

# Plane Facts

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## 747 Quality Continues to Improve With Age

By Sue McNally and Leslie Wilder

Since 747 production began 30 years ago, the quality of the world's largest jumbo jet has continued to improve with age. Now Boeing and key supplier Northrop Grumman are introducing state-of-the-art technology and manufacturing processes to improve the way the 747 is built.

Drawing on technology from other Boeing airplane programs, the two companies have invested hundreds of thousands of hours over the past two years converting original engineering drawings of the 747 fuselage skin panels into three-dimensional digital (computerized) datasets.

Northrop Grumman is transferring that data to its new numerically controlled, high-speed, flexible machinery to build the skin panels. At the same time, Boeing is replacing 747 tooling with new modular equipment designed by the Fuselage Assembly Improvement Team (FAIT). Construction of the tooling is scheduled to begin in mid-November.

The goal is to increase quality, streamline production, reduce cycle time, eliminate waste and, most importantly, increase customer satisfaction.

Assembling the body sections of an airplane as large and complex as the 747 is demanding. Any variation in the size of parts or the

location or size of holes can cause fit problems in final assembly. Boeing and Northrop Grumman formed a team in 1994 to address issues of variability and accurate assembly. This effort became known as Accurate Fuselage Assembly (AFA).

Northrop Grumman builds most of the 747 fuselage—from aft of the flight deck to just before the empennage (tail). The panels in that section measure 153 feet and comprise some 25,000 parts. Northrop Grumman used full-size plaster models to define the contour of the tools that build the panels—a cumbersome process subject to variation. In addition, some of the cutting and drilling processes sometimes resulted in panel variation, making assembly of the panels difficult.

Technology from other Boeing airplane programs has shown that variability is greatly reduced and quality greatly improved when parts are designed with computers and built using corresponding digital databases that run the manufacturing machines.

"Once we digitized the 747 drawings, we were able to identify and correct potential manufacturing problems during the design stage and before expensive tooling and processes were developed," said Rick Brigman, a Boeing AFA engineer. "We made some significant improvements in our engin-



A Northrop Grumman employee checks a 747 panel section before it is trimmed and drilled by the company's new flexible skin trim and drill machine, also known as the "Pogo." These panel sections and others like it eventually will be assembled at Everett using new tooling designed by the Fuselage Assembly Improvement Team. Photo courtesy of Northrop Grumman.

eer definition, which is helping the shops build our 747 panels."

The three-dimensional digital data are translated by Northrop Grumman's new "Pogo" machine, which trims and drills holes in panel sections with amazing accuracy. The same is true for the company's new stringer drilling machine.

"I couldn't believe we were going to drill the skin on one machine and the stringer on another, and that the holes for both pieces would line up," said Lou Deiorio, a senior airframe mechanic at Northrop Grumman.

"These new machines changed my mind. They produce parts that fit 100 percent of the time, every time."

The FAIT-designed tooling will allow part-to-part indexing of the digitally designed panels. This means the pre-drilled holes of each panel will be matched directly to the pre-drilled holes of its mating panel, rather than indexing the panel to the tooling fixture. In most cases, mechanics no longer will use the tool to align the panels.

The new modular tooling, which should be assembled and

fully operational by fall 1998, is simpler and sturdier, takes up less factory space and is more flexible. But the most significant improvement is the reduction in variability.

"Assembling the digitally designed panels with our new tooling will simplify our processes, reduce our flow time and improve the quality of our product," said Rodger Riggers, FAIT program manager. "And that means we're responding to our airline customers." PF

An AFA/FAIT video is available by contacting a representative at the Boeing and Northrop Grumman Everett Plant.