





July 1916 — July 2016 Celebrating the the Boeing Co.'s 100th anniversary

Spirit of Renton

It takes a strong partnership to build the most popular airplane in commercial aviation history and it's happening here in Renton. We call that The Spirit of Renton.

- Over 9,000 737's call Renton home
- Over 184 million miles flown
- Over 2,000 airborne simultaneously
- Flown by 342 airlines in 111 countries
- Takeoff/landing every 2 seconds

Congratulations, Boeing on your 100th Anniversary! Here's to our next century together!





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OUR REGION IS THE AEROSPACE CAPITAL OF THE WORLD

A note from Sound

appy anniversary and congratulations to the Boeing Co.! Sound Publishing, Inc., with its 49 community newspapers and websites, joins with many Washington state businesses to recognize and celebrate the Boeing Co.'s 100th anniversary.

It is impossible to contemplate Boeing without thinking about the company's Pacific Northwest roots. Founder Bill Boeing, who was drawn to Washington state's timber industry, rode in his first airplane in 1915 over Lake Washington and had an early float-plane hangar on Seattle's Lake Union.

It is equally impossible to look around the Puget Sound region without seeing the many ways Boeing has fueled and shaped the places we call home. Today, more than 130,000 highly skilled workers are employed by 1,300 aerospace-related firms throughout the state, producing some of the world's best-known and well-respected products and services.

As the company and the region have grown together, Boeing's impact has stretched far beyond the economic and employment statistics. The company made its first donation to the University of Washington in 1917, helping start an aeronautical engineering program, and throughout its existence, has been a generous source of gifts and investments in our region's educational, cultural and charitable institutions.

During its first 100 years, the Boeing Co. encountered its share of bumpy air. Fluctuations in the national economy, competition in the aeronautics industry, and inconstant political and military policies all challenged the company's resilience. It certainly hasn't always been easy for the behemoth company, yet Boeing has seemingly met each challenge with as much knowledge, experience and grace as possible.

Looking toward its next century, the company continues to trust its future to innovation. This has always been the Boeing way, from the first factory in a Duwamish River shipyard to the recently opened composite-wing assembly center in Everett. The ripple effect of Boeing innovation has brought hundreds of high-tech air-andspace companies to the Pacific Northwest.

Businesses and institutions in Washington state have been fortunate to have the Boeing Co. as a community partner. Sound Publishing knows the cities and communities it serves are strong, smart and prosperous places thanks to the contributions Boeing has made for 100 years.

For that, we say Thank You!

- Gloria Fletcher, President and CEO, Sound Publishing

Inside

SECTION G

A history of accomplishment	4-6
Competitors and mergers	7
Beyond Everett	8
Near misses	10
Going to war	14-16
The Teague connection 18-19	
Taxes	\overline{D} -
Record deliveries 21	•
To the moon 22	BD
SECTION H	
Headlines	
Family connections 4-6	
Everett connection	
A Boeing timeline12-13	
Influence around the globe 14	
The Oso crash	15
The Labor connection	16-17
The Renton plant	18
Δ course for the future	21-22

Esterline is pleased to be part of the Snohomish County community. Every individual and organization we worked with during our relocation process was helpful and professional. Snohomish County has lived up to its business-friendly reputation, and we value being a part of the community.

MIKE McCOY PRESIDENT, ESTERLINE EASC TRUSTEE BOARD MEMBER

AEROSPACE ASSETS

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AEROSPACE IN SNOHOMISH COUNTY

Snohomish County is home to an a industry represented by over 220 firms and 46,000 workers. 50% of all aerospace workers in the state are employed in Snohomish County The supply chain works with Boeing as well as Airbus, Bombardier, Comac, Embraer, Sukoi and with each other.

The following groups represent a majority of Snohomish County's 220 supply chain companies:

Avionics	 Maintena 	INCE

- · Materials Engineering
- Modification IT & Software
- Engineerin
 Modificati
 IT & Softv
 Interiors
 Logistics
 Machining
- Materials
 Metal Fab.
 Structures
 Surface Tre Surface Treatment Systems

INDEX

EDUCATION & WORKFORCE TRAINING

- 1 Everett Community College ⇒ Advanced Manufacturing Training Center ↔ Corporate & Continuing Education Center
- 2 Edmonds Community College → National Resource Center for Materials Technology Education
 → Business Training Center
- 3 Aerospace Joint Apprenticeship Committee
- $\stackrel{l \rightarrow}{\to} \textit{Glacier Peak \& Arlington High Schools} \\ \stackrel{l \rightarrow}{\to} \textit{Sno-Isle Tech Center}$
- 4 Center of Excellence for Aerospace & ed Materials Manufacturing









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ADVOCATE DEVELOP CONNECT

On the cover

See anyone you recognize? These 100 Boeing Co. employee faces were chosen at random (mostly) from various years between 1916 and 2016. A few of those you might know (numbered left to right, top to bottom) are:

- **1.** William "Bill" Boeing, founder.
- 2. Wong Tsu, Boeing's first aeronautical engineer, designed the Model C.
- 9. George Conrad Westervelt, Bill Boeing's lifelong friend and first collaborator.
- 14. Joe Sutter, "father of the 747."
- **19.** Clairmont "Claire" Egtvedt, engineer, president and chariman, 1917-1966.
- 24. Jack Waddell, 747 test pilot.
- 28. Alvin "Tex" Johnston, 707 test pilot.
- **35.** Dorothy Kuljis, lead receptionist at Plant 2.
- 38. William A. Allen, president, 1945-1968; chairman, 1968-1972.
- 47. Carolyn Corvi, vice president and general manager, 2000-2008.
- 68. Kavya Manyapu, engineer.
- 74. A.C. Darby Jr., 787 quality technician.
- 85. Bratt Sutton, 777 wing structures.
- 90. Rose Loper, test pilot.
- 91. Susan Darcy, test pilot.
- 96. Michael Lombardi, Boeing archivist.
- **100.** Molly McLaughlin, 777 engineer.

Credits

Lead reporter: Dan Catchpole

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- Editors: Scott North, Eric Stevick

Special thanks to: Boeing archivists Michael Lombardi and Thomas Lubbesmeyer Photos are courtesy of: The Boeing Co., unless otherwise credited Sound Publishing thanks Robert Frank, Steve Powell, Mark Klaas and Dennis Box for their contributions to this special section.



You can find these stories and more images about The Boeing Century online at heraldnet.com.

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 - A Future of Flight/Boeing Tour
 - B Flying Heritage Collection
 - C Historic Flight Foundation

- 6 Washington Aerospace Training & Resource Center 7 Embry-Riddle Aeronautical University
- 8 Sno-Isle Tech Skills Center

- D Museum of Flight Restoration Center

Priority Corridor Other Major Roads * IPZ: Innovation Partnership Zo ** MIC: Manufacturing / Indust FOR MORE INFO, CONTACT

Scrappy start forged a company built to last



The B&W was the first Boeing product, named for its designers, William Boeing and Navy Lt. George Conrad Westervelt. The first B&W, finished in June 1916, was made of wood, linen and wire.

Through ups and downs, triumphs and missteps, Boeing has done what most of its competitors could not: It survived.

> **By Dan Catchpole** Herald Writer

steady, chill wind blew across the North Carolina beach as the man climbed into the spruce, linen and wire contraption. The small motor chugged. The mooring line was released, and the craft ran into the wind along a thin wooden track. At 10:35 a.m. on Dec. 17, 1903, it lifted into the air. Orville Wright jerked the plane's heavy rudder — left and right fighting to stay in the air.

Boeing was hooked by the thrill of flying, and its technical challenge. He said to Westy, as friends called him, that they could probably build a better plane.

That year, he bought a rudimentary plane and took flying lessons from Glenn Martin's Los Angeles-based company.

Like other aviation pioneers, Boeing and Westervelt were tinkerers, with no formal training in the science of flight.

Pensacola, Florida, where Navy flyers put it through tests.

The Navy was so impressed that Boeing's representative, C. Berlin, fired off a telegram: "Advise you get ready for big business. Everything points to big order. They ask how soon we can turn out twenty machines like these."

The Boeing Airplane Co. was in business. But its survival was far from certain.

World War I brought a huge wave of orders, and by 1918, dozens of airplane makers had popped up, mostly in the Northeast and industrial Midwest. The names of some are still familiar today — Boeing, Lockheed, Martin. Most, though, including some of the biggest at the time, long ago disappeared into the maw of the industry's churn.

Chicago-San Francisco route. Boeing's bid was about half the cost of the next lowest. Again, competitors expected the company to bleed money. Again, the company made huge profits.

Bill Boeing set up a holding company to raise money for the expansion of his aviation empire. His company bought other air carriers, manufacturers and suppliers. After a partnership with enginemaker Pratt & Whitney, the holding company became the United Aircraft and Transport Co. (UATC). The carriers were collectively known as United Air Lines.

UATC's stock soared even as the Depression crashed into Wall Street. The holding company raked in fat profits in the late '20s and early '30s.

Four big holding companies, including UATC, dominated the

After 12 seconds and about 120 feet, the Wright Flyer smacked back into the sand. Man had flown.

Earlier that year, a recent Yale dropout steamed into Grays Harbor on Washington's coast. He'd come to turn his inheritance into a fortune in logging. Bill Boeing had a sharp mind for mechanics and business. He was an avid hunter and adventurer, as well.

BELOW:

In 1930, **Boeing Air** Transport 80As carried aviation's first flight attendants, one per airplane, who were then required to be registered nurses.

Boeing quickly joined the cluster of millionaires who'd wrenched fortunes out of the state's lush forests, rich mineral veins and bountiful fish runs. By 1915, he'd bought a yacht - as well as the shipyard that built it - and a mansion in the Highlands, a posh enclave north of Seattle.

In July of that year, he and a friend, George Conrad Westervelt, paid a wiry barnstormer, Terah Maroney, to take them flying. Lake Washington dropped away below as the plane banked and turned through the air.

The pair learned by trial and error while designing their own plane, the B&W, named for the initials in their last names. "Our interest was in progress," Boeing later told an interviewer.

While flying was still a hobby for Boeing, he hired a crew to help develop the B&W and built a floatplane hangar on Seattle's Lake Union. Westervelt moved back east before the B&W flew in June 1916. The plane performed well, as did a second one completed that fall.

Boeing established the Pacific Aero Products Co. on July 15, 1916. The articles of incorporation listed nearly every flying-related endeavor imaginable, including making airplanes. Pacific Aero Products was renamed the Boeing Airplane Co. less than a year later.

By 1917, the company developed the first all-Boeing airplane, the Model C, a seaplane trainer pitched to the Navy. Workers dismantled the prototype, packed it in crates and loaded it on a train bound for

Peace halted military orders. The industry contracted rapidly. Like others, Boeing struggled. "For quite a while during 1920 and 1921, I was tempted to abandon the whole subject," Bill Boeing said.

Loyalty to his employees kept him from closing the company, he said. His wife, Bertha, chalked it up to sheer stubbornness.

The Boeing Airplane Co. accepted just about any work it could get to keep its core team together. They made furniture, a handful of fast boats, and fixtures for a corset shop in Walla Walla. Again and again, Bill Boeing reached into his pocket to cover payroll.

The company was saved in 1921, when it won a bid to make 200 MB-3A biplane fighters for the Army. Boeing had underbid the company that designed the plane. At the time, the military contracted separately for airplane development and production.

Many competitors scoffed at Boeing's low bid, saying it would pull the company under - or at least leave its knees badly scraped. Instead, it was such a windfall that Bill Boeing gave out a cash bonus at Christmas.

One of the company's young engineers, Claire Egtvedt, challenged Bill Boeing to hire more engineers to design new and better aircraft.

"We are building airplanes, not cement sidewalks," he said.

Boeing certainly saw that engineering was critical to the company's success. In 1917, he gave money to the University of Washington to start an aeronautical engineering program and to build a wind tunnel. He'd also hired three UW engineers, including Egtvedt and his classmate Phil Johnson. Both would one day lead the company.

Building up, breaking new ground

Airmail was big business by the carry mail and passengers.

industry by 1930. The business model was to tie suppliers, manufacturers and airlines together under one corporate umbrella.

More than 5,000 people crowded Boeing Field in 1933 to behold Boeing's newest plane, the Model 247. It was like no passenger plane before. Earlier frame-and-wire designs looked more like birdcages with propellers. The 247 had a sleek, streamlined, all-metal body and powerful Pratt & Whitney Wasp engines.

The 247 was the first modern airliner and established fundamentals of passenger airplane design that are still used today. It also was a commercial flop.

Airlines rushed to order the new plane but found they'd have to wait. Boeing had committed the first 60 deliveries to its own air carrier, United.

Competing airlines, led by TWA, pushed other manufacturers to meet or beat Boeing's design. Douglas Aircraft in Southern California responded by launching its DC series, which quickly antiquated the 247. Boeing's misstep in handling customers opened the door for Douglas, which would dominate the commercial airplane market for more than 20 years.

Scandal and breakup

UATC was caught up in Depression-era politics in 1934. Critics accused Boeing and other airmail carriers of colluding to squeeze excessive profits from federal airmail contracts. Smaller competitors said they were being pushed out by the big holding companies.

Hugo Black, an Alabama senator at the time and a future Supreme Court justice, led a Senate investigation, banging its bully pulpit as loud as he could. He grilled Bill Boeing and other industry leaders who were called to testify.

The worst accusations were never substantiated. However, in 1934, federal legislation prohibited any single company from both controlling airplane manufacturing and running an



From previous page

airline. UATC split into three companies, known today as Boeing, United Airlines and United Technologies, which includes Pratt & Whitney.

The experience embittered Bill Boeing, who sold his shares in his company and walked away, making good on his long-term plan to retire in his 50s. That left the company in the hands of Boeing's president, Claire Egtvedt.

Egtvedt focused on making big airplanes. By 1935, he committed to developing a four-engine bomber, essentially betting the future on its success. The Model 299 is better known as the B-17 Flying Fortress. Egtvedt also greenlighted work on what would become the B-29.

The other two big planes Boeing developed in the late '30s, the 307 Stratoliner and the 314 Clipper, were both commercial failures.

Tragedy led the company to double down on its commitment to being a research leader. The prototypes of Boeing's B-17 and 307 both crashed during flight tests, killing several people. Test pilot Eddie Allen pushed the company for a dedicated aerodynamic testing program. The company already understood - as did its competitors — that better testing could reduce development costs.

It built one of the country's most advanced wind tunnels in the early 1940s, powered by the Pacific Northwest's cheap hydroelectricity.

Big bombers, big business

World War II brought huge orders for B-17s and B-29s. Like the rest of the industry, Boeing rapidly expanded. Before the war, Egtvedt turned over day-to-day operations to Phil Johnson, who carefully guided the company through wartime expansion until his death in 1944.

Boeing's workforce soared from 5,000 in 1939 to more than 51,000 in 1945. New federally financed plants were built in Renton and Wichita to churn out warplanes.

