

# Life on the cutting edge

**Boeing Portland touts world-class fabrication  
and metal-removal rates**

Machinist Dennis Higgs operates a Cramic milling machine at Boeing Portland. The airplane part is a flap track for the new 747-8. ED TURNER PHOTO



By BRENDA PITTSLEY

Uncut titanium may look like one of the large silvery pieces of driftwood that regularly wash up on Oregon's beaches. But on the Boeing Portland factory floor, the metal is hardly a piece of floating debris in terms of value. A 5,400-pound (2,449-kilogram) hunk of titanium is valued at six figures.

From the lumpy form of the metal will emerge a side-of-body chord, a part that attaches a wing to an airplane body. A finished part—destined for Boeing's airplane production facilities in Washington state—weighs 250 pounds (113 kilograms) and looks nothing like weathered wood. Giant tools carve the hard metal with geometric exactitude, whittle sharp edges and exquisitely polish rough surfaces.

The rate at which metal is stripped away to form a new part is the baseline on which Boeing measures its performance against the machining industry. And the Boeing Portland factory has one of the best metal-removal rates in the world. "It's fair to say our [metal-removal] rates are several times greater than most in the world," said Portland

nium 5553, Inconel (a nickel-based alloy) and Carpenter 465 (a type of stainless steel).

Boeing Portland's unassuming character is even reflected in its main lobby. There, a wall is covered with shelves full of plaques and framed documents. But the display has nothing to do with the site's industry or professional accomplishments. They are testimonials from school children, senior citizens and community organizations that have benefited from employees' volunteer efforts over the decades.

Not on display is the U.S. Federal Aviation Administration Aviation Safety Inspectors Recognition Award. This was presented to the site in May 2008 following an audit that one inspector said was his first in 20 years without a single write-up.

Also absent from the wall is the ISO 14001 certification from the International Organization for Standardization, recognizing the site's environmental policy, plans and actions. Portland is one of four Boeing sites with the certification (see Page 20 of the March 2008 *Boeing Frontiers*).

Nonetheless, Portland is attracting attention. The site's continuous improvement success has drawn the interest of manufacturing industry



Machinist Tony Truong loads a partially machined 737 landing-gear beam onto a hard-metal milling machine. ED TURNER PHOTO



Solid cobalt cutting tools like this one are used for finish profiling on the super profilers.

ED TURNER PHOTO

General Manager Jenette Ramos, who has visited the "titans of machine shops" in North America, Europe and Russia.

Located about 200 miles (320 kilometers) south of Seattle, Boeing Portland has a relatively low profile—but the factory is considered a center of excellence for complex machining.

"We're pretty self-contained here," said Mike Hallgrimson, project manager. "We're in a unique situation in that we have right here virtually everything we need to do business."

The Portland facility is the largest machining business unit in Boeing Commercial Airplanes. With around 1,600 employees at its 87-acre site, it isn't one of the state's largest employers, but it is one of the largest profile milling facilities in the world. It produces some 400 end-items from extremely hard, corrosion-resistant metals such as tita-

representatives from around the world. Since 2006, the site has hosted some 16,000 visitors from companies such as Nike, Toyota and Mitsubishi, who come to learn best practices. Even 30 members of the Oregon Air National Guard visited for a Lean learning event. "Once last year we had six countries represented in one day," Ramos said.

The visitors see things such as a state-of-the-art slotter machine that strips metal from a base form at a rate 13 times faster than the industry average. They also see 40-year-old workhorse metal-cutting machines that can mill Carpenter 465—a notoriously tough metal to cut—at a rate 290 percent above the industry average.

These metrics are "pretty significant accomplishments," said Ur-maze Naterwalla, tooling engineer and applications and testing specialist on the factory floor. "It puts us on the map for metal cutting."



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A coolant waterfall flows in the cutting zone of a super profiler.

ED TURNER PHOTO

The site is also on the map for safety. “Considering what we do with hard metal and the complexity of what we do, the Boeing Portland site is really safe,” explains Ron Breunig, a factory consumables handler in the grind shop where cutting tools are sharpened. “We are consistently one of the best performers in terms of safety.”

