

# Spinal Tap



## What Boeing teams did to get B-1B bomber *Swift Justice* flying again

By Lisa Maull

It was just another day in the sky for *Swift Justice*, a routine mission for one of the U.S. Air Force's B-1 bomber fleet.

When a temperature warning light illuminated, the crew was not overly concerned. They landed the bomber at Ellsworth Air Force Base, S.D., anticipating nothing more than routine maintenance and a quick fix.

It was Dec. 4, 2007.

But this would be no easy repair job, and the story of what happened in the months ahead to get the bomber ready for duty again is a testament to the ingenuity and perseverance of a dedicated team from across Boeing, its suppliers and the Air Force.

After the bomber landed at Ellsworth, mechanics discovered that an engine bleed air duct had ruptured, severely damaging the jet's "backbone," its upper center longeron. But that 47.5-foot-long (14.5-meter-long) part, made from boron-epoxy composite, is unique to each aircraft, with no spares available.

"It seemed impossible at first," said Michelle Voorheis, technical lead from the Boeing B-1 airframe team, of the effort needed to recreate the damaged part to return this valuable asset to flight.

Voorheis' team, along with Air Force project engineer Brian Koehl, first had to find and restore the original tooling for the part. When production of the B-1 bomber

ended in 1987, the Air Force stored B-1 tooling in the Arizona desert at Davis-Monthan Air Force Base.

The team eventually found the correct tooling in the desert and then worked with Boeing's C-17 tooling group to remove the corrosion and grime from 20 years of outdoor exposure.

Next, Specialty Materials Inc. in Lowell, Mass., the original boron and epoxy supplier, provided 14,000 feet (4,267 meters) of 4-inch-wide (10-centimeter-wide) unidirectional tape to fabricate the new part. Cytec Engineered Materials Inc., in Tempe, Ariz., supplied the adhesive film and primer.

Boeing's Composite Fabrication & Assembly Center near Seattle performed the layup and cured the part in its 90-foot-deep (27-meter-deep) autoclave. The center's layup crews worked around the clock for 11 days to meet deadline.

"I worked with composite experts across Boeing to gather data and knowledge on boron-epoxy composite fabrication," said Lamar Dearth, manufacturing engineer at the fabrication center, who wrote 357 planning pages needed for the fabrication effort. "I also drew extensively on the technical people of the Boeing Research and Technology organization. This enabled me to plan the teardown of the damaged longeron, salvage and recondition the titanium component, and master the fabrication

techniques to recreate the unique part."

The B-1 was flown (under ferry-flight restrictions) to the Boeing Recovery and Modification Services Center in Long Beach, Calif. There, a team led by Mark Hayes, a C-17 Maintenance Operations Support manager, removed the damaged part and installed the new one as well as associated structural panels and other components. "We appreciate the opportunity to showcase our talents," Hayes said. "It gave us a sense of pride that the B-1 team wanted to work with us. Hopefully, this will open doors for future modification jobs with other programs at Boeing."

A few months ago, after 15 months spent grounded, *Swift Justice* roared down the runway of the Long Beach airport to return to its base in South Dakota.

"This B-1 effort is a perfect example of reaching out and applying capabilities from across the enterprise," said Mahesh Reddy, B-1 program manager. "It's a great example of what can happen when diverse groups within Boeing work with engineers, aircraft mechanics, suppliers and our customer to find a solution." ■

[lisa.a.maull@boeing.com](mailto:lisa.a.maull@boeing.com)

**PHOTO:** The 47.5-foot-long (14.5-meter-long) replacement longeron was installed on B-1 bomber *Swift Justice* at the Boeing Recovery and Modification Services Center in Long Beach, Calif. MICHELLE VOORHEIS/BOEING