The company embraced mass production and developed a supply chain that presaged future production flow. Subassembly plants around the Puget Sound region, including two in Everett, fed a steady stream of B-17 and B-29 parts to assembly lines.

In 1944, U.S. factories turned out more than 90,000 airplanes. Boeing was not the biggest airplane maker during the war. Consolidated Vultee, North American Aviation, Curtiss-Wright and Douglas were all bigger.

Peace hit Seattle like an economic bomb. Nearly all military contracts were canceled or severely reduced. Boeing laid off tens of thousands of workers, and lost money in 1946 and 1947. An anticipated commercial air travel boom did not materialize until the 1950s.





It didn't have cash to weather the storm. Massive layoffs were necessary. The company's board wanted an "ice water man," someone who could make the deep cuts, Boeing President Thornton "T" Wilson said at the time.

More than 85,000 workers were laid off. In 1971, a billboard near the Seattle-Tacoma International Airport captured the region's despair in one simple sentence: "Will the last person leaving SEATTLE turn out the lights."

Executives considered selling or canceling the 737, said Peter Morton, a retired Boeing vice president who led the program's marketing at the time. "The company was in financial straits, and everything was on the table."

Even as the 737's fate hung in the

ABOVE:

The 5,000th B-17 built after the attack on Pearl Harbor carried the signatures of all the people who built it. The plane rolled out with great ceremony at **Boeing Plant 2** in Seattle, surrounded by builders, riveters and designers.

Boeing fared better than many competitors, though. The B-29 stayed in production thanks to its advanced design and critical mission in the new atomic age. It kept the plants running after war.

The company beat competitors in designing a jet bomber, which began as a research project during the war. Boeing made the most of captured Nazi technology and research into jet airplane design. That led to the B-47 Stratojet bomber, which established the shape of today's big jet planes at a time when competing designs were rooted in the status quo of spinning props

The Jet Age roared in July 1949, when De Havilland Aircraft's Comet first flew. When the British-built jetliner entered service in 1952, it left American industry behind. Douglas and Lockheed pursued prop planes instead.

Phil Johnson's successor at Boeing, Bill Allen, carefully weighed the risks. In 1952, he committed the company to developing the jet-powered 367-80, or Dash 80, a prototype that bred both the KC-135 Stratotanker and the 707.

A few weeks after the Dash 80's first flight, Boeing test pilot Tex Johnston famously flew barrel rolls in the plane over Lake Washington during Seafair. Flight tests for the Dash 80 did not always go smoothly, though, test pilot Jim Gannett told an Australian reporter a few years later. "Once, the nose wheel stuck up and we worked four hours trying to get it down," Gannett said. "We had to take an axe to the wheel well. The nose finally came down about one second before we landed."

Boeing beat Douglas to the jetliner market. Douglas responded with the DC-8, which performed well but suffered from production problems. Other challengers, such as Convair, arrived on the market too late, or missed the mark when they got there.

The 707 established Boeing as the dominant jet maker. The company's position was bolstered by its focus on innovation, quality and customer service, and on designing a family of jets to span the market.

Boeing rapidly expanded during the 1960s, introducing the 727, 737 and 747, and trying to develop a The 707 established Boeing as the dominant jet maker. The company's position was bolstered by its focus on innovation, quality and customer service, and on designing a family of jets to span the market.

supersonic transport airplane. While commercial airplane sales climbed Boeing hired workers to keep pace with its rapid growth. Shift changes were carefully choreographed to handle the daily ebb and flow at plants and offices around the Puget Sound region. In seemingly every office and shop, workers from the time say they felt they were part of something bigger.

Boeing was pushing the bounds of commercial jet travel. The SST promised to take us faster than ever before. And the 747 jumbo jet, the world's first widebody, would take us farther.

Still, Boeing felt growing pains, Australian journalist Peter Dunn noted in 1967; "like a fat man in leather trousers, it is running out of room."

That same year, St. Louis-based McDonnell rescued Boeing rival Douglas Aircraft from financial collapse. Douglas' slide started in the early 1950s, when the company was at its peak. At the time, hundreds of Douglas planes hauled passengers around the world, compared to about 50 Boeing planes.

The Boeing boom collapsed into the Boeing bust in the late 1960s. Soaring oil costs, a global recession and growing environmental concerns forced airlines to slash orders. The SST was abandoned. The company had spent heavily on developing new airplanes.

balance, engineers were improving it.

"Boeing's a complicated company," Morton explained. "You can have a team of engineers improving the airplane at the same time you have the bean-counters running the numbers on closing the program."

He and his team convinced the company to keep the plane and scoured the world for orders. It sold well in often-overlooked markets.

By the late '70s, the 737 was on its way to becoming the best-selling commercial jetliner ever. In the early '80s, Boeing introduced the 757 and 767.

The rise of Airbus

Boeing misread the future market when it upgraded the 737 in the early 1980s with a lowest-cost tweak. Demand for single-aisle jets exploded. Airbus, stepped in with its new A320.

"Each year, there are maybe one or two decisions that shape the industry for the next 20 years," said Barry Eccleston, the current head of Airbus' operations in North America.

The A320's advanced design came along as the single-aisle market blossomed following airline deregulation. Northwest Airlines, a longtime Boeing customer, ordered 100 A320s worth a collective \$3.2 billion. When United placed an order for A320s a few years later, it shocked the industry and even some people at Airbus. The order, from a company that shared Boeing's corporate DNA, removed any doubt that the two airplane makers were in a bare-knuckle fight.

Some of Airbus' claims about the A320 were overblown. Nonetheless, Boeing's rival had taken the lead in the single-aisle market. "It had a better wing than the three-seven, and we had to catch up," former Boeing manager Mike Alexander said.

Boeing responded with variants of the 737, referred to as the Next Generation. They've been hugely successful and are still in production.

Airbus countered with the A330 and A340 - planes designed to challenge Boeing's dominance of the

LEFT:

Boeing displayed planes from its 7-Series family at **Boeing Field** as part of the 787 premiere in July 2007.

G6 July 2016 Sound Publishing

THE BOEING CENTURY

More companies are making jetliners than at almost any time since the Jet Age began. On its 100th birthday, Boeing is the world's biggest aerospace company, but its future is uncertain, just as in 1916.

From previous page

TOP RIGHT:

An Airbus A320-200 (left) and Boeing 757 at the airport in Dusseldorf, Germany, on June 29, 2000.

BOTTOM RIGHT: The first 787 destined for a customer lifts off at Paine Field on its first flight on Jan. 19, 2011. widebody market. Boeing responded with its 777, which killed off the A340, its direct competitor.

By the early 1990s, Boeing was feeling pressure from trade globalization and other changes affecting the American economy. A recession and the end of the Cold War further weakened aerospace companies and prompted a wave of consolidation. Boeing pursued the strategy with vigor, buying divisions of Hughes Communications and Rockwell International.

A different Boeing

Tuesday, Dec. 10, 1996, was a typical early winter day in Seattle: light rain, temperatures in the 40s. Boeing CEO Phil Condit and McDonnell Douglas CEO Harry Stonecipher met alone for 45 minutes in a suite at the Four Seasons. They hashed out a deal for Boeing to buy the flailing McDonnell Douglas for \$13.3 billion in stock.

McDonnell Douglas leaders exerted a strong influence in the new company — much stronger than many at Boeing had expected. They brought a rigidly cost-conscious view to the board. Condit and Stonecipher made it clear that shareholder value was the performance measure that mattered most.

Condit "sold his soul to shareholders," said Stan Sorscher, a retired Boeing engineer and former official with the Society of Professional Engineering Employees in Aerospace, the union representing Boeing engineers.

Stonecipher, who was one of the company's largest shareholders, joined Wall Street analysts in arguing that Boeing was no different than any other manufacturer — be it Coca-Cola or cars.

Boeing went from being the smartest, most successful commercial jetliner manufacturer to simply squeezing out as much cash as possible for shareholders, said Richard Aboulafia, a leading aerospace industry analyst.

Leaders at Boeing's commercial airplane division pushed for a successor



EDGAR R. SCHOEPAL / ASSOCIATED PRESS



MICHAEL O'LEARY / HERALD FILE PHOTO

to the 767 to compete with the A330. However, a faction led by former McDonnell execs balked at spending huge amounts on R&D. Instead, they pushed for outsourcing the development costs and the risks to suppliers.

The result: the 787's far-flung supply chain.

Outsourcing fit with Condit's longheld desire to move Boeing away from its bread and butter — making big jet planes. Boeing, in his eyes, should be a "systems integrator," not a manufacturer. That meant it should manage suppliers making airplane parts that it could then snap together, like a piece of Ikea furniture.

Condit took the corporate offices

to Chicago, a move meant to put the Puget Sound factories at arm's length. "We are in the midst of a men-

tal shift, from being an American company that exports to the world to being a truly global company," he said in 2003.

Becoming a "truly global company" has been painful and expensive for Boeing and many of its workers.

Boeing's success was built on "product, process and listening to the customer," Sorscher said. "The new focus was cost-cutting and shareholders."

In 2001, L.J. Hart-Smith, a senior Boeing engineer, urged against blindly outsourcing work. The benefits are illusory or, at best, limited to specific situations, he said. Outsourcing could easily leave the company vulnerable to troubled suppliers. His concerns were dismissed but proved prophetic of the difficulties encountered on the 787 program.

The airplane's development costs soared to more than \$20 billion. It was delivered more than three years late. Producing the first 300 planes has cost Boeing nearly \$30 billion more than it has recovered from sales.

Production and development headaches haven't been limited to the 787 program. Developing the 747-8, the newest version of the iconic jumbo jet, took longer than Boeing had needed to design the prototype of the original in the 1960s.

Ethics scandals forced out first Condit, then Stonecipher, who succeeded him. The board found a successor: Jim McNerney, the head of 3M.

McNerney brought with him a rigid focus on stock price and shareholder dividends that earned praise and condemnation. In 2015, he described his tenure at Boeing as "trying to get the business fundamentals of this company as strong as the technical." Investors responded, sending the stock price soaring even as problems continued to plague 787 production, which is running more or less smoothly today.

That focus, though, alienated many workers and even suppliers. Boeing sees its suppliers, its workers and even its finances as "commodities to be squeezed" for quarterly profits, Aboulafia said.

Not long before he retired, McNerney declared that the company would not pursue "moonshots," but rather focus on incremental innovation. Be evolutionary, not revolutionary. Hard words for engineers at Boeing to hear.

The company invested more than \$3 billion in research and development last year. By contrast, it spent more than \$6 billion to buy back shares.

Meanwhile, more companies are making jetliners than at almost any time since the Jet Age began.

On its 100th birthday, Boeing is the world's biggest aerospace company, but its future is uncertain, just as in 1916.

The centennial? "We'll celebrate the hell out of that," said Conrad Ball, one of Boeing's top engineers.

But after the party, "there's no guarantee, there's no special place for Boeing in the future," he said. "If anything, people are coming for us."

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Other companies hungry for piece of commercial market

By DAN CATCHPOLE Herald Writer

Companies around the world are trying to elbow their way into the big commercial jetliner market, which is split between industry giants the Boeing Co. and Airbus Group. Some are newcomers, and others, such as Bombardier and Embraer, are well-established in the regional jet market. The newcomers all claim to offer more efficient aircraft.

Even those established companies face a big uphill fight to break into the market. They have to convince potential buyers — airlines and leasing companies — to take a chance on new airplanes that have less customer support behind them. They also have to make buyers comfortable about walking away from the relationships they have with Airbus and Boeing.

And the would-be competitors likely cannot slash the plane's sticker price as much as the big boys might.

Bombardier CSeries: Back from the (almost) dead

Schedule delays and huge cost overruns have dogged development of Bombardier's CSeries. The problems prompted a change in the Canadian company's leadership and a potential \$2 billion infusion from public coffers. In early 2016, Boeing reportedly dropped its 737-700 price by nearly 70 percent in a deal with United Airlines to fend off Bombardier's offer. The program appeared headed for failure.

But Delta Airlines gave it new life when it ordered 75 CS100 aircraft, with options for 50 more. The order by a major airline effectively put a stamp of approval on the CSeries.

Both CSeries jets are slated to enter service later this year. The CS100 is slated to enter service on



FRANCOIS MORI / ASSOCIATED PRESS The Bombardier CS300 flies at the Paris Air Show on June 15, 2015. Delays and cost overruns have dogged development of the CSeries aircraft.

July 15 — Boeing's centennial anniversary — with Swiss International Air Lines.

Embraer E-Jets E2: Planes from Brazil

Brazilian planemaker Embraer is edging into the single-aisle market with its E-Jet E2 family, a significant overhaul of its existing E-Jets. The biggest one, the E-195 E2, seats 120 in a typical, two-class layout. That is about the size of Boeing's 737-700 and the 737 MAX 7, which is in development.

Embraer has been cautious in its effort to break into the market. But its deliberate approach is working. It is the world's thirdbiggest airplane maker, though third is still way behind Boeing and Airbus.

Comac C919: Late and out of date

The Commercial Aircraft Corporation of China (Comac) has delayed the first flight of its new C919 time and again. By the time the C919 enters service — projected for 2019 — it already will be outdated compared to the Boeing 737 MAX and Airbus A320neo. While it isn't expected to draw foreign interest, it will win orders at home.

Fortunately for company leaders, Comac's home, China, is projected to buy more jetliners in the next 20 years than any other market.

Comac C929: Believe it when you see it

In 2015, Comac and Russia's United Aircraft Corporation said they plan to develop a twin-aisle jetliner to supplant the Boeing 777. China and Russia could become serious competitors one day, but both countries have big hurdles to overcome.

Technology is the easiest piece. Consider that both nations have put astronauts into space, but neither has developed a car that can compete in Western markets.

Every merger takes Boeing to new places

By DAN CATCHPOLE Herald Writer

Boeing hasn't simply outlasted many of its competitors, it has consumed some, including several giants of aerospace: North American Aviation, Piasecki Helicopter and, most significantly, McDonnell Douglas.

Boeing began with an acquisition. Its first production plant, including the Red Barn, was a converted shipyard purchased by Bill Boeing in 1910.

The company has spread across the globe and expanded its business far beyond making airplanes, in large part through mergers and acquisitions. That is how Boeing came to Wichita, Kansas (Stearman Aircraft, 1929); Philadelphia (Vertol Aircraft Corp., 1960); Seal Beach, California (Rockwell International successor to North American Aviation, 1996); St. Louis (McDonnell Douglas, 1997); and other sites.

In recent decades, Boeing has expanded the services it offers by buying other companies, such as Jeppesen in 2000. The Denver-based company provides information management services and products for aviation and maritime customers.

The McDonnell Douglas deal made Boeing the biggest aerospace company in the world. McDonnell Douglas was a huge defense and space contractor, while Boeing dominated commercial aviation.

A common joke among Boeing workers is that McDonnell Douglas bought Boeing with Boeing's money. Critics of the deal derisively dubbed the result "McBoeing."

