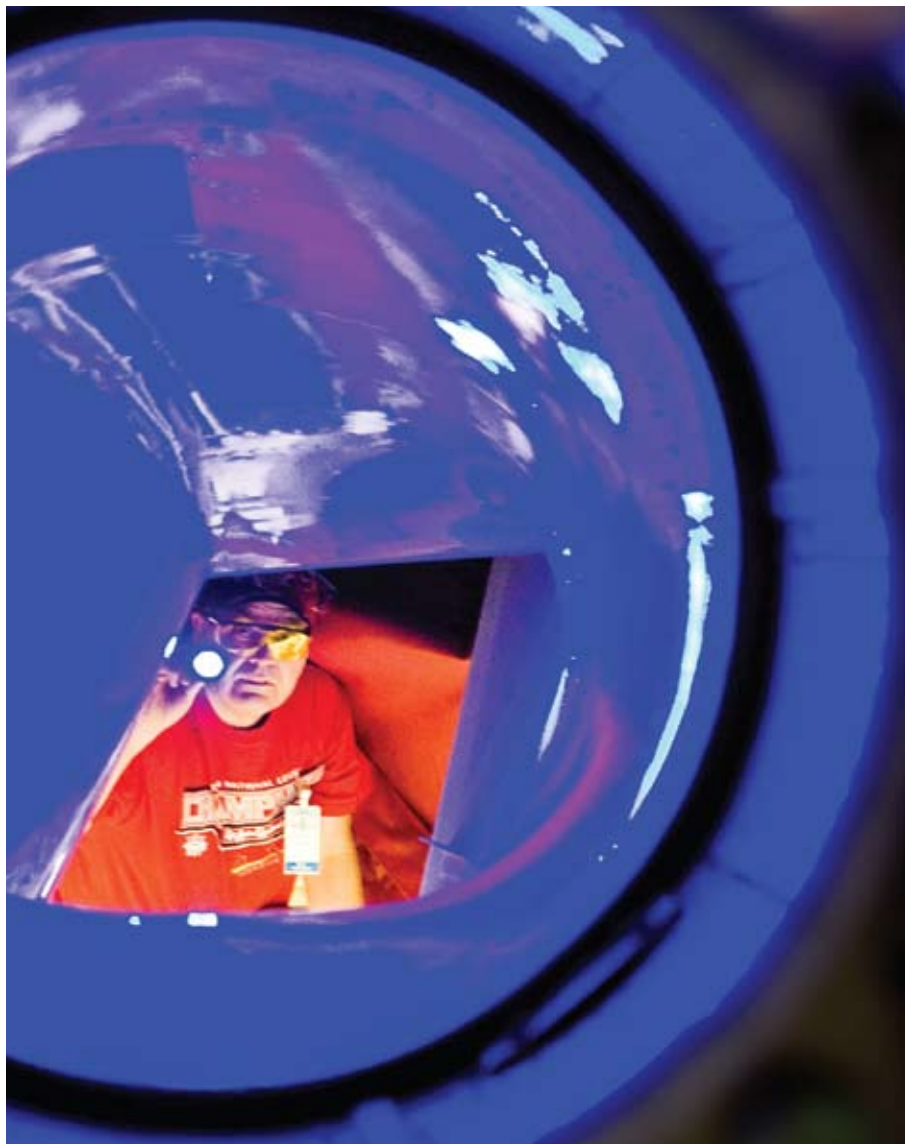
After a successful run of its enterprise-developed FOD exhibit last year, the Commercial Airplanes FOD team decided to focus its attention on specific issues inherent to that business. The team looked at real-life examples of found FOD, like this one:

An airline customer was investigating a loud rattle that came from the aft galley ceiling during flight. When the plane landed, a maintenance crew opened the ceiling and discovered a long wooden broom handle, apparently left there during production.

**Solution:** Brooms now are part of the 5S (sort, simplify, sweep, standardize and self-discipline) process and always have a place. “It’s easy to see where brooms should be returned,” Swanburg said. “In this case, there wasn’t a safety issue, but it was annoying to crew and passengers. There is a simple way to prevent it.”

The 2009 FOD exhibit uses interactive elements—video games and a challenge quiz—to enhance learning, Swanburg said. Attendees answer questions by touching a screen at an interactive kiosk or by testing their skills at a FOD-removal game.

