

NEWSLETTER

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Delamination prompts Boeing to inspect 787 fleet

By: [Jon Ostrower](#) Washington DC

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Boeing again faces a manufacturing quality issue, requiring inspections and repairs of its 787 fleet.

Structural stiffeners were found to be improperly joined to the composite skin in the aft sections of the aircraft, causing parts of the aircraft's carbon fibre structure to delaminate, confirms the airframer.

"Boeing has found that incorrect shimming was performed on support structure on the aft fuselage on **certain** airplanes in our facility in Everett, [Washington]," said the airframer.

Flightglobal has confirmed there are at least three affected airframes, Airplanes 56, for All Nippon Airways, where the problem was first discovered, and Airplanes 57 and 58, the first two aircraft for Qatar Airways.

Boeing declined to say how many 787s have this issue, though sources indicated that there are "significantly more" than the three initially identified in the factory.

Programme sources say the stiffeners, or longerons that run along the length of the aircraft, are delaminating around the rear opening of the Section 48 section above and below the cutout known as the "bird's mouth" that holds the Alenia Aeronautica-built horizontal stabiliser.

Boeing said the issue is a "straightforward repair" and poses no "short-term safety concern" and the airframer said its inspections have revealed "delamination in some instances."

Boeing is currently conducting inspections on the already built 787s and those waiting to be assembled, at least **50 airframes**, in Everett and its North Charleston, South Carolina facilities.

"We have this condition well-defined and we are making progress on the repair plan," said Boeing and declined to say if the inspections were slowing preparations for delivering additional 787s.

The issue, identified around 24 January was traced to assembly of the aft fuselage by Boeing South Carolina, Formerly Vought Aircraft Industries, where Sections 47 and 48 are fabricated, assembled and stuffed with systems before being delivered to final assembly lines in North Charleston or Everett.

When the longerons are installed on the wound carbon fibre barrel, frames and longerons are secured to the skin of the structure to give it strength. When natural variations in the fit of parts exists, aerospace mechanics will install shims, or spacers, which compensate for variations and wedge into structure to create a tighter fit.

Without the shims, damage can be sustained to the composite when fasteners are installed by pulling the structure together, damaging the layers of carbon fibre.

Over the long-term composite delamination can decrease the fatigue life of the aircraft's structure.

Boeing said it has "already taken appropriate steps to address this issue" in South Carolina, declining to elaborate on what steps it has taken.

"We have already notified our early customers to ensure they are informed and aware of our plans to make repairs, should they be needed," the company said.

ANA, currently the sole operator of five 787s, said: "Currently we are not experiencing the issue; however, we are aware of this issue arising at the factory, and will take appropriate action when contacted by Boeing."

For the affected aircraft, Boeing said its "current plan", which one programme source described as "tedious", will not require the removal of the 787's tail cone and horizontal stabiliser to fix the longerons, its initial remedy for aircraft in the factory, and it can "address this condition without removal of any major structural parts."

"Repairs, should they be needed, will be implemented in the most efficient manner possible," said Boeing in order to maintain a design that conforms with its airworthiness certification standards.

Boeing has faced manufacturing quality issues before, most notably the June 2010 inspection, teardown and reinstallation of many Alenia Aeronautica-built horizontal stabilisers after many were assembled without proper shimming creating gaps in the structure that threatened the fatigue life of the empennage.

AN UPDATE AS I ASSEMBLE THIS ISSUE

UPDATE 2-Boeing says flaw could affect 55 Dreamliner

Wed Feb 22, 2012 8:58am EST

By Harry Suhartono

Reuters

SINGAPORE, Feb 22 (Reuters) - About 55 of Boeing Co's 787 Dreamliner jets could have a recently discovered flaw in the fuselage, the company said on Wednesday, while reiterating that the world's first carbon-plastic passenger plane is safe to fly.

Boeing earlier this month reported signs of "delamination" on a support structure in the rear fuselage, the latest in a series of glitches in developing the revolutionary jet.

The company is examining a backlog of assembled Dreamliners to see whether they show similar signs of stress, which it has blamed on incorrect "shimming" -- a process planemakers use to fill tiny gaps when aircraft are built.

"All the airplanes that were built up to plane 55 have the potential for the shimming issue," James Albaugh, chief executive officer of Boeing Commercial Airplanes, told reporters during a media roundtable in Singapore.

Albaugh said the problem was "very fixable."

"We are in the process of fixing the airplanes that are in the (production) flow," he said. "There is no safety or flight issue on the airplanes that we have delivered."

Although composite parts have been in use for years, the 787 is the first airliner built mainly out of the new materials, which help airlines to save fuel by reducing aircraft weight.

Albaugh said the inspections might affect delivery of the aircraft to customers in the short term, but the company still expects to meet its target for this year.

The first six aircraft produced are generally test models.