Many longtime Boeing workers and some industry watchers blame the deal for many of the problems the company has experienced since, such as 787 production issues and alienation of its workforce. Boeing's string of successes in the Jet Age was replaced with McDonnell Douglas' mixed record, said Richard Aboulafia, an industry analyst with Teal Group in Washington, D.C.

Still, the merger went better than the McDonnell and Douglas shotgun wedding in 1967. McDonnell, a leading fighter-jet manufacturer at the time, bailed out Douglas, which was in a financial crisis despite making popular passenger jets. The merger seemed to drive Douglas out of the commercial market more quickly. The company has spread across the globe and expanded its business far beyond making airplanes.



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Model C seaplane trainers are put together in the Assembly Building that was adjacent to the Red Barn at Boeing's Oxbow Plant, later called Plant 1, in Seattle.

A reach far beyond its roots

he Boeing Co. began in a lakeside hangar in Seattle. Today, the aerospace giant sprawls across international borders: an engineering design center in Moscow, a plant in Melbourne that makes a part for 787 wings, an airliner service center in Dubai, and dozens of other operations around the world.

STORY BY DAN CATCHPOLE THE HERALD

Despite its long list of locations, as well as its headquarters in Chicago, Boeing is still fundamentally a Washington company. Today, about half of its workforce is in the state where it was born in 1916. Nonetheless, many here fear that the company has one foot out the door. As the saying goes, "Boeing, Boeing, gone."

Talk about leaving Washington seems to be in the company's DNA, though.

Even before he started selling airplanes, Bill Boeing publicly threatened to leave for California after a police raid on his house in 1916. Sheriff's deputies raided his home in the Highlands, a big-money enclave north of Seattle, seizing liquor and wine worth several thousand dollars. The sheriff was enforcing recently passed local bans on alcoho Boeing was already building his first plane, the B&W, and in July 1916, he founded Pacific Aero Products Co., which became Boeing Airplane Co. the following year.

More buildings soon were added. The location was "to be an ideal aircraft factory and therefore must be self contained," reported the 1920 Aircraft Year Book, which was published by the Manufacturers Aircraft Association. "All operations necessary to the construction of modern aircraft could be performed within the plan ..."

That is far different from today's plants, where aircraft are assembled from parts made around the world.

The Navy's order for HS-2L flying boats, a Curtiss design, prompted construction of an even larger building 200 feet long by 150 feet across with up to 30 feet of clearance. It would be big enough "to assemble the super aircraft of the next few years," the Aircraft Year Book noted.

For several years, Bill Boeing kept n office in the Hoge Building near Pioneer Square in downtown Seattle. His cousin, Edgar Gott, ran what came to be called Plant 1. The Seattle facilities expanded to keep pace with demand. In 1936, Boeing opened the much larger Plant 2, which was big enough for B-17 assembly. The plant was on the Duwamish River's east shore — the same side as Boeing Field which eliminated the need to barge planes across the river for flight testing. During World War II, Plant 2 was so critical to wartime production that a fake neighborhood was built on top of it as camouflage. From the air, it looked nothing like a factory. Plant 2 was demolished in 2010. The 1940 administration building remains at the site.

Seattle Post-Intelligencer reported. Hamilton's show the next day was cut short when his Curtiss Reims Racer biplane crashed into a pond in the track's infield. Suffering only scrapes and bruises, he was back in the air the following day.

The Meadows and nearby grassy fields continued to be a popular spot for flyers. In 1928, the county-owned airport, already dubbed Boeing Field, officially opened. The following day, Boeing's Model 80, a 12-person passenger biplane, made its first flight there. Since then, the airport has witnessed several Boeing first flights, including the 247, 307, B-17, B-29, B-47, B-52 and 737.

Boeing is still active at the airport, and in 2015, it opened a new 737 delivery center there.

Renton plant

Boeing came to Renton on the shores of Lake Washington to build warplanes as part of a federal rearmament push as World War II loomed. Boeing initially made B-29 Superfortress bombers there. It later produced C-97s, 707s, 727s, 737s and 757s. Today, Renton produces more commercial jetliners than any other plant in the world. Boeing Commercial Airplanes is based in nearby office towers on the former site of the Longacres Racetrack, which operated until 1992, when Boeing bought the land. The Longacres Mile Handicap is still run every year, now at Emerald Downs in Auburn.

build more than 10,000 of them.

Boeing Wichita focused on military production for the next couple decades. It led B-29 production, and, after the war, it assembled B-47s and B-52s.

After B-52 production ended in the early 1960s, Boeing's Wichita Division made jetliner fuselage sections, which were shipped to Washington for final assembly. The company sold its production operations there in 2005 to Onex, which created Spirit AeroSystems. Spirit is one of Boeing's biggest suppliers, and it still ships 737 fuselages by rail to Renton.

Huntsville

The Space Race brought Boeing to Huntsville, Alabama, in 1962. The company's presence was small to start — a handful of employees working out of a downtown hotel on the Saturn V rocket program. Four years later, the company had about 4,500 workers there.

Since then. Boeing Huntsville has continued to work on the nation's space program, including the International Space Station

Lake Union hangar, Seattle

In 1915, Boeing and George Conrad Westervelt designed and started building their first plane, the B&W, in a float-plane hangar Boeing had constructed at the foot of Roanoke Street on the northeast shore of Lake Union in Seattle.

The hangar witnessed the first flights of the B&W and the company's second plane, the Model C. The young company quickly outgrew the facility.

Plant 1 and Plant 2, Seattle

Boeing Airplane Co. moved production to Ed Heath's shipyard, which Boeing had bought in 1910. The yard was on the Duwamish River south of downtown Seattle and near Georgetown, which had recently been annexed into the city.

The site's main workshop — the Red Barn — was later moved to the Museum of Flight at Boeing Field in Seattle, where it remains today.

Boeing Field

Boeing Field in Seattle began as Meadows Race Track, a one-mile loop tucked in an oxbow in the then-meandering Duwamish River. It opened for horse racing in 1902 and saw the state's first auto race in 1905 and its first airplane flight in 1910.

Barnstormer Charles Hamilton awed onlookers at the Meadows on March 11, 1910, "circling and wheeling with the abandon of a swallow," the



Boeing 787-8s line the floor at the Boeing South Carolina Delivery Center on Feb. 16, 2016, in Charleston, South Carolina.

Everett plant

Boeing had sub-assembly plants making B-17 and B-29 parts in Everett during the war. The company came to the city for good in 1966, thanks in part to intervention by Robert Best Sr., then publisher and owner of the Everett Herald.

Boeing came to Everett to build the 747 jumbo jet. Since then, it has expanded its plant as it has added new airplane programs — the 767, 777, 787 and now the 777X. With the 767, the company said early on that it would build the jet in Everett, but Boeing made the area compete for 787 and 777X jobs, stoking fears that it will leave Washington.

The Everett plant is the biggest build ing by volume in the world. Roughly 40,000 people work at the site. If it were a city, it would be Washington's 27th biggest, right behind nearby Edmonds.

The plant sits next to Paine Field, an airport developed with federal dollars during the Great Depression. The airport then served as an Air Force base into the 1960s. Today, it is a center of aerospace manufacturing.

Wichita

Boeing's Wichita ties go back to the late 1920s, when Stearman Aircraft Co. became part of United Aircraft and Transport Corp. UATC was a holding company set up by Boeing and Pratt & Whitney to consolidate aircraft production and commercial air services. When anti-trust legislation broke up UATC, Boeing kept Stearman as a subsidiary and later made it part of the company.

Stearman landed a lucrative contract in 1934, making a military trainer called the Kaydet. It would eventually

Boeing is Alabama's largest aerospace company. However, in 2015, Boeing's European rival Airbus opened a final assembly line for its popular A320 there.

St. Louis

St. Louis has been turning out fighter jets since the 1940s. Its warplane tradition began with McDonnell Aircraft, which opened shop there in 1939. The Korean War catapulted the company into the top tier of military contractors. Its hugely successful F-4 Phantom remained in service with U.S. forces for more than 30 years.

After McDonnell's 1967 merger with Douglas Aircraft, which created McDonnell Douglas, St. Louis remained the company's center for fighter-jet production. Boeing bought McDonnell Douglas in 1997 and moved its defense division to St. Louis. Boeing workers there still make F-15 Eagles and F/A-18 Super Hornets.

North Charleston

In 2009, Boeing executives decided to do something the company had never done before: make commercial jetliners outside Washington. The company took over problem-plagued production facilities run by suppliers Vought Aircraft and Alenia Aeronautica in North Charleston, South Carolina, and opened a second 787 final assembly line there.

The decision hit Puget Sound like a gut punch.

A Boeing executive publicly stated that the move was retribution for a 2008 strike by Machinists union members. It wasn't a cheap decision, either. Boeing expected that going to South Carolina would cost about \$1.5 billion more than staying in Everett, according to internal company documents from the time.

The North Charleston plant has struggled to get up to speed, adding to production and supply problems that have dogged the 787. However, Boeing South Carolina workers have made huge gains and are closing in on Everett's quality and pace.



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Some ideas brighter than others

By DAN CATCHPOLE Herald Writer

B oeing engineers are constantly generating new product ideas. Some are better than others. Some are bold and push the boundaries of what's possible. Others seem inspired by science fiction. And some sound silly today.

The aerospace giant's innovations are ideas that panned out. Here are some that did not.

Model 326

The clipper of tomorrow never arrived.

In 1937, Pan American Airways wanted an amphibian capable of safely flying nonstop from America to Europe. Boeing proposed its doubledecker Model 326, a six-engine clipper with room for 100 passengers. The enormous plane was to be an ocean liner in the sky, complete with luxurious lounges for passengers to relax in during the long trip across the Atlantic Ocean. The Model 326 would have been the first pressurized airliner. However, Pan Am did not pick any of the four competing designs. And the first pressurized airliner became the Boeing 307 Stratoliner, which entered service in 1939

As late as 1942, Flight magazine referred to the Model 326 as the "clipper of tomorrow."

PA-3

It looked like a cartoon car, but it was a very real idea — and it almost became reality.

During World War II, Boeing and its competitors had focused on making warplanes. With the war winding down and soldiers returning to civilian life, Boeing looked for products to

sell to vets in peacetime. It designed a car, a van, modular housing units and even kitchen appliances. In the end, the company stuck with what it knew — airplanes.

While the U.S. military canceled most orders for warplanes after 1945, Boeing kept busier than most of its competitors thanks to continued demand for the B-29 and its new,



With World War II winding down, Boeing designed this car, the PA-3, along with other products it could sell to returning soldiers in peacetime. In the end, the company stuck to aeronautics, and the car was never produced.

jet-powered B-47 Stratojet bomber, which first flew Dec. 17, 1947.

X-20 Dyna-Soar

It was a reusable space plane that no one ever used.

In the late 1950s, the U.S. Air Force wanted to fly to the stars. Boeing's design, the X-20 Dyna-Soar, beat out eight competitors. It was designed to be flown both as an airplane in Earth's atmosphere and as a spacecraft — just like the space shuttle a quarter-century later.

In 1960, the Air Force picked seven astronauts, including Neil Armstrong, for the X-20 program. The first space flight was tentatively scheduled for early 1965.

The Dyna-Soar never made it past the mock-up stage. Congress opted to shift the X-20's budget to the Gemini program.

The Air Force had already spent \$410 million — about \$3.2 billion today — on mock-ups before the X-20 was canceled. Research for the program later influenced the development of the space shuttle.

2707

In the mid-1960s, the future of air travel was clearly supersonic. At least, that was what many folks thought. Boeing and Lockheed vied for a federal contract to develop a supersonic transport (SST).

"At stake in the battle are billions of dollars, thousands of jobs, American prestige, the U.S. balance of payments and the futures of the two aircraft builders," the Associated Press reported in 1966.

The Boeing 2707 won the contract. It was the company's marquee program and attracted many of its best and brightest engineers.

"Our SST colleagues were clearly the haves to our have-nots," Boeing engineer Joe Sutter wrote in his book, "747: Creating the World's First Jumbo Jet and Other Adventures from a Life in Aviation."

Boeing's other development programs at the time — the 737 and 747 — had to fight for whatever resources the 2707 did not command.

The Boeing 2707 would have held about 275 passengers, making it roughly twice as big as the Concorde. The program had more orders than the Concorde, too — 122 from 26 customers.

However, interest waned due to environmental concerns and rising fuel prices. Boeing canceled the program after Congress pulled its support in 1971.

Double-deck 747

The Boeing 747 began as a full double-deck airplane, essentially two 707 fuselages stacked on top of each other. That design would not allow it to carry much cargo, and the plane would have been hard to evacuate in an emergency. So Boeing switched to a single-deck design. To do so, it had to get launch customer Pan American Airways on board.

Boeing's Milt Heinemann flew to New York and convinced Pan Am's leadership to consider one wide deck. Pan Am agreed to consider both designs. Boeing made mock-ups of each, which the airline's execs inspected in Renton.

The trip convinced Pan Am president Juan Trippe that a single, spacious deck was the better design.

767-X

By the 1980s, European airplane maker Airbus had made significant inroads into the twin-aisle jetliner market. Boeing engineers searched for a response.

"The 767 was starting to lose some campaigns against the A330, so we knew we needed to do something," Boeing Vice President Lars Andersen told The Daily Herald in Everett in 2015. In the '80s, he was part of the 767 program. Boeing's first responses were bigger versions of the 767, including one with a partial second deck at the rear of the plane. The awkwardlooking plane was nicknamed the "Hunchback of Mukilteo."

Airline executives weren't interested in the Hunchback, though. So Boeing opted for an all-new airplane, which became the 777.

777-100

When the 777 first flew in 1995, it was a 777-200. So why didn't Boeing make a 777-100?

That designation was used for a conceptual design from the late 1970s. It was a large tri-jet airliner, but Boeing shelved the project in favor of two twin-jet airplanes: the single-aisle 757 and the twin-aisle 767.

Even though the earlier tri-jet never flew, Boeing launched the 777 family with the 777-200, rather than a -100 variant.

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As Boeing celebrates 100 years, Edmonds Community College, Everett Community College, and Washington State University look forward to continued collaborations that help the world's largest aerospace company soar.

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Boeing helps Everett Community College students soar

As the Boeing Company celebrates its 100th birthday, EvCC is proud to be educating employees for the company's future.

Boeing selected EvCC as the first community college in the nation to participate in the company's AerosPACE challenge – a collaboration to close the skills gap in aerospace engineering. Students from the college's Advanced Manufacturing Training and Education Center (AMTEC) worked with teams from three universities to design, build and fly an unmanned aerial vehicle (drone).

AerosPACE is one of many ways Boeing supports higher

education. Boeing also funds scholarships for EvCC students, encourages employees to share their expertise with EvCC programs and has hired thousands of EvCC alumni.

Happy birthday Boeing from the students, faculty, staff and trustees at EvCC!