So, what’s behind Portland’s success? Ramos said it’s placing a premium on each employee’s value and focusing on a one-team, one-plan approach. “The underlying belief of our culture here is that every person has something important to do, and every person is vital,” she said.

Manufacturing Director Mike Starr said there are no silos in the Portland work environment, no isolated work groups that focus on narrow objectives rather than the big picture. This was reinforced when every employee received the 2008 Portland Site Expectations document, which aligns every person and function to company and site goals.

Other innovations introduced in the last three years at Portland include “line-of-sight teams,” an Employee Involvement (EI) program, flow lines and numerically controlled testing.

The line-of-sight teams place representatives from strategic work groups—managers, Lean leaders, industrial engineers, manufacturing engineers, supply chain analysts, quality assurance personnel and other support functions—together in one office directly on the factory floor to facilitate coordination and communication.

The EI program started in early 2007 with four teams and by June 2008 had grown to 45 teams with 410 people. These teams draw on worker expertise for on-floor decision making. “The benefit of EI is that it allows the work crews to self-manage their own areas, within their business boundaries. It allows them to shape the environment they work in,” Starr said.

Program manager Dennis Watson admitted EI had early skeptics but said it’s now going really well. He cautions the program is not a quick fix. “It takes years to grow mature teams, but the resulting knowledge transfer helps ensure the Portland site continues to expand its capacity, retain its work force, remain competitive—and keep those metal removal rates the highest in the industry.” ■

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A finished bull gear for a 737 horizontal stabilizer actuation unit. ED TURNER PHOTO



Shawn Tolman, a gear-line machinist, studies work performed on a 737 horizontal-stabilizer actuation unit bull gear. ED TURNER PHOTO

## Made in Portland

Boeing Portland is all about metal parts. Parts fabricated in the site's metal shops are integral to the entire airplane—from the flight deck to the tail. Used in all Boeing commercial airplanes, some are considered lifeline parts, meaning the assembly line stops if they're not delivered. Those parts include

### Complex Machining

- Flap tracks
- Flap supports and linkages
- Flap carriages
- Landing-gear beams
- Engine mounts
- Terminal fittings
- Stub beams
- Spar fittings
- Splice assemblies
- Flaperons
- Trunnions
- Drag braces
- Mini-cantilevers
- Main landing-gear attach fittings
- Side-of-body chords
- Torque tubes

### Gear Systems

- Gear boxes
- Power-drive units
- Jack screws
- Auto throttles

### Pilot Controls

- Control columns
- Aisle stands
- Speed brakes

## Big skills, big hearts

The 1,600 employees at the Boeing Portland facility in Oregon are proud of their highly recognized expertise in metal cutting. They're also proud of their community, as evidenced by volunteer activities. Here are some of the ways Portland employees reach out to their neighbors:

- Employees gave \$235,000 to the Boeing Portland Employees Community Fund last year.
- Volunteers routinely support the Start Making a Reader Today reading program and the Portland Rescue Mission. They also

provide food and gifts to 30 families in need during the winter holidays.

- A group of employees and retirees builds wooden doll cradles and toy trains for children of fallen soldiers, local children's hospitals and other local nonprofits. Last year, they built 44 cradles and 44 trains.
- The Portland site made a land grant of approximately 14 acres to the City of Gresham to build a new wetland complex for storm-water treatment in 2005.

# Keeping a sharp edge

There's a clear path for career advancement in metal cutting at the Boeing Portland site. International Association of Machinists/Boeing Joint Programs training resources include more than 65 courses, a fully equipped machining training lab and a mentoring program with the most experienced machinists on the shop floor. The goal is to maintain a highly skilled workforce to carry on Boeing Portland's tradition of metal-cutting excellence.

**Apprenticeships:** Machinist apprentices who successfully complete a four-year program of classes and hands-on training become state-

certified journeyman machinists. Electrical apprentices who successfully complete a five-year program (or 10,000 hours) of on-the-job training and off-hour classes become state-certified journeyman electricians.

**Internships:** A Boeing-sponsored partnership with local school districts and community colleges places 12 interns per year in a three-year program to promote exposure to the manufacturing environment and provide opportunities for basic education and skill development.