“Every time we show a problem, we challenge them to find a solution,” Swanburg said. “We have processes in place to an-



**PHOTO:** Daniel Wagoner, sheet-metal assembler and riveter, F/A-18 Final Assembly, uses a special “blacklight” flashlight to check for foreign object debris (FOD) during the assembly process. The flashlight is part of a larger effort to improve FOD detection and elimination. PETER GEORGE/BOEING

swer every FOD situation. The challenge comes in ‘thinking’ FOD prevention all the time.” The new exhibit will make its debut at the National FOD Conference in Layton, Utah, Aug. 11–13. It will spend the rest of this and next year traveling to Commercial Airplanes sites in the United States and Canada.

## FOD FOCUS ENTERPRISEWIDE

Indeed, FOD prevention teams are driving Commercial Airplanes and Integrated Defense Systems to initiate myriad FOD prevention practices. Commercial Airplanes launched mandatory FOD training several years ago; it’s mandatory for all Manufacturing and Operations employees. Another process improvement in the works at IDS is a common tool accountability and control procedure, PRO-6865. An effort is under way to standardize this process across the company. Utilizing company best practices, several areas are piloting the use of “electronic toolboxes” that include tools embedded with passive radio frequency identification tags that are electronically linked to the box itself. To remove a tool, an employee must swipe his or her badge on a sensor on the box, so the system “knows” that a tool is gone from the box, and who removed that tool. At the end of a shift, all tools in the box must be returned and accounted for.

“Identifying and eliminating FOD in every way possible gives both Commercial Airplanes and IDS the ability to continue to produce the quality products customers deserve,” said Maryfrances Wolf, director, IDS FOD prevention.

Driving personal accountability is a top priority in the St. Louis FOD effort, according to Dave Thole, acting director of St. Louis production operations. “St. Louis has implemented several improvements, including incorporating specific FOD check sequences at critical steps in the build instructions that require operators to sign off that they’ve completed the necessary checks. It’s all about everyone taking personal responsibility for eliminating FOD.” Teams also are partnering with Advanced Manufacturing Technology to provide operators with tools that will limit or prevent debris in the assemblies, and enabling the high-performance work teams on the shop floor to know their FOD performance and identify how they will improve that performance.

Manufacturing and Quality organizations in St. Louis also are leading an effort to provide teams with specific feedback on how they’re doing in preventing FOD. The teams are conducting FOD assessments with the customer to better understand customer expectations on complying with the requirements. “We are also positively reinforcing superior performance at the team level,” said Thole. “We want to encourage our people to find the best solutions, because they are in the best position to know how to eliminate FOD, what the roadblocks are and how we can work most effectively to improve our performance.”

At IDS in Philadelphia, Obie Jones, Philadelphia site leader and director, Operations, Rotorcraft Systems, said the team is using every communication vehicle available to reach employees with FOD prevention information. “We’re trying to make it as easy and convenient as possible for everyone to access the information they need,” he said. IDS employees also sign a personal commitment to help eliminate FOD and improve quality and safety.

Since FOD can include anything used on the job, Philadelphia implemented a mandatory daily 5S process to prevent FOD from migrating into production areas. “It’s easy to drop earplugs, utensils, drill bits and even safety equipment,” said Bob Cassidy, Manufacturing director. “We’re enhancing product integrity through new security measures, including badge access to roped-off areas around aircraft. Single-point permission is required for entry into these areas to limit traffic on aircraft, which further protects products from FOD. “But it doesn’t stop there,” Cassidy added. “At the end of the day, the aircraft and surrounding areas are swept for anything left behind during our regular ‘clean-as-you-go’ processes. Toolboxes are audited to ensure that all tools are accounted for, and production workers and managers walk all areas to ensure they are FOD-free. It’s like that old saying, ‘A place for everything and everything in its place.’ The only difference is, this is serious business.”

– Bev Holland and Donna McGinley



“The work I do I want to be proud of. I want my customer to like my work and be happy with it. Quality means having pride in my work no matter how big or small the project.”

– Robert Miller, Shared Services Group welder, Wichita, Kan.

BEVERLY NOWAK/BOEING



“Quality is what is keeping our loved ones in the air, safe and alive. It should be sewn into everything we do.”

– Rebecca Robinson, procurement agent, Supplier Management, Rotorcraft Systems, Mesa, Ariz.