For more information about EvCC's advanced manufacturing programs, visit EverettCC.edu/AMTEC

WSU Everett engineering students reach for the stars – and Mars

In June, the Mars Rover team from Washington State University's newest campus in Everett won the secondplace trophy in a global rover competition at the Mars Desert Research Station in Hanksville, Utah. Students designed, built and tested the rover that is meant to work alongside human explorers on the surface of the Red Planet.

Their success was possible through generous contributions from The Boeing Company, including carbon fiber for the rover and in-classroom mentorship from Boeing employees for our engineering students.

WSU North Puget Sound at Everett is proud of our partnership with The Boeing Company and looks forward to that partnership soaring over the next 100 years.





From all of Cougar nation: happy 100th birthday, Boeing!





Edmonds Community College says thank you to The Boeing Company for its commitment to education and student success!

- The Boeing Company has hired many graduates from the Engineering/Engineering Technology programs and the Washington Aerospace Training and Research (WATR) Center.
- Since the WATR Center opened in June 2010, more than 3,100 students have finished WATR programs and 55 percent of them are employed by Boeing.
- Students in the Materials Science Technology Associate's degree programs have the opportunity to intern at the Boeing Research and Technology division.

"Studying materials science gave me both confidence

and clarity in dissecting the way by which products both simple and complex are designed, manufactured, and repaired. Viewing my surroundings through this lens of knowledge has garnered me the skills and reputation required to land a profitable and engaging career."

— Yonas B., Alumnus, Materials Science Technology Associate of Applied Science-T degree, now working as an MP&P Technical Analyst at The Boeing Company

Edmonds CC enthusiastically expresses its sincere appreciation and thanks to The Boeing Company for its partnership and collaboration. Happy 100th birthday, Boeing!

Learn more about Edmonds CC STEM programs at edcc.edu/STEM and the WATR Center at washingtonaerospace.com.



Warplanes kept company cruising in the early years

By DAN CATCHPOLE Herald Writer

ar is in Boeing's bones.

is best known for mak-

ing big commercial jets

As it turns 100, Boeing

"We were so busy in the air, there was no time to be scared." **ART UNRUH** Arlington native who served on a B-17 in WWII

BELOW:

Fortresses

of the 381st

Bomb Group

are escorted by

a P-51B of the

354th Fighter Squadron in

B-17G

1944.

that have carried billions of travelers around the globe. For much of its history, though, Boeing has depended on military orders for business. William Boeing and Conrad Westervelt, a U.S. Navy officer, started the company to make military airplanes. At the time, World War I was

raging, spurring the rise of military aviation. The idea of flying paying passengers was then more theory than practice. The first passenger airline had briefly operated a couple years earlier. The St. Petersburg-Tampa Airboat Line offered rides across Tampa Bay for \$5 one way (about \$119 in 2016).

After World War I, demand for warplanes dried up. To keep the lights on, the Boeing Co. had to make furniture along with airplanes. In the 1930s and 1940s, the company found success making bombers and other big military planes. Boeing was not the biggest airplane maker during World War II, but it won several key contracts after the war - for the B-47, the B-52 and the KC-135. Since then, most — but by no means all - of Boeing's successes



have come from commercial jetliners. Here are some of the most significant Boeing military products. This list does not include planes that Boeing took over through mergers and acquisitions.

Model C: Boeing's first warplane

Boeing designed the Model C seaplane as a trainer for the U.S. Navy after the United States entered World War I.

The plane marked several firsts for the young company: first all-Boeing design, first production order and first profitable airplane program. It was designed by Wong Tsu, Boeing's first aeronautical engineer. The company built 56 Model Cs, most for the Navy. Bill Boeing and test pilot Eddie Hubbard used a Model C on March 3, 1919, to make the first international airmail delivery - a run from Seattle to Vancouver, British Columbia.

Thomas-Morse MB-3A: Stealing success

When airplane orders plummeted after World War I, the Thomas-Morse MB-3A helped Boeing stay afloat during difficult times. For several years, Boeing made furniture and small boats in addition to airplanes to pay the bills.

In 1921, the U.S. Army Air Service solicited bids to build 200 MB-3As. With access to cheap spruce and more efficient production systems, Boeing underbid the plane's designer, Thomas-Morse Aircraft in upstate New York, for the contract.

While the deal buoyed Boeing, it was a serious blow to Thomas-Morse. It wasn't able to absorb the plane's development costs and was taken over by Consolidated Aircraft a few years later.

PW-9/FB: Boeing's first fighter P-26: Peashooter

In World War I, the U.S. military relied on French- and British-designed fighters and bombers. By the early 1920s, Boeing and other American airplane makers were catching up.

Boeing engineers used what they had learned from the MB-3A in designing what the company named the Model 15. It was the first Boeingdesigned fighter plane.

The Army and Navy both ordered the biplane in 1923. The Army Air Service designated it PW-9, which stood for "pursuit water-cooled design 9." It had several designations for the Navy FB-1 through FB-5. Boeing delivered 157 of the fighters, as well as 77 trainer derivatives, called NBs by the Navy.

Its performance established Boeing's reputation as a warplane producer, and its steel frame marked Boeing's move away from spruce-andwire airplanes.

Y-1B/B-9: The Death Angel

The B-9 bomber broke with the cumbersome-looking biplane bombers of the dav.

Its streamlined fuselage and single wing gave it a sleek look and enabled it to outrun fighters. It also had four machine guns to fend off any fighter that got close.

A 1931 article in Modern Mechanics dubbed the plane the Death Angel, and described it as a "veritable flying fortress." That moniker would be more famously applied to Boeing's next bomber design.

Few Death Angels were produced. The B-9 was soon surpassed by the Glenn L. Martin Co.'s B-10 bomber.

Boeing's first swept-wing jet bomber, the B-47, flew less than 20 years later.

By the late 1920s, Boeing had produced several successful biplane fighters, including the P-12/F4B. The plane — called P-12 by the Army and F4B by the Navy — first flew in 1928, and Boeing delivered nearly 600 within four years.

Despite the plane's success, Boeing engineers were already exploring a monoplane fighter when the P-12/F4B first flew.

Their work produced the P-26, a streamlined, open-cockpit fighter popular with pilots. The plane was among the fastest of its day. But by the time the United States entered World War II, the P-26 had been surpassed by more modern planes and had been all but taken out of front-line service. A few remained in service with Filipino units.

When Japan attacked the Philippines, the Japanese devastated Filipino and American air units. However, on Dec. 12, 1941, Capt. Jesus Villamor led the 6th Pursuit Squadron of the Philippines Army Air Corps against a fleet of enemy bombers escorted by agile Zero fighters. Despite being outclassed by the Zeros, Villamor downed two. However, a few days later, his unit destroyed its planes rather than let them be captured.

B-17: Built to fight

When the U.S. Army asked American airplane makers to develop a long-distance, heavy bomber, Boeing was losing money and cutting jobs. Its Model 247, the first modern airliner, took flight in 1933 but wasn't selling. There were few profitable prospects. So the company's board backed chief engineer Claire Egtvedt's vision of a powerful fourengine warplane, essentially betting

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From previous page

the company to bankroll development costs. Boeing engineers delivered.

Part racehorse, part draft horse, the Model 299 could haul more bombs than other bombers and outrun any fighter of its day. The Army Air Corps dubbed it the B-17.

When the plan first rolled out in 1935, a young Seattle newspaperman, Richard Williams, was tasked with composing a photo caption. He wrote, "Declared to be the largest land plane ever built in America, this 15-ton flying fortress, built by the Boeing Aircraft Co. under Army specifications, today was ready to test its wings." The flying fortress moniker stuck. Boeing quickly noted its PR value and trademarked the term.

The prototype crashed during a test flight, killing Boeing test pilot Leslie "Cowboy" Tower and Major Pete Hill. The Army picked the Douglas B-18, but ordered a handful of B-17s, too. Within a few years, the B-18 was obsolete, while the B-17 was still ready for the front lines.

Boeing designed the B-17 to be durable and ferocious. The idea was for a bomber able to shoot down attacking planes and remain aloft despite damage it suffered.

In 1944, Arlington resident Art Unruh was a 20-year-old staff sergeant and waist gunner on a B-17 in the 15th Air Force's 32nd Bombardment Squadron. His plane hit some of the most heavily defended targets in Europe.

"We were so busy in the air, there was no time to be scared," Unruh told The Daily Herald in Everett in 2015. "It's when you get back and start walking around that airplane — it's butchered and beat up. You get shaky."

On his last mission of the war, his plane limped home with much of its vertical fin blown away and more than 600 holes from flak and bullets fired by enemy fighters.

Col. Robert Morgan, pilot of the most famous B-17, the Memphis Belle, told an interviewer, "We could never have flown the B-29 in Europe. It wouldn't have taken the punishment. ... The B-17 was built to fight and that's what it did, it fought."

The butcher's bill for B-17 crews could be terrible. On Oct. 14, 1943, 291 Forts took off from England to bomb factories in Germany; 60 planes, more than one in five, did not return.

Despite the losses, America's airplane industry turned out bombers faster than the Axis air forces could shoot them down. In March 1944, Boeing's Seattle plant alone built 362 B-17s. In all, more than 12,000 B-17s were made by Boeing and other manufacturers working under license.

B-29: Rushed into combat

The B-29 Superfortress was the most sophisticated bomber of its day. It could fly higher, faster and farther with more bombs than any other plane. During World War II, the B-29s and their crews took the fight to Japan. Flying from distant bases, they attacked the country's ability to wage war. In August 1945, two B-29s dropped atomic bombs on Hiroshima and Nagasaki. Japan surrendered a few days later.

The B-29 bristled with computer-controlled machine guns. It had

Continued on next page



LEFT: Harry Spencer, a former member of the 792nd Bombardment Squadron, looks around the cockpit of a B-29 during a visit to the **Historic Flight** Foundation in Mukilteo with his family on June 21, 2014. During World War II, Spencer flew 35 missions in the Pacific Theater as a bombardier and navigator aboard B-29s.



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From previous page

pressurized crew cabins, allowing it to fly higher than other bombers.

Boeing built a new plant in Wichita, Kansas, to handle most of the final assembly work. But problems dogged the program early on, delaying deliveries. Hundreds of military and civilian mechanics descended on the plant, working outside, sometimes through snowstorms. Subcontractors stopped all other work. Within a few months, Boeing and the Army Air Forces had won the Battle of Kansas.

While the production issues were worked out, the Superforts suffered technical problems when first introduced in 1943, especially engine fires.

"Scared? If you weren't, you weren't normal," Everett native Harry Spencer told The Daily Herald in 2014. He flew 35 combat missions as a bombardier and second lieutenant. Those sorties included the B-29's first combat mission and the bomber's first raid over Japan.

American forces switched tactics to begin firebombing Japanese cities. Spencer recalled flying over Tokyo: "It looked like the whole city was ablaze - the fires, the ack ack, planes going down - ours and theirs. It was just like flying into hell."

C-97 Stratofreighter

BELOW: Boeing learned valuable lessons from its B-47 bomber, the first American airplane with swept wings and podded engines.

American industry ballooned rapidly during World War II. The downsizing after the war happened just as fast, and it hit workers and companies hard.

Many expected a post-war boom in commercial air travel, which never materialized. Boeing sold few 377 Stratoliners, but it sold 888 of its military variant — the C-97 Stratofreighter. Most were KC-97s, the U.S. military's first dedicated aerial refueling tanker.



B-47: Setting the standard

In the summer of 1945, a 32-yearold Boeing engineer was taken to a collection of nondescript, low-rise buildings in the woods of western Germany. What George Schairer found there changed American aviation and the Boeing Co.'s future.

He dashed off a letter to Seattle: "The Germans have been doing extensive work on high speed aerodynamics. This has led to one very important discovery." Then he drew a wing sweeping back. The angled swept wing was a critical breakthrough necessary to get the most out of jet engines.

The discovery, combined with two years of Boeing's own research and development, led to the B-47 Stratojet.

As the post-war elation chilled into the Cold War, B-47s stood ready to take nuclear war to the Soviet Union. The bomber was retired in the mid-1960s, but its shape and configuration set the standard for big jet airplanes to this day.

B-52: Stratofortress

Every Air Force pilot flying a B-52 Stratofortress is younger than the bomber they're flying - usually by several decades. Boeing started making B-52s in 1952, yet the workhorse refuses to retire. It has outlasted several replacements - and even its replacements' replacements.

Its durability is a testament to its ruggedness and flexibility - and to how little aviation technology has progressed since the '50s. The 76 B-52s that make up the Air Force's longrange punch are getting an upgrade to bring them into the digital age. However, their bones are still of 1950s vintage.

During more than 60 years in active service, B-52s have dropped everything from leaflets to a nuclear bomb. After the Soviet Union fell, the United States cut the wings off 365 B-52s as part of post-Cold War disarmament. However, the Stratofortress is still flying. It is expected to stay in service until at least 2040.

KC-135: Flying Gas Station

In 1954, Boeing test pilot Tex Johnston famously rolled the company's Model 367-80 while flying over Lake Washington. The company built the plane to prove the concept of jet transport, and it delivered. It led to the KC-135 Stratotanker and its sibling, the

707. Boeing made more than 800 KC-135s and variants. They continue to be the Air Force's primary aerial refueling tanker — at least for now. Boeing is making a replacement, the KC-46 Pegasus.

Minuteman missile: Always ready to defend

In 1957, the Soviet Union launched a small satellite - Sputnik - that passed silently overhead, inspiring awe and fear in America. If the USSR could launch a satellite, it could soon launch a nuclear missile capable of leveling U.S. cities.

In response, Boeing developed the LGM-30 Minuteman missile. It was named after the Revolutionary War militiamen ready to pick up their muskets at a minute's notice. During peak production, the program employed nearly 40,000, mostly in Seattle and at a final assembly site in Ogden, Utah.

By the 1970s, 1,000 missiles were deployed at launch sites around the U.S. Today, 450 missiles are still active. The Air Force plans to keep the Minuteman in service until at least 2030.

CH-47 Chinook: Twin-rotor workhorse

Designed in the early 1960s, the CH-47 Chinook is one of a handful of aircraft from that time still in production. Boeing has produced more than 1,200 of the twin-rotor helicopters. At peak production in 1967, the Boeing Vertol plant in Philadelphia rolled out a new Chinook every 24 hours.

V-22: Controversy takes flight

What takes off like a helicopter, flies like an airplane, and saw its development costs balloon by 1,000 percent? The Bell Boeing V-22 Osprey was one of the most controversial weapons programs in recent decades.

Bell Helicopters and Boeing started developing the tiltrotor aircraft in the early 1980s. The V-22 did not enter active service until 2007. The innovative aircraft's engines and rotors point up, allowing for vertical takeoffs and landings. Once in the air, they tilt forward and the V-22 flies like an airplane.