Apprentice Kristen Brown (left) and Darwin Utter, a Joint Programs and Apprenticeship Lab Instructor, work on a manual lathe in the skill lab. ED TURNER PHOTO



Lean focal Dave Judd, Industrial Engineers Luong Hua and Ethan Milton and Quality Assurance Investigator Denise Schwartz work an issue in Boeing-Portland's line-of-site office. ED TURNER PHOTO

# Closing on a century of progress

The history of Boeing Portland began when T.H. "Harry" Banefield and C.J. Parker went into the construction business together in 1909. In 1923 the partners purchased the Portland Wire and Iron Works in Portland, Ore., a business that later became the Iron Fireman Company. By the late 1920s, the company was the world's largest manufacturer of automatic coal stokers. In tough economic times, the company also built rototillers and Christmas lights, much as Boeing built furniture and speed boats in its formative years. By the late

'30s, the Iron Fireman Company was producing precision machined parts and assemblies for the Boeing B-17. In 1963, the Iron Fireman Company built a new plant and moved to Gresham, Ore., just east of Portland. There it manufactured 747 main landing-gear beams and trailing-edge products into the early '70s. In 1974, Boeing purchased the Gresham plant, where expanded operations continue today at the site now known as Boeing Portland.





Urmaze Naterwalla examines an end mill used on the 747-8 main landing-gear beam and machined on a super profiler. ED TURNER PHOTO

# Is there a doctor in the house?

## Portland employee describes 'best place in the world for metal cutting'

Urmaze Naterwalla isn't really a doctor. But his prescription for testing and collecting numerical data on the system associated with cutting and delivering finished metal parts has been so revitalizing at the Boeing Portland site, the leadership team there awarded him an honorary doctorate degree in metal cutting.

"The focus on technology has increased exponentially during Naterwalla's three years at the Portland site," said General Manager Jenette Ramos. "Performance improvements are definitely sharpening the site's competitive edge."

"It's hard to describe the cool things we're doing with hard metals in Portland," said Operations manager Ted McCrow. "We're learning and teaching the industry to cut metals."

Naterwalla said success at Boeing Portland is not an individual effort, but that of a great team comprised of cutting tool specialists, engineers, developers, procurement, machine operators and shop leads—all driven by strong management support. The team's No. 1 priority, Naterwalla said, is to deliver predictable and repeatable performance. "What we've really gotten good at in the past few years is making data-driven decisions," he said.

Naterwalla may not have a PhD, but he does have advanced degrees in mechanical and industrial systems engineering from Purdue University and Ohio State University. He also performed machining research at Ohio's Engineering Research Center for Net-Shape Manufacturing.

Long before academics, Naterwalla was learning to cut metal in his uncle's machine shop in Mumbai (formerly Bombay), India. At age 10,

he was cleaning, filing and drilling vintage British motorcycles. He showed an aptitude for the work and gained an appreciation for that generation of machines—classic Norton, Triumph, and BSA motorcycles from the '30s to the mid-'70s—which he still collects and restores. "I admire the old bikes for the technology that doesn't exist in modern bikes," he said. "It's what we might call the artistic flair, a blend of engineering with the art of motorcycles."

Naterwalla said working in machine shops paid his way through college. During those years he worked at a lab in Indiana that made machines for testing other machines to American Society for Testing and Materials standards. There, he teamed with World War II pilots and mechanics. "They taught me most of what I know," he said. His hands-on experience continued with a job at Ingersoll, a top manufacturer of high-velocity metalwork machines and services.

Then, three years ago, he visited Boeing Portland. "I left drooling!" he said. "The capacity and expertise here are unique. Anyone in the metal-cutting world would be impressed."

Indeed, Boeing Portland has a long history of machining large parts in hard metals. "The employees here have vital, tribal knowledge and abilities to machine a fully hardened part, such as the 20-foot (6-meter) main landing-gear beam for the 747-8.

"And, we're doing this," he added, "at faster and faster rates."

So, with a lifetime of metal-cutting experience, it's obvious Naterwalla loves what he does. And he's doing it at what he said is "the best place in the world for metal cutting—the Boeing Portland facility!"

— Brenda Pittsley