MIKE GOETTINGS/BOEING

# 10X: Simple changes = significant results

Hustle and bustle has become a regular way of life for people—so much so that we have a term to describe our efforts to respond to the many pressing demands on our time: “multitasking.” It’s shorthand for doing simultaneously as many things as possible, as quickly as possible.

Although the ability to track more than one task or project at a time is advantageous, dividing one’s attention in too many directions can result in wasted time and flawed results.

Accordingly, Integrated Defense Systems Engineering has initiated a program to decrease the risks of multitasking and to enhance quality. Named for its tenfold improvement potential, 10X consists of seven simple disciplines that anyone can apply to help ensure first-time quality, increase the amount of work completed in a given period of time, and create a more focused work environment. By applying these 10X disciplines, the first 100 projects enabled Engineering-led teams to, on average, improve output rate by 3.9X (290 percent) and quality by 4.2X (320 percent)—in less than two weeks.

Here’s 10X in a nutshell:

- Establish clear priorities.
- Focus and finish.
- To deliver work earlier, limit the amount that is processed at one time.
- Prepare—start to finish.
- Use checklists to prevent mistakes, defects and “traveled risk” (incomplete work passed on to the next workstation, which can cause problems later).
- Face and resolve issues quickly.
- Drive daily execution.

For more information, visit <http://10x.ids.web.boeing.com/index.aspx?com=102&id=1> on the Boeing intranet.



“Putting quality in the airplane exactly the way the customers want it, to meet or exceed their expectations; it just makes sense to give them what they purchased.”

— Jon Riddle, Commercial Airplanes team leader for systems installation, 767 Final Body Join, Everett, Wash.

GAIL HANUSA/BOEING



“Every individual has a responsibility for ensuring quality. Own it.”

— Kimm C. Parker, Quality engineer, F-15 Program, St. Louis

PETER GEORGE/BOEING



“Quality is having a happy customer the first time.”

— Gordon Wegan, Quality engineer, Boeing Research & Technology, St. Louis

RICHARD RAU/BOEING

# No big deal?

Think again—little mistakes such as a simple typo can add up to thousands of dollars in losses

Engineers prepare a document called an installation plan to guide manufacturing teams in how to assemble a product. The plan lists a particular operation and the steps to complete that operation. But those operations and the steps within each operation can fill several pages. To facilitate the operation, each step includes an illustration of the step on a “picture sheet.”

The complexities of the operations turn little errors into big headaches. One operation might seem simple: Install a bracket on a bulkhead. But when an engineer typed a “2” instead of a “3” in reference to a picture sheet reference in the installation plan, the manufacturing team looked at the wrong picture. The result was a bracket installed in the wrong place. The mistake was not found until the aircraft moved down the assembly line, where another team needed to install some other part that wouldn’t fit because there was a bracket in the way. The manufacturing teams had to take correc-

tive action, which required the team to research what was wrong and then correct the mistake. In this case, a simple typing error—something that took a fraction of a second to make—translated into hours of extra work in research, removing the bracket and reinstalling it in the correct position. And that extra time did not include documenting the problem, notifying the customer and doing extra engineering analysis to determine whether any unnecessary drilled holes affected the structural integrity of the product.

By the same token, taking a little time to address a small issue can save more than time and money—it can potentially save lives. When a Weapons Programs production team found what looked like a piece of brass during a foreign object debris walk—a check at the end of a production shift to find any stray materials on the floor—they didn’t merely pick it up. They examined it and determined it was part of a connector that had somehow broken off from a kit built in the shop.

Instead of disassembling dozens of kits to find the defective one, the team used a borescope, a magnifying glass at the end of a flexible tube, to inspect several kits. When they found the defective kit, they corrected it—before it ever shipped to the customer. They also took the extra step to determine how the part had broken off and added a verification step to ensure it couldn’t happen again. By doing the right thing, they not only saved time and money for Boeing but also guaranteed that the customer got a quality product that would not fail at a critical moment.

– Kathy Cook



“Quality means doing it right the first time. That’s very important because the products we build save lives.”

– Nicole Pugh, Patriot Advanced Capability-3 integration technician, Huntsville, Ala. MICHAEL MCCORMICK/BOEING



“Quality work involves discipline and paying attention to detail. Being consistent is critical.”

– Steve Hawkes, avionics technician 737 flight line, Renton, Wash. JIM ANDERSON/BOEING