Critics say that it is expensive about a \$100 million sticker price — to buy and fly, and it does not perform as well as the CH-47 Chinooks and CH-46 Sea Knights it is meant to replace. The

Pentagon's former top weapons tester told the New York Times that the V-22 is like a bad poker hand — and the Marines keep betting on it.

The Marine Corps and other Osprey supporters say it outperforms traditional helicopters - especially as a medevacs - and its capabilities justify the price tag. They also say it is as safe as any other military aircraft. However, a 2015 crash that killed two Marines renewed safety concerns.

F-22: A Flying Fortune

Boeing got back into the fighter business in the 1990s when it teamed with Lockheed Martin to design and build the F-22 Raptor, a stealth, fifthgeneration fighter. Like nearly every modern weapons program, the fighter has not performed quite up to what was promised. The F-22 generally has done well (and certainly better than its successor, the Lockheed Martin F-35).

Even so, the Pentagon stopped F-22 production in 2011 after 187 deliveries. But Boeing will likely still be making jet fighters into the next decade. When the company bought McDonnell Douglas in 1997, it inherited the F-18 Hornet, which is assembled in St. Louis. Boeing has upgraded and enhanced the durable 1970s-vintage warplane. While not as fancy as an F-22 or an F-35, the F-18 and its variants have done something neither of those 21stcentury jets can claim: They've proven they can get the job done without a lot of fuss and drama — and for a lot less money.

P-8: Submarine hunter

The P-8 Poseidon is the U.S. Navy's new submarine and ship hunter. Based on Boeing's 737-800, it is assembled in Renton. The P-8 entered service in late 2013.

KC-46: Fueling distant fights

After a messy bidding process that included a couple do-overs, Boeing won the Air Force's contract to develop a new aerial refueling tanker based on its 767. The KC-46A is assembled in Everett, and is in development. It is slated to enter service in 2017, when it will start replacing 1950s-era KC-135s.

With its long range and large fuel capacity, the Pegasus, as the KC-46 is called, is critical to extending American air power to far-flung hot spots.



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Billy Elliot, on stage in Everett July 8 – 31

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How's the future look? Ask Teague

Virtual-reality tour is Boeing contractor's latest innovation



Murrav Camens

Head of Teague

Aviation Studios

By JIM DAVIS The Herald Business Journal

EVERETT — The future of Boeing can be seen, but it can't be touched. A virtual-reality tour set up in a studio at Boeing's Everett plant reveals the interior of the 777X, the company's next-generation airplane that's still years from production.

It's not Boeing employees who created this. It's designers from longtime Boeing collaborator Teague.

The industrial design firm is pioneering the use of virtual reality for aviation to help its designers understand the physical space of new planes and to help customers visualize what's coming.

"(Boeing) needs to bring customers and show them what they're going to spend hundreds of millions of dollars, or billions of dollars, on if it comes to a large order," said Murray Camens, a Teague vice president and head of the company's Aviation Studios. "We can do that virtually."

It's not unusual for a Boeing contractor to work on a project as sensitive as the 777X. Teague began collaborating with the company 70 years ago and has been deeply involved with every plane Boeing has designed since the 707.

In fact, Boeing relies on thousands of suppliers to help with critical phases of production, said Boeing spokeswoman Mary Miller. Supplierprovided components and assemblies — or, in the case of Teague, intellectual property — make up about 65 percent of the cost of Boeing products.

Last year, Boeing Commercial Airplanes alone spent more than \$40 billion purchasing parts and work from about 1,500 suppliers.

In Boeing's early years, one of its first suppliers was Seattle's Western Drygoods, which provided the company with Irish linens that were used on the fuselage and wings of airplanes. Since then, suppliers have entered and left the company's supply chain. Teague stands as one of a small group of suppliers that have continued since the



Teague senior 3D imagery designer Tyler Brinkhorst shows how clients will use virtual reality goggles and toggle to view a plane's interior during a demonstration on June 3 in Everett.



Walter Dorwin Teague founded the company that bears his name in 1926.

early years. Others include UTC Aerospace Systems and Rockwell Collins.

Walter Dorwin Teague founded his company in 1926 in New York doing what was then called styling and now is known as industrial design.

Teague helped his first client, Eastman Kodak Co., design cameras, retail locations and even World's Fair exhibits. (Later industrial design achievements at Teague would include the Pringles canister.)

In 1946, Boeing hired Teague to work on the interior design of the Boeing Stratocruiser. Designer Frank Del Giudice came to the Puget Sound area on a three-month contract and never left. He became the Boeing creative lead for Teague and established Teague's first Seattle studio.

With the Boeing 707, which launched a little more than a decade after the Stratocruiser, Teague became the design firm for every Boeing plane through the 787 and now the 777X.

"Everything you see when you walk into a plane, Teague has touched it," Camens said. "If it's a Boeing airplane, we have literally thought it through, conceived it, conceptualized it, made a mock-up of it, developed it into a physical full size and supported the engineering of Boeing to actually develop it into a production piece and then followed it into production.

"Then you have the airline that comes and they purchase that airplane," he said. "And they customize that interior with their colors, their finishes, their surfaces, their branding, and we support that part of the process, as well."

Teague now counts Boeing as its largest customer, although the company does design for others, including Microsoft, Starbucks and Intel. In 1997, Teague moved its headquarters to Seattle. The company runs studios in Boeing's Everett and Renton plants.

"If you think of 70 years of relationship, we've been in many buildings across the Boeing campuses both inside and outside the fence," Camens said. "We're inside the fence right now and this is where we like to be because it's about collaboration and co-creation. What better way to do it than inside the

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A walkway bearing messages about design is one of the decorative touches in

From previous page

home of the client?"

In Everett, the modern, open office floor studio sticks out in an aging warehouse. About 100 designers work in the space on everything from the nose to the rudder of planes. The designers have even played a major role in the custom liveries that have become so popular, such as the Seahawks livery unveiled before the Super Bowl two years ago and the "Star Wars"-themed livery with R2-D2.

the office of industrial design firm Teague.

Boeing relies on Teague to find, attract and train talent from all over the world, said Camens, who is Australian. His designers are constantly looking for new colors, new materials and new designs. At the moment, one of the major influences in aircraft interiors is lighting, Camens said. It can help calm people's senses as passengers board and fly on an airplane.

"It creates a changing environment," Camens said. "It creates a differentiation. When it comes to competitive differentiation, lighting is fairly easy to change out."

From the Boeing 707, which was the company's first jetliner, Teague has created models of aircraft interiors where potential customers can walk down aisles, sit in seats and even eat meals. The company employs 30 builders creating mock-ups in Everett.

Virtual reality is seen as a natural next step, said Eric Klein, Teague's design visualization manager. The technology has been around since the 1950s, but it was mostly just two small television screens inside goggles, Klein said. The technology has finally begun to become refined in the past few years with the Kickstarter-funded Oculus Rift goggles. While the goggles are mostly used in the gaming industry, Teague is adapting them to aviation.

"The best thing about it is the sense of scale that you get in being immersed in the space," Klein said. "We use it as a design tool to actually understand the environment we're working in and then translate the work we like into physical mock-ups so we can work in the virtual and work in the physical and understand faster where we should be headed."

Camens said he sees this as another way for his company to provoke discussion.

"The future is not just going to happen," Camens said. "We create the future. I think as designers, we are really looking to the future and then we can back cast it. That's what the future is going to be. This is what we're going to do to get there."

Boeing gives 13 supplier-of-theyear awards, and only 12 in 2015. Teague has won a supplier-of-theyear award three times over the past five years. This year's award was re-designed into a black monolithic piece that comes together in the middle magnetically.

"The award is in two parts," Camens said. "You have Boeing and you have the supplier. It's about the collaboration between the two, and you can click them together to make a better whole, of course."

Teague designed the award.

Tax figures suggest breaks have helped draw suppliers

By JERRY CORNFIELD *Herald Writer*

OLYMPIA — It is no secret that a batch of generous state-sponsored tax breaks helped convince the Boeing Co. to build its newest airplanes in Washington.

What is less known is that these same tax breaks — coupled with Boeing's presence — are a factor in an increasing number of aerospace suppliers setting down in Snohomish County and throughout the state.

You can see it in a new batch of data released by the state Department of Revenue.

In 2015, aerospace companies avoided \$322.1 million in tax payments to the state by taking advantage of incentives provided exclusively for industry-related expenses. These include a lower tax rate on aircraft sales and waiving of certain sales and property taxes.

Boeing, not surprisingly, reaped the greatest share, \$300.4 million, as a result of strong plane sales and capital investments for the 737 MAX and 777X. This includes work on the \$1 billion, 1.3-million-square-foot facility to build carbon-fiber wings for the new jetliner.

Company officials say Boeing continues to be a big spender in the state, as well. They estimated that in 2015, Boeing spent \$13 billion in Washington on wages and benefits for its workers, as well as purchases from local suppliers and contributions to community groups.

A distant second in terms of total savings was Toray Composites America in Tacoma, which produces the carbon-fiber-composite material Boeing uses on its planes. Toray saved \$1.73 million in 2015.

Kaiser Aluminum, producer of aluminum used in the planes, followed with \$1.2 million in savings, and Electroimpact of Mukilteo, maker of automated manufacturing equipment for Boeing, Airbus and other plane builders, reported nearly \$1.1 million in savings from incentives.

In all, 287 firms shaved a few dollars to several hundred thousand dollars

off their respective tax bills in 2015, according to information submitted to the state.

It was a similar picture in 2014, when tax breaks saved 262 companies a collective \$231.3 million, according to preliminary data released by the state.

Of the total, Boeing reported \$217 million in savings, followed by Electroimpact with \$1.32 million.

Exotic Metals Forming Co. of Kent, which specializes in sheet metal components for aircraft, reported the third-highest savings that year, \$834,649. Close behind was Senior Aerospace Operations with \$796,526; Senior Aerospace is the parent company for Absolute Manufacturing and Aerospace Manufacturing Technologies, both in Arlington, and Damar Aerosystems in Monroe.

Meanwhile, 13 companies in 2014 and 24 companies in 2015 reported savings of less than \$500 from an aerospace tax break.

This year marks the first time the state is requiring companies to disclose the value of aerospace incentives, which were first approved in 2003 as the state successfully convinced Boeing to assemble its 787 jetliner in Washington.

In 2013, state lawmakers and Gov. Jay Inslee agreed to expand the suite of tax breaks to help persuade Boeing to build the 777X in Everett. They also extended the life of the tax breaks from 2024 to 2040.

At the time, the tax breaks were estimated to save Boeing and the entire aerospace industry \$8.7 billion through 2040.

State revenue officials caution that the data released in early June could, and likely will, change before the agency publishes its annual survey of tax breaks in December.

There are an estimated 650 aerospace suppliers and 1,350-aerospace-related companies operating in Washington that are not named Boeing, according to the state Department of Commerce.

Companies had to turn in their financial information by the end of April, though some were granted extensions. Some firms may amend their filings before the year is out.

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To the moon

RIGHT:

The world's first view of Earth taken by a spacecraft from the vicinity of the moon. The photo was transmitted to Earth by the **United States** Lunar Orbiter I, which was built in Seattle. This crescent of the Earth was photographed on Aug. 23, 1966



Airplane maker's expertise boosted America's space program, as well

By CHRIS WINTERS Herald Writer

or a company associated with things that fly through the air, Boeing has done a lot of work outside the bounds of our atmosphere.

During the 1950s, the United States feared it was suffering from a "missile gap." In 1955, the Soviet Union detonated the first hydrogen bomb, and in 1957, it became the first nation to put an object into orbit: Sputnik I.

These events worried the United States, and the military put more resources toward developing the ability to deter a Soviet attack.

One of the early projects was the Minuteman, a solid-fuel intercontinental ballistic missile that could be launched at a moment's notice and remain on alert for years at a time.

The U.S. Air Force awarded Boeing the contract in 1958. The first test launch of a Minuteman came on Feb. 1, 1961, and the first launch from a silo that November. Just one year later, 10 newly deployed Minuteman missiles became President Kennedy's "ace in the hole" during the Cuban Missile Crisis. They were the final deterrent that he didn't have to use during the 13-day standoff with the Soviet Union.

At its peak, the Minuteman program employed nearly 40,000 people in Seattle and at the final assembly site in Ogden, Utah. The U.S. still maintains 450 Minuteman III missiles as part of its nuclear arsenal.

The Minuteman also served another purpose: It proved that Boeing was capable of designing and developing complex projects that involved many parts, contractors, supply chains and quality controls. In other words, systems within systems within systems.

"It's not just understanding that and choreographing all movement and connections," said Michael J. Lombardi, Boeing's corporate historian. "The other part of it is working all the faults out of it so that the system works flawlessly."

That capability is known inside the

industry as Large Scale Systems Integration, or LSSI, and it grew out of Boeing's transformation during World War II.

"We went from creating a few dozen airplanes by hand per year to the point where we were building thousands of airplanes in a moving line," Lombardi said.

A Congressional inquiry after the 1967 fire that killed three astronauts on what would have been the Apollo 1 mission, determined that NASA was having trouble building rockets and training astronauts for a mission to the moon.

Boeing's capabilities with large systems led to the company's selection by NASA to manage the Apollo program, to handle the nuts and bolts of building moon rockets while NASA focused on the mission.

"Essentially, Boeing donated 1,500 engineers and executives to assist NASA in the management of Apollo-Saturn," Lombardi said.

Boeing went on to build the firststage booster for the Saturn V rocket that took astronauts to the moon in Apollo 11. It also joined then-competitors McDonnell Douglas and North American Aviation (both now part of Boeing) as a principal contractor for the entire Apollo project.

Since then, Boeing's expertise has been crucial for many projects in the U.S. space program: ■ The Lunar Orbiters flew five missions in 1966-67 that took the first close-up photos of the moon and helped NASA select the Apollo landing sites. The orbiters were built at the Boeing Missile Production Center in Seattle and tested at the Boeing Space Center in Kent.

■ The Lunar Roving Vehicles were moon buggies that flew on Apollo 15, 16 and 17 and were left parked on the moon for future astronauts to use. They were also built in Kent.

■ One early interplanetary probe, Mariner 10 in 1973, was the first to visit multiple planets with a gravity assist; in this case, using Venus' gravity well to accelerate and propel the probe to Mercury.

■ The Inertial Upper Stage Rocket was a rocket that could be launched from a Titan IV booster or the space shuttle. It was used to send the Magellan probe to Venus in 1988, and in 1990, to send the Galileo probe to Jupiter and the Ulysses probe to the sun. Up until 2004, it was also used to put satellites in orbit.

■ Boeing was the prime contractor on the International Space Station starting in 1993, and in 2008 was awarded the \$650 million contract to deliver and integrate the remaining components of the ISS, which is still operational.

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THE BOEING CENTURY



















TOP ROW, FROM LEFT: The Model C seaplane trainer; the Model 80A transport; a restored 307 Stratoliner. CENTER ROW, FROM LEFT: The B-17G; a B-29 Superfortress and crew; an XB-47 carrying missiles. BOTTOM ROW, FROM LEFT: The 737-300; the 747; the 777-200.





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BOEING HISTORY IN THE HEADLINES



TOP ROW, FROM LEFT: On May 2, 1966, the front page announced that Paine Field was being considered for a 747 factory; a spread on Sept. 30, 1968, marked the rollout of the first 747, noting that 10,000 people attended; the front page on April 10, 1994, described the 777's debut as a "multimedia spectacular." **BOTTOM ROW, FROM LEFT:** A story on Dec. 16, 1996, announced Boeing's \$13.3 billion deal to buy McDonnell Douglas; and a full-page photo on Dec. 16, 2009, shows workers cheering as the 787 makes its first flight.



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For many in the region, Boeing runs in the family. From right, Jean Barnes, 66; her husband, Dean Barnes, 71; and her brothers, Gerald "Jay" Gallagher, 61, and Gordon Gallagher, 69, all worked at Boeing. So did Jean Barnes' friend Anita Naylor (left), 68. Naylor's father, who worked at Boeing before her, helped his daughter get a job with the company.

Boeing pride runs deep

STORY BY JULIE MUHLSTEIN • THE HERALD

A t the Barnes household in Lynnwood, siblings crowd around a kitchen table. Stories fly as old photos rekindle memories of their work lives at Boeing. "In our immediate family, we've put in 130.5 years at Boeing," said Gerald "Jay" Gallagher, 61, who recently visited the home of his sister, Jean Barnes, and her husband, Dean Barnes. The Barneses are both Boeing retirees, as is Gordon Gallagher, 69, another brother visiting that day. Anita Naylor, a longtime friend of Jean Barnes, was there, too. And yes, Naylor also put in decades with the company. In a frame on the table was a picture of the siblings' late father, Jerry Gallagher. He worked for the Boeing Co. from 1950 until 1983. From '67 on, he was a leader in final 747 assembly at the Everett plant. Jay Gallagher, who also is retired from Boeing, said their father died in 1998.

For this clan and myriad others in the region, Boeing is a family affair — an employer of parents and their children, siblings and cousins, husbands and wives.

"I used to see Dad in the main factory. All of us worked at Boeing with Dad," said Jean Barnes, 66. Their sister Jackie Andrews, now deceased, had a Boeing job, too. She worked in the wire shop in Everett.

Jean Barnes said her son, Tom Faurie, is another family member who worked at the company for a time.

And she shared her secret for how she got to know her husband. Dean Barnes, 71, worked as a Boeing custodian in the same building where Jean was a manager in production control. "He had been married, but lost his wife," Jean Barnes said. She kept a jar of candy on her desk, and Dean would stop by for Hershey's Kisses. They retired together in 2005.

Jay Gallagher, also of Lynnwood, worked for years in metrology that supported in-flight tests. He retired in 2014 after working the last eight years in Everett. He was involved in static tests for the 787.

His brother Gordon, who splits his time between Lynnwood and Mesa, Arizona, was a machinist who made interior panels for Boeing aircraft.

Naylor's father, Keith Marsden, wasn't able to join the group recently, but the Bothell man has vivid memories of working with his daughter.

At 96, Marsden can't recall exactly how many years he spent with Boeing. He does remember his last day of work: March 31, 1975.

He had worked at Boeing's Plant 1, on Seattle's Duwamish Waterway, and at Plant 2 near Boeing Field before coming to Everett for his last 12 years with the company.

"When I started in the Everett plant, we had to wear coats because the doors weren't on there yet. It

Continued on next page

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From previous page

was the largest building in the world," Marsden said. "I was in quality control at the Everett plant. Basically, I'm a machinist. I was a lead, responsible for rejected parts and whatnot."

In his long career, he worked on Boeing's B-314 "Yankee Clipper," a flying boat produced in the late 1930s and early '40s, and on the 747 into the 1960s and '70s.

And while he was in Everett, he helped his daughter Anita land a Boeing job.

"I told one of the shop supervisors at the time, 'I've got a daughter you should have working for you.' I just talked about her, and said, 'You'll get a day's work out of her,' " Marsden recalled.

For Naylor, that day's work turned into 37 years with the company.

"Back in those days, the 1960s, a parent could recommend someone," Naylor said. "I remember him telling me, 'Don't do me wrong. Keep up the good name.' I did well by him."

She started as a dispatch clerk at Boeing Plant 2 before coming to the Everett plant in 1968. "I got laid off in 1971, but came back in 1977," said Naylor, 68, who lives at Lake Shoecraft.

She worked in Boeing records, and later as a lead in stores. When technology changed that job, she went to school for computer training to help other Boeing records staff with the transition to computers.

"I was there from the 727 up to the 787. The last place I worked was interiors, the stow-bin area," Naylor said. "I retired in 2010 after about 37 years."

Naylor looked to her father as a role model at Boeing. "He is a delightful person, and he was so dedicated to his job," she said. "He was a lead in inspection. He was so thorough with what he did — sometimes too thorough. But he made sure he did everything right."

Many in the area have family ties to Boeing, although they never worked for the company themselves. Kelvin Whitney-Scism Barton grew up in a family of Boeing workers and Boeing suppliers. He is retired from Everett Transit and now lives in Blaine. After the 9/11 terrorist attacks, Barton said, he worked altering Everett bus routes to Boeing to jibe with the company's security concerns.

His grandfather, Ralph Scism, worked at Boeing's Renton facility



Boeing's B-314 "Yankee Clipper" was one of the planes that Keith Marsden worked on during his many years at Boeing. Marsden, of Bothell, also put in a good word for his daughter, Anita Naylor, who was hired in the 1960s and had a 37-year career with the company.



B-29s," Barton said.

building shipping containers for parts.

During World War II, Barton's grand-

mother, Marie Scism, worked at the

plant near Boeing Field as an assem-

bly line mechanic. "The family does

not know if she worked on B-17s or

Barton's uncle, Glen Scism of

Whidbey Island, worked at Boeing's

main factory. All of us worked at Boeing with Dad."

"I used to see Dad in the

Jean Barnes, on her father, Jerry Gallagher, shown at left. Barnes and her three siblings all worked at Boeing.

Renton plant as a toolmaker. He retired in 1970.

They weren't Boeing workers, but Barton said his father and brother both worked in machine shops that made parts or repaired equipment for the company.

In the Barnes house, the siblings looked at a keepsake photo and

explained its history. Their father and two other men, in 1960s suits and ties, had just completed a power test on the prototype 747, RA001, dubbed the City of Everett.

"I kissed the first tail of the first 747," Naylor recalled. "I was working second shift at the time, and they brought it in from the paint shop."

The Gallaghers, Barneses, Naylor and her dad couldn't be more proud of their work or their company.

"We talk about the old days at Boeing all the time," Naylor said. "I worked with a lot of wonderful people. We were well taken care of. We were well paid. We worked hard. I take great pride in Boeing."

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'Part of something remarkable'

Longtime employees remember notable moments in their careers at Boeing



"I walked

factory one

morning to

encounter a

747 hoisted

on jacks.

I always

stood in

plane."

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Bonnie Grisim

"In the late 1940s, my father graduated in one of the first classes of Boeing aviation mechanics. At that time, they trained and certified their own mechanics. His entire career was at Boeing and that job took care of our family. His example inspired me. I started at Boeing in 1969 and stayed 32 years.

"I was a product analyst for Boeing Commercial Airplanes at the Everett and Seattle flight lines. We coordinated with different divisions to ensure they had their needed parts. I started and ended with the 747 with many models between. I was particularly proud to source parts during emergency situations. We helped gather the nuts and bolts to get planes safely on their way.

"It was important work, but also fun. There were around 30,000 people working at Boeing Everett and we had huge Christmas parties. In the 1970s, everything shut down and we set up tables in the aisle ways. Everyone brought food and managers were in charge of turkeys and hams. We warmed the food in the paint-booth ovens

"Sometimes a moment reminds you that you're part of something remarkable. I walked into the factory one morning to encounter a 747 hoisted on jacks. I always stood in awe of that plane. Even if you understand the physics of flight, actually walking under the enormity of that plane boggles the mind. It's an absolute marvel."

— Deanna Duff

John Monroe

"When I started working at south Boeing Field in 1965, Interstate 5 didn't even yet extend from my Everett home through Seattle. I began as



a draftsman for the Minuteman missile program, earning \$1.92 an hour. When I decided to pursue higher education, Boeing paid for every credit at Everett **Community College**

through graduation from University of Puget Sound. The value wasn't just in the dollar amount, but knowing they believed in me. They invested in my future with the company.

"My entire 37-year career was at Boeing. That's unusual these days and says a lot about Boeing's commitment to employees. I worked on the 7J7 program and ultimately retired as director of program management for the 777. My best memories are the relationships I built with customers and suppliers. I still exchange birthday and Christmas cards with many of them. Since retiring, I've traveled as far as Israel to visit former clients. They became friends for life.

"The bedrock of Boeing is creating a lasting sense of community. I became involved with Economic Alliance Snohomish County because of Boeing's ethos to give back. One of my most cherished keepsakes sits on my desk. It's a golf ball from my mentor, Alan Mulally - former CEO of Boeing Commercial Airplanes. It was a retirement gift and is decorated with his doodles of playful airplanes. It's a reminder that working at Boeing is a hole-in-one, both personally and professionally."

- Deanna Duff

Brad Phillips and Phil Caruso

Brad Phillips turned the corner, and it felt like he was home again. He and his family moved from California to Washington about five years ago so he could continue a job

with Boeing. About a year later, he was walking around the Everett plant when he saw his old friend Phil Caruso.

'We never planned to end up here together. I came up first and he came up after, and I was like, 'What are you doing up here?' " Phillips said.

The pair actually started out 30 years ago, working for McDonnell Douglas in Long Beach, California. The two men worked around each other, usually in tool-

ing or shipping and

They kept their

jobs when Boeing

bought McDonnell

Douglas in 1997.

California were

years ago.

Then their jobs in

receiving.





eliminated about five

Phillips bid through the union contract on a job in Everett so he could keep his seniority and benefits. About a year later, Caruso arrived in Everett. They've had to

adjust to the weather, moving from sunny California to often dark and gloomy Washington. Still, they're glad they can continue to work together after all these years.

"It's been a beautiful thing," Caruso said.

He added that neither of them has really changed over the years.

"We were young and good-looking and fun," Caruso said. "Now we're still pretty much good-looking, just older." – Jim Davis

Wes Nielsen

Wes Nielsen joined Boeing just as the company got into the Jet Age. He started with the B-52 bomber, which had just gone into production, and he ended with the B-2 stealth bomber. In between, he worked on the KC-135 Stratotanker, the 707 (including the first Air Force Ones), 727, 737, 747 and 767.

"When I started at Boeing in '54, management was pretty firm with people," he recalled.

He joined the 747 program in 1968, just after production had started.

The size of the plane stunned him when he first saw it in the factory. It was twice as wide and twice as tall as anything he'd previously worked on. "It was a whole new world."

The factory wasn't finished when I started on the 47," he said. "Some



office workers were stuck in desks in utility tunnels under the factory floor," because their offices were still being built. Equipment was sometimes in short supply. "We didn't have

any ladders to get into the airplanes," Nielsen said. "We needed them, and I was the team lead, so I found them."

Well, he found some that were being delivered to another team.

"So, I borrowed them. I saw a guy from the other team. I walked right by him, pulling those ladders," Nielsen said. "He never said anything about it, so I kept walking."

Nielsen got to know every inch of the 747 during his years on the program. He climbed to the top of the plane's tail, which towers more than 60 feet above the factory floor. And in the 1980s, he got to go on a predelivery flight.

"I was sitting in the last row in the back of the plane," he said. "They hadn't hung any curtains between sections, so I could see all the way to the front of the airplane."

When the plane began to take off, "I could see the floor curve" as the nose lifted off first, Nielsen said. "I saw a 747 bend."

Every long airplane bends during takeoff, but with curtains drawn between sections, few passengers realize it.

"We circled around Mount Rainier. It looked close enough to reach out and touch."

— Dan Catchpole

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747 forged Everett link



The Boeing assembly plant in Everett is adorned with a set of murals that set a Guinness World Record. A mural was applied to all six assembly bay doors, which are each 82 feet high and 300 to 350 feet wide — about the length of a National Football League field. The mural shown in this image was replaced in 2014.

t started with a handshake.

A simple handshake between two giants of aviation: Juan Trippe, the visionary head of Pan Am, and Bill Allen, Boeing's clear-eyed president. The two friends had rented John Wayne's yacht for a summer fishing trip in Alaska in 1965.

STORY BY DAN CATCHPOLE THE HERALD While they chased salmon, the audacious Trippe pressed Allen to build an airplane that could carry more passengers farther while slashing costs. By the day's standards, what he proposed was more of an ocean liner in the sky than a jetliner.

"If you build it, I'll buy it," he said. "If you buy it, I'll build it," Allen replied.

The men shook hands. That handshake led to the 747, an airplane that revolutionized air travel, brought Boeing to Everett, and almost financially ruined the company.

Boeing was in the midst of a rapid and dramatic expansion. It had committed huge resources to several development programs in its fierce competition with Douglas Aircraft and other rivals. Nonetheless, Allen, who was as prudent as Trippe was bold, promised to deliver the plane in four years.

It had been only eight years since the 707 first flew, and only a year since the

first 727 had been delivered. Boeing was developing the 737 and the 2707, more commonly called the SST shorthand for supersonic transport.

The SST was the company's most prestigious development project. It was competing with Europe's Concorde. Many aviation leaders saw speed as the future of air travel, and Boeing executives expected 800 orders for supersonic jetliners.

But the 747 presaged where commercial aviation was really headed. Passengers preferred cheaper over faster, and flying direct, rather than through hub airports.

Boeing Vice President Malcolm Stamper took over the team tasked with designing a plane two-and-a-half -times bigger than the jetliners then

Continued on next page



In 1940, Joseph F. "Joe" Sutter took a summer job at Boeing's Plant 2 while studying aeronautical engineering at the University of Washington. He would become known as the "father of the 747" for managing the design team under Malcolm Stamper, head of the 747 project.

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LYNNWOOD AND BOEING, A SHARED HISTORY

This year, as Boeing celebrates its 100th year, communities across the region reflect on the role the aerospace giant has played in their histories. Like so many regional communities, Lynnwood's early history and Boeing's presence in Snohomish County are intertwined.

With the Boeing culture of community involvement, it is not surprising that several employees were key figures in the incorporation and early governance of Lynnwood. For example, one Boeing employee led early Lynnwood incorporation efforts in 1959, and another sat on the first Lynnwood City Council. Mayor Hrdlicka, who moved to Lynnwood and worked for Boeing in the early 1960's, was an active community member, Councilmember and Lynnwood's Mayor for 25 years.

As Boeing expanded and grew, so did Lynnwood. The opening of the Boeing factory at Paine Field in 1967 brought thousands of workers to the area looking for housing, services and goods, and Lynnwood's economy and local businesses benefitted. By the 1980's, Boeing and the aerospace industry were taking hold in south Snohomish County, employing thousands directly and creating jobs in services and retail for many more. Today, Lynnwood is home to over 2,000 Boeing employees. Aerospace companies located in Lynnwood employ dozens more.

Boeing's spirit of innovation continues to advance aerospace and build the success of the company, which benefits Lynnwood and Snohomish County in many ways. As Lynnwood builds its City Center, welcomes Sound Transit Lynnwood Link Light Rail, and achieves its vision to be a regional model for a sustainable, vibrant community, we celebrate Boeing on reaching its centennial.

Sound Publishing July 2016 H9

From previous page

flying. Joe Sutter, a young engineer who'd proved himself on Boeing's other jets, was tapped to lead 747 engineering.

Hundreds of Boeing engineers, scattered around spare offices in south Seattle, started sketching out the behemoth 747. Many had been assigned to the program simply because "they were available," Sutter said. "Luckily, the whole gang of engineers and production people were pretty knowledgeable."

Those engineers and other workers who would help turn the 747 into a reality came to be known as "The Incredibles."

World's biggest building

Before production could begin, though, Boeing had to build a factory for the new airplane. Fittingly, the biggest commercial airplane to fly would be assembled in the world's biggest building by volume.

Boeing property managers searched for large, undeveloped locations close to a railroad, a highway and a long runway. Everett's Paine Field was an obvious candidate. The company also considered other sites in Washington and out of state, including in California.

Sutter and others balked at going out of state.

"I told them it would be a big disaster," he said. "We had 29 months to roll an airplane out, and if I was going to spend 25 percent of my time running between here and California, when the hell would I help design the airplane?"

Meanwhile, Paine Field officials courted Boeing. The airport, owned by Snohomish County, had primarily been a military base since World War II, but the Air Force was on its way out.

Robert Best, the airport commission's head — and the Everett Herald's owner and publisher — knew Bill Allen "enough to pick up the phone" and arrange a meeting, said George Petrie, Paine Field's director at the time.

In March 1966, Petrie and Best pitched Allen on a plan to help Boeing acquire the forested land surrounding Paine Field. Boeing's chief interrupted the pair.

"He said they had already optioned about 700 acres," Petrie said. "Bob and I looked at each other in amazement. We had no idea Boeing was thinking that big."

Whatever was needed

In April, Pan Am placed the first 747 order — for 25 jumbo jets worth about \$525 million, equivalent to about \$3.8 billion today.

The next month, The Herald's front page declared: "Boeing Considering Paine Field Area for Site of 747 Jet Plant." Allen said "a community's ability to provide such services as roads, utilities and competitive tax rates" was key.

Local officials pledged to do whatever was needed to land the 747, which Boeing said would employ as many as 15,000 people. Today, more than 40,000 people work at the Everett plant and offices. Within days, officials had plans for sewer and highway extensions to the site.

In June 1966, Boeing signed a 75-year lease for use of the airport in exchange for paying part of the maintenance costs. The following month, Boeing's board greenlighted the new airplane, and the company committed to assembling it in Everett.

"I give great credit to Bob Best for getting Boeing here," Petrie said. He "did a great job promoting the airport. And since he owned The Herald, I think we got good coverage."

'Just wilderness'

Legions of contractors set about turning the forest into a factory.

"It was just wilderness," Sutter said. "It looked like a huge endeavor, because there was no main road from I-5 over to that site. There was no railroad system up the hill, and there was a big forest with bears in it and a swamp."

Problems were solved one by one, "but they did have to chase off a bear every once in a while," Sutter said.

Everett Irwin, a Boeing truck driver at the time, hauled one of the first loads of production equipment to the site in 1966. It was about 2 a.m. when he pulled in from Mukilteo Speedway. The site was bathed in floodlights.

"It was a big vacant lot," he said. "There was no blacktop. It was just dirt."

He watched the plant take shape over the ensuing months as he delivered countless loads. "It grew from nothing," the 79-year-old said.

The Incredibles

Soggy weather and labor disputes



with contractors slowed construction. Boeing was under pressure to deliver Pan Am's first 747 on time. Late deliveries meant penalty payments to Pan Am, something the company could hardly afford.

With construction still going on, a Boeing exec greeted the first 113 production workers to the site on Jan. 3, 1967, calling them "The Incredibles," The Herald reported. The nickname stuck, becoming part of aviation lore.

Workers pushed through inconveniences and discomforts, said Paul Staley. The Everett resident was a 29-year-old machinist when he joined the 747 program in September 1967.

At times, fog filled the unfinished factory, he said. "We built the factory, the jigs and the airplane all at the same time."

Engineers and machinists worked with slide rules and hand drawings. More than 75,000 drawings detailed how to make and assemble the massive plane's 4.5 million parts.

When the prototype — dubbed the City of Everett — rolled out of the plant on Sept. 30, 1968, the crowd gasped, then broke into applause.

A fleet of gliders

Company and airport officials worried that the 747's powerful engines would suck up the runway's top layer. The jumbo introduced high-bypassratio turbofan jet engines, which eclipsed everything else at the time.

When Paine Field staff asked the Federal Aviation Administration for money to resurface the runway, "the FAA claimed they were out of money," recalled Don Bakken, an airport commissioner at the time. "So, Boeing's lobbyists went to work. In about two weeks, the Secretary of Transportation flew out and gave us a check."

Just before lunchtime on Feb. 9, 1969, Boeing test pilot Jack Waddell eased the City of Everett's throttle forward. As the massive airplane accelerated, he pulled back on the controls. Finally, as it raced toward midfield, it left the ground.

The flight came nearly two months behind schedule.

Challenges popped up. Engineers found a potential flutter that could tear the plane apart. After that was fixed, they discovered a problem with Pratt & Whitney's enormous new JT9D engines that could cause them to break up at full power. Pratt & Whitney redesigned the fan shaft but struggled to produce the new version quickly enough.

Airplanes were rolling out of the factory faster than engines were arriving. Boeing workers hung 5,000-pound blocks of concrete in place of the engines to keep the planes from tipping onto their tails, and parked them around Paine Field.

"I think we had 32 (parked) at one time," Bakken said. "We had a meeting with Malcolm Stamper and he said, 'We have the largest fleet of gliders in the world."

A weapon of peace

Test flights showed the plane didn't



Continued on next page

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ABOVE: Paine Field and the first Boeing building, date unknown.



"If you build it, I'll buy it." JUAN TRIPPE Pan Am

"If you

buy it, I'll

build it."

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A marriage, of sorts

Like any long-term couple, the corporation and the county have had their ups and downs

By Chris Winters Herald Writer

n the 50 years since Boeing first came to Everett, there have been enough ups and downs to challenge any long-term relationship. Boeing has long been the largest employer in Snohomish County. Recent arrivals can be forgiven for thinking the current tiff over tax breaks to be a low point in the relationship between the company and local

governments. Many local officials courted and

BELOW: Sen. Patty Murray, Snohomish County Executive **Bob Drewel** and Boeing CEO Harry Stonecipher on Dec. 16, 2003, before Stonecipher's announcement to Boeing employees that the 7F7 would be built in Everett.

welcomed Boeing and the 15,000 employees the company was expected to bring to Everett to build the new 747. But when the plan was announced in 1966, it was greeted with caution in some quarters.

"Like all these relationships, they begin so positively," said former Snohomish County Executive Bob Drewel.

There were fears that the county wasn't ready for a manufacturer of Boeing's size, and in pure planning terms, that was prescient.

Taxpayers rejected a levy that would have paid for road upgrades to support the increased traffic. The



HERALD FILE PHOTO

initial growing pains forced the city and county to hire more workers to keep pace with the growth in population, traffic, crime and even building permits.

At the same time, the city and county started seeing increased tax revenues, and home foreclosures dropped as a growing supply of wellpaying jobs took root in Snohomish County.

The big challenge emerged as Boeing began an extended period of growth in the 1980s and 1990s.

The new 767 and twin-engine 777 required Boeing to expand its factory by about 56 acres over the course of a dozen years.

"Boeing was expanding their plant to build the 777, but they had exceeded the site population that had been granted them a long time previously," said City Councilman Paul Roberts, who was Everett's planning director from 1988 to 2004.

The previous limit had been 18,000 employees, but the arrival of the 777 was expected to double that, Roberts said.

The company ultimately was told to pay \$50 million into a fund to support increased infrastructure development.

"The county and the city got pretty excited about mitigation funds and paying their own way, so to speak," Drewel said.

But some local entities, including Snohomish County, appealed the decision because they felt that \$50 million wasn't enough, Roberts said. The upper echelons in Boeing's corporate office weren't too happy with it, either, for the opposite reason.

"But people in operations knew exactly what was happening," Roberts said. "They knew people couldn't build planes if they were sitting in cars.

Also in the early 1990s, the state of Utah successfully convinced Boeing competitor McDonnell Douglas to

build a factory there.

Boeing was planning what would become the 787 Dreamliner, and Washington state leaders grew apprehensive that the company might seek out a state friendlier to its business interests.

City and county staff set up a series of regular meetings with Boeing officials, Drewel said. They began to plan together, not just for the 787, but for other projects, as well.

Part of that involved planning the entire area around the main Boeing plant in advance to better accommodate future growth.

"If we could provide predictability, that would be the right step," Roberts said.

The result has been more transparency and cooperation. And while the tax breaks extended to Boeing starting in 2003 have helped cement that relationship, the local economy has also benefited with the opening of a Dreamliner assembly line and a new wing assembly building for the 777X. Other work has similarly boosted hundreds of Boeing's subcontractors in the area.

"The last 15 to 20 years, it seems it's been going pretty well," said Michael Lombardi, Boeing's corporate historian.

Compared with Everett, where the company's name adorns billboards and city officials regularly express thanks for its presence, Boeing's relationship with other communities sometimes isn't as positive, he said.

In Renton, for example, Boeing doesn't register much in the larger community, despite the manufacturing plant in the center of town, Lombardi said.

In the future, maintaining a mutually beneficial relationship will take work on both sides.

'Like any relationship, it's about clear and direct communication," Roberts said. "I think the city is committed to that, and I think Boeing is, as well."

Chris Winters: 425-374-4165; cwinters@heraldnet.com. Twitter: @Chris_At_Herald.



MICHAEL O'LEARY / HERALD FILE PHOTO A Boeing 747-8 is moved across Highway 526 from the assembly plant to the fuel dock on Feb. 13, 2011.

From previous page

perform to Pan Am's order specifications, and the airline put off taking delivery of the first plane until December 1969. On Jan. 21, 1970, the first paying customers boarded a 747 — Pan Am's Clipper Constitution — to fly from New York to London. It had been less than five years since Trippe and Allen's handshake.

Airlines were hardly impressed with the early 747s, which suffered from myriad problems that led to delayed and canceled flights. Boeing technicians and engineers set to solving the issues. Ernie Arnold led a four-man team cataloging every part in a rudimentary computer database.

"We analyzed every component on the 747," the 95-year-old retired Boeing electrician recalled. "When we found a problem, we told engineering to fix it."

Boeing worked out the 747's early kinks in short order. The world's first widebody aircraft was soon flying routes across the world, putting distant cities in easy reach. It shrank the world, earning the moniker "Queen of the Skies."

In July 1966, at Boeing's 50th anniversary gala, Trippe predicted big things for the 747, calling it "a bold and gigantic venture in the best tradition of American industry."

It was more than a machine, he said. It was a mighty weapon in the Cold War.

"There can be no atom bomb potentially more powerful than the air tourist, charged with curiosity, enthusiasm and goodwill, who can roam the four corners of the world, meeting in friendship and understanding the people of other nations and races," Trippe said.

The jumbo jet, he said, was "a great new weapon for peace."



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In 1959, 4 people died in 707 crash near Oso

By STEVE POWELL Marysville Globe Writer

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COURTESY OF RON PALMER

The tail section of a Boeing 707 sits on a sandbank in the North Fork Stillaguamish River on Oct. 19, 1959, after the plane crashed and broke apart.

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Influence is felt both in state and far beyond

By Kayse Angel *Courier-Herald Writer*

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Bill Boeing founded the company in 1916 with George Conrad Westervelt, a naval officer. Boeing's first shop was on the shores of Lake Union.

From those beginnings, the company helped launch the airmail and commercial airline industries. It built warplanes that helped win World War II. And over the years, the company built a reputation that commanded attention and influence.

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"I used to be called the 'Congressman from Boeing,' " Dicks said. "I didn't mind that at all. I was elected 18 times and it didn't hurt (Sen. Warren) Magnuson or (Sen. Henry) Jackson either."

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Rep. Chris Hurst, D-Enumclaw, said the tax package has helped Boeing, but the results have raised eyebrows. "I think that like a lot of other legislators, that once those tax breaks were enacted, we saw a lot of jobs move out of state," he said. "If we could do it over, maybe we would do a little different formula."

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"We are pioneers in a new science and a new industry," he once told a reporter. "Our job is to keep everlastingly at research and experiment, and let no new improvement pass us by."



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THE BOEING CENTURY

In 1959, 4 people died in 707 crash near Oso

By Steve Powell Marysville Globe Writer

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Influence is felt both in state and far beyond

By KAYSE ANGEL Courier-Herald Writer

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Members of Boeing Shared Services Group and Snohomish PUD's Energy Services team at a June Energy Matters Event



Labor: The seatbelt sign has come on

Recent decades have been turbulent ones for Boeing, unions

By DAN CATCHPOLE Herald Writer

rganized labor's influence on Boeing runs back to the company's earliest days. In 1917, the company changed job titles to make it harder for trade unions to organize its workers.

When workers unionized in 1935, Boeing didn't support the effort, but the company didn't vigorously oppose it, either. Violent clashes between pro- and anti-labor groups were not uncommon at the time. Boeing generally had good labor relations for the next few decades.

However, those relationships have deteriorated in more recent times, a decline exacerbated by workers' and corporate executives' feelings of increasing vulnerability to global economic forces. During that time, those executives have increasingly come to define the company's success in terms of the size of shareholder dividends.

Anti-unionism runs deep in the aerospace industry. Many of its early leaders were staunch labor opponents. A 50-day strike in 1935 prompted Reuben Fleet to move his company, Consolidated Aircraft, from Buffalo, New York, to sunny San Diego, which offered tax concessions, better conditions for flight tests, and, most important, a low rate of organized labor.

That same year, a handful of Boeing workers voted to organize as part



JUSTIN BEST / HERALD FILE PHOTO

Engineer Tim Donahue (left) and about 100 other SPEEA members strike at Boeing's Everett plant on Feb. 9, 2000.

of the International Association of Machinists.

Organized labor was on the rise after decades of violent and bloody clashes. New federal law gave legal and political cover to unions, which were increasingly popular among workers feeling the gnawing anxiety and economic uncertainty brought by the Great Depression. Many employers used the threadbare job market to squeeze sweat out of workers, who had little choice but to comply: it was that or risk losing their jobs. With workers feeling used by their bosses and finding no shelter in the job market, it is little wonder they flocked to organized labor during the 1930s.

At the time, many Boeing workers left for better-paying jobs at shipyards. In the first issue of the District Lodge 751's newspaper, the Aeromechanic, a worker reported, "So many of the boys have been leaving Boeing's to go work at the Navy Yard for more money, that soon they'll be able to build planes instead of ships in Bremerton." Boeing and Lodge 751 rapidly expanded during World War II. Black activists pushed the two to stop barring black workers. At the time, the IAM oath, which members repeated before every local meeting, included the pledge that "I will not recommend for membership in this union any other than members of the white race," reported the Northwest Enterprise, a black newspaper in Seattle, in 1940. The union and Boeing blamed each other for racist hiring policies.

Continued on next page



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From previous page

Federal pressure and the local campaign succeeded in opening Boeing to black workers. However, racism endured in the company's plants, shops and offices to varying degrees. During the war, Boeing leaders considered building segregated plants in order to sidestep racial clashes.

By 1945, Lodge 751 leaders were calling to remove the racist clause from the IAM oath. It was taken out at the union's 1948 national convention. Today, racism rarely comes up in discussions about Boeing's workplaces. Indeed, members of the National Society of Black Engineers have named Boeing the top employer several times in recent years.

Labor and industry generally united behind the war effort. However, in 1943, some 20,000 machinists marched in Seattle's streets to protest a wage freeze that they said was unfair to workers. Engineers started organizing in 1944, forming what is known today as the Society of Professional Engineering Employees in Aerospace (SPEEA). After the war, Boeing laid off more

than 50,000 workers.

In 1948, machinists marched on picket lines during Boeing's longest strike, which lasted nearly five months. In the end, Boeing largely won, and union members returned to work with little to show for their time on strike. At the same time, the IAM held off a bid by local Teamsters to oust the Machinists union from Boeing, which was collaborating with the Teamsters.

For the most part, Boeing and labor got along during the 1950s and 1960s. That era saw widespread labor and management cooperation as the American economy generally boomed.

"Labor turned inward and focused more on the bargaining table," rather than advancing the broader labor movement, said Charlotte Garden, a professor at the Seattle University School of Law.

Boeing suffered from the airplane industry's up-and-down cycles, resulting in big layoffs followed by waves of rehiring.

"Even with the layoffs, there was a sense of stability," said Leon Grunberg, a University of Puget Sound sociology professor emeritus who has studied Boeing's culture for more than 20 years. He and fellow UPS professor Sarah Moore have written two books on the subject: "Turbulence" and "Emerging from Turbulence."



Stephanie Lloyd-Agnew holds up a contract while chanting "just say no" with fellow machinists during a rally at the Everett Machinists Union Hall on Nov. 11, 2013. Boeing had proposed to build the 777X in Washington in exchange for significant concessions from the union.

Some 80,000 workers were laid off during the Boeing bust of the late 1960s, but Machinists didn't protest. They understood the financial trouble the company was in. That was a time when the company president Thornton "T" Wilson regularly walked the factory floors and ate lunch with workers in the cafeteria. And back then, CEO pay wasn't tied to stock price.

Relations between workers and management began to change in the 1980s, a process that has accelerated since the 1990s.

While unions generally suffered political setbacks during the 1980s, the Machinists union at Boeing flexed its muscle in 1989. After contract negotiations stalled, 57,800 union members, including more than 43,000 in the Puget Sound region, walked out, shutting down jet assembly. They returned to work 44 days later, declaring victory. Relations became so bad that historically docile SPEEA members went on strike in 2000, sporting placards reading: "No nerds, no birds." With its stock price falling, Boeing blinked, giving in to most of SPEEA's demands.

Despite the tactical wins, District Lodge 751, SPEEA and organized labor largely have been fighting an overall decline in power since then.

Myriad factors have hurt unions: overseas market pressures, increasing labor opposition, more sophisticated anti-union campaigns, stagflation in the 1970s and others. As unions have found it harder to win at the bargaining table, they have lost relevance to workers' lives, Garden said.

The IAM couldn't stop Boeing from opening a second 787 line in South Carolina, a bastion of the growing anti-labor movement. South Carolina Gov. Nikki Haley didn't shy away in her 2012 state of the state address: "We'll make the unions understand full well that they are not needed, not wanted, and not welcome."

Boeing has used the threat of moving work out of state very effectively to weaken labor, Grunberg said. "Unions at Boeing are going to be weaker in the future."

Even Boeing workers have low expectations for what the IAM or SPEEA can achieve, according to survey data collected by Grunberg and Moore.

In 2013, Boeing leaders stopped just short of actually threatening to take the company's new airplane, the 777X, out of state if Machinists didn't agree to significant contract concessions.

"This is my company, too," said Daniel Swank, a mechanic on the Everett flight line, during a "vote no" rally on an icy November afternoon. "Many of us own stock in the company. I'm third-generation Boeing. I love this company, and I hate what they're doing to us." "Unions at Boeing are going to be weaker in the future."

Boeing scholar, coauthor of "Turbulence"



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Boeing's history is Renton's, too

Relationship has had a huge impact on the city and its workforce

By Kayse Angel *Courier-Herald Writer*

RENTON — The Boeing Co. and the city of Renton have grown up together through good times and bad. The company came to Renton in 1941 when the U.S. Navy and Boeing announced plans for construction of a new airplane assembly line plant east of the Renton airport.

On Dec. 7, 1941, the Japanese navy attacked the U.S. Pacific fleet at Pearl Harbor. The moment the first American battleship was bombed, the mission and destiny of Boeing and Renton changed course.

By April 1942, the first Boeing employees started to work at the Renton plant. In 1943, it was announced that the airplane Model 345 four-engine B-29 bomber would be produced at the Renton factory. More than a thousand B-29s were assembled and flown from Renton Army Air Force Field.

By the end of World War II, Boeing, and the Renton plant, had grown into one of the most dominant aerospace manufacturers in the world.

Renton Mayor Denis Law said the city has a "strong 75-year relationship with Boeing. It has been an integral part of this city. There was a day when you couldn't keep from running into someone who worked at Boeing or had a loved one who worked for Boeing."

After the war, Boeing aircraft assembly at the Renton plant came to a close from July 1946 through early 1949.

The U.S. government owned the plant at the time, and Boeing was told

to vacate in 10 days. But the company was then given an extension, and the rest is aerospace history. Boeing was awarded a research

contract to study ramjet propulsion,



A Boeing employee works on an engine at the company's Renton 737 plant in March.

and in September 1947, the War Assets Administration turned over the deed for the airport to the city of Renton for \$1.

The Renton airport became a center for the birth of the Jet Age.

The 1960s ushered in a series of highs and lows in Renton.

Boeing bought the Renton plant from the Air Force in 1962.

One of Boeing's best-selling jetliners, the 727, took flight on Feb. 9, 1963. In 1967, Boeing rolled out the 737,

which became the best-selling aircraft, surpassing 727 sales in 1990.

But it wasn't all roses and truffles. In 1969, commercial airline orders fell off the table, which caused a series of layoffs both in Renton and across the region. When Boeing's supersonic transport project collapsed in 1971, unemployment spiked as the company laid off thousands.

It was a low point for the largest employer in the state, but while the unemployment lines grew in 1971, the recovery was well on the way.

By 1972, orders for the 727 had jumped. By 1977, the 727 was the world's top-selling aircraft. By 1978, Boeing had begun producing the 757 and 767 airliners, and in the 1980s, it won military contracts including the cruise missile.

In 2011, Boeing announced its intention to build the new 737 MAX. The 737 MAX took off for the first time on Jan. 29, 2016.

In an email, U.S. Sen. Maria Cantwell said, "For 100 years, Boeing has driven world-class innovation in partnership with a world-class workforce in the Pacific Northwest." The city of Renton and Boeing have a lasting historical and community connection.

Boeing is still the largest employer in the city. As many as 60 percent of the city's residents worked at Boeing in past years, Law said. While the workforce in Renton has diversified, Boeing still represents about 50 percent overall.

Law said that while Boeing is the top employer in the city, many overlook what the company does for the community through the Employee Community Fund, including scholarships and many other programs.

"Boeing puts money into the community, millions of dollars," Law said. "This company has been really important to Renton and this region."

been an integral part of this city." **DENIS LAW** Mayor of

Renton

"It has

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Today's outlandish ideas could be tomorrow's aircraft



Boeing and NASA have been experimenting with a design for an unmanned aircraft called the X-48, an example of a blended wing body. Blended-wing designs, which have little in the way of a fuselage and sometimes no tail, could greatly increase fuel efficiency. The X-48 above is a scale model with a 21-foot wingspan; at full size, the aircraft would have a wingspan of 240 feet.

There's a quote by Boeing's founder in the office of Brian Tillotson, one of company's top engineers, that, he says, captures the spirit of the aerospace giant.

"The company started when Bill Boeing turned to his friend Conrad Westervelt and said, 'I think we can build a better one.' We talk about that all the time: How do we make this better?"

Tillotson's job is to think not just about how to improve today's products but also to figure out what Boeing needs to offer decades from now. It can take years to develop new aerospace technology, so companies have to look ahead.

"It's not all that unusual to be in a meeting at Boeing where we're talking about 20 or 30 years from now," or even 50 years, he said.

When that time arrives, airplanes could look very different, with today's familiar tube-and-wing silhouette being replaced by exotic designs that could deliver huge gains in fuel economy. Planes could have wide, flat fuselages and long, skinny wings, or they might look more like a bat in flight or a B-2 bomber. And they could be powered by the stuff of comic books, such as fusion energy. Fusion is what makes stars and our sun burn bright. For decades, scientists have been trying to harness the process here on Earth. Research continues, and many advocates say the goal is not far away. So far, only Marvel Comics' Iron Man appears to have succeeded.

Forecasting the future requires imagining what is possible and what is needed, Tillotson said. Much of that work is done by the Boeing Research & Technology division.

Engineers consider how technologies are likely to evolve and how they could evolve. That is the "possible" side of the equation.

"We also look at the 'need' side," he said. "That's half of what we do. And the other half of what we do is kind of beating that against the possibilities. It's that intersection of needs and possibilities that really tells you, 'All right, that's something that we really need to be looking harder at."

But the future doesn't always work out as expected. In the 1950s, Boeing and other companies imagined supersonic jets whisking passengers around the world faster than the speed of sound.

In the 1960s, Boeing's premier development project was designing the Model 2707, a supersonic transport that people called SST. Boeing built the Development Center to house the program near Boeing Field. The federally funded project seemed so obviously the future of air travel that Seattle's basketball team was named the SuperSonics. But rising fuel costs and environmental concerns made supersonic commercial flights infeasible. The Concorde and a Soviet version came and went. And the Sonics now play under the name Thunder in Oklahoma City. The Development Center, however, remains. It's where Tillotson works now.

Forecasting the future takes humility, too.

"It's easy to fall into the trap of saying, 'Oh, it's obvious to everybody that we'll need this, or it's obvious that this technology will be available,' " he said. "You really need to take a minute to write down: Why do you think that's obvious? What are you assuming about the world that makes you think that?"

Writing down your assumptions helps you notice when developments

Continued on next page

Soaring with The Boeing Company

STORY BY DAN CATCHPOLE THE HERALD



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MIT's "double bubble" D series design concept is based on a modified "tube-and-wing" structure that has a very wide fuselage to provide extra lift. The aircraft would be used for domestic flights to carry 180 passengers in a coach cabin roomier than that of a Boeing 737-800.

From previous page

tell you that one of your assumptions is off, he said. "You'd better go check that before you invest any more money."

That's the best way to avoid "drinking your own bath water until you drown in it," he said. "We do that like other companies; sometimes we do it well, sometimes we do it badly."

To Boeing's credit, there are plenty of programs that the company began and abandoned after realizing they didn't have a future, at least not with Boeing. For example, it dabbled with public transit systems in the 1970s. Ultimately, Boeing decided transit didn't fit with what the company does best: building big jets. So, what could be in Boeing's future?

"Fusion energy may become possible in our lifetime," Tillotson said. "So we've got a few folks thinking about 'What do we do if that comes true or if it starts to look like that's going to work?' "

With a fusion reactor, there would be no need for fuel tanks, which would drastically alter the layout of an airplane. Fusion would remove concerns about carbon emissions and fuel economy. That would free engineers to reconsider airplane design in ways people haven't even thought of yet.

Humans are visual creatures, and we expect big changes to be visually obvious, Tillotson said. But that is not always the case.

Brian Tillotson, engineer at Boeing's Development Center

Advances in electronics, exotic materials and other technologies mean we can dramatically change what an airplane can do with the same fuselage and wings. Just look at the B-52, which first flew in 1952, he said. It looks the same, but functionally, it can do much more today. That is a big reason why the Pentagon hopes to keep Stratofortresses flying at least for another 25 years.

"A few weeks ago, I was at a workshop," Tillotson said. "We were talking about what will we be dealing with in the world of defense in 100 years, and semi-seriously, someone said, 'What will be the new payload on a B-52 in 100 years?' "

Technology does not always

progress in a straight line, said Christian Gelzer, a historian at NASA's Armstrong Flight Research Center. Commercial jetliners today fly much more slowly than the Concorde, and even than earlier passenger jets. For example, flying from Seattle to Los Angeles took about 2 hours, 15 minutes, in 1972, and takes about 2 hours, 40 minutes, in 2016. Rising fuel costs and environmental concerns have slowed jets down.

"Technology is a human creation, and people decide how to use it," Gelzer said.

Airplanes powered by hybrid systems, such as electric and gasturbine engines, could become widespread in the future. Many hope they will further reduce the cost of flying, but they could also be slightly slower than today's jets, he said.

Blended-wing-body designs could radically change the shape of airplanes. These designs sometimes have no tail and not much of a fuselage. Instead, the body and the wings flow into each other. Boeing and NASA have been experimenting with an unmanned model, called the X-48. The shape could be much more efficient than today's tube-and-wing airplane. Blended wing body designs could slash how much fuel is needed by as much as 40 percent, Gelzer said. "Considering that engine manufacturers claw madly for gains of 0.2 percent to 0.5 percent in fuel efficiency, that is a big deal."

At Boeing, Tillotson helps shape the company's R&D spending.

Aerospace companies have to provide for today's needs while preparing for the future, he said. When discussing R&D strategy with Boeing executives, "those guys, they'll push back if we're not bringing them enough advanced stuff.

"They will say, 'We've also got to be in business in 50 or 100 years,' " he said. " 'So go back, and bring me a little more of the exotic stuff.' ... I'm not just making that up. I've been in meetings when they've said that to us. And, I got to tell you, it's a heartening experience."

Outside his office, Tillotson can look up to see airliners crisscrossing the sky.

"That's only been true for the last 100 years. And we did that. We did that," he said.

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