Analysts have said the discovery of the flaw some nine weeks after the aircraft entered service has raised questions over whether Boeing can meet what many already saw as an ambitious plan to raise output to 10 a month by the end of 2013 from 2.5 now.

Sticking to the plans, Boeing expects to boost monthly output to 3.5 in the second quarter and to five by year-end.

DECISION ON 787 STRETCH BY YEAR-END

Boeing has so far delivered five of the aircraft to Japan's All Nippon Airways, which put the plane into regular passenger service starting on Dec. 1. Due to production problems, that was three years later than originally planned.

ANA said Boeing had contacted the airline to say there were no safety issues involved in shimming and to give a general indication of the inspection procedure.

Boeing has promised to deliver a detailed procedure, which ANA expects to get soon. Meanwhile, all of its five Dreamliners are operating normally, the airline said.

[Japan](#) Airlines has already said it no longer expected its first Dreamliner by the end of February as a result of the manufacturing glitch.

The 787 problem comes as Boeing rival Airbus investigates the cause of cracks in part of the wings of its A380 superjumbo. It also insists its jets are safe.

Chief Executive Officer Tom Enders pledged last week that Airbus would apply lessons from the A380 glitches to the development of the A350, which is the European company's carbon-composite answer to the 787 Dreamliner.

Boeing will decide whether to go ahead with plans to produce a stretched, or longer, version of the 787 Dreamliner by the end of this year, Albaugh said.

Most aircraft analysts expected Boeing to push ahead with the 787-10, which would carry around 320 people, 40 more than the longest 787 version currently on offer, the 787-9.

The 787 and A350 address the mid-sized segment of the market, which is expected to number several thousand aircraft in coming decades as airlines renew fleets to save fuel and open up new routes.

Airbus and Boeing are also battling to maintain a roughly equal share of the single-aisle aircraft segment, the industry's largest by volume, after updating their best-selling 150-seat jets with new engines.

Airbus took the lead last year with strong sales of its A320neo, but Boeing is redressing the balance with its 737 MAX.

"We have over 1,100 commitments, and our goal this year is to turn all of those into firm orders," Albaugh told reporters, adding that Boeing aimed for a couple of thousand firm orders by the time the updated aircraft enters service in 2017.

"If there really is a softening in the economy, you could see some deferrals, you could see some people cancelling and you could see fewer orders," Albaugh said.

Underlining concerns about the economy, Singapore Airlines said on Wednesday that it was cutting cargo capacity by 20 percent because of weak demand and high fuel prices

COMMENTS & DISCUSSION

TO START We encourage you to read our September 2010 issue of the NEWSLETTER. It is available on our web site "tatsco.com". The feature article was **WHAT'S WRONG WITH THE 787 EMPENNAGE? On MAY 17TH BOEING** advised they had encountered a problem with SHEAR TIES in the most aft fuselage section . . . SECTION 48. This section was designed and originally produced in Charleston, South Carolina, by Vought Industries (Boeing bought the facility and forgave the progress payments made to date - a total of slightly more than one billion dollars - earlier this year). Shear ties are used to connect the lower section of the fuselage frames to the fuselage skin. **Boeing found that the shear ties could peel back from the fuselage skin after exposure to extreme hot and cold temperatures and could lead to structural failure.** Thicker ties will be installed*.

The second article was **on June 24 another shoe fell On 24 June Boeing had to disclose that it was forced to undertake inspections on the entire fleet of the horizontal stabilisers built by Alenia Aeronautica in Foggia, Italy, following the discovery of overtorqued fasteners and improperly installed shims in the rear spar.**

Programme sources say the gaps, which the shims are intended to fill, range between 0.25cm and almost 0.5cm, and the ones used to fill gaps in the horizontal stabiliser became compressed after fasteners were over-torqued as a means of pulling the surfaces together, causing a "pre-load" condition that can undermine the fatigue life of the structure.

While Boeing maintains that the fleet had not been "grounded", the company decided not to fly each aircraft until it underwent two-day inspections before returning to flight-test operations.

The company insists that quality "escapes" such as the one found in the horizontal stabiliser is not uncommon during the early part of a programme, the episode was another in a series of workmanship issues that prompted an internal inquiry how 25 horizontal stabilisers could have been shipped to Everett over three years without notice.

"It turns out [the issue] is fairly deeply imbedded in the assembly," says Scott Fancher, vice-president and 787 programme general manager, referring to the issue with the horizontal stabiliser. "So we're in the process of auditing the records associated with that to understand whether or not there's a systemic issue with the escape or whether it's a one-off." NOTE: We understand Mr. Fancher was transferred to a new position last week.

Simply stated, based on the FAA Designation I held for 25 years - Designated Airworthiness Representative - DAR - with the Authority to issue Airworthiness Certificates for Transport Aircraft, the conditions described above and the current problem of missing "shims" in Section 48 render the **AIRWORTHINESS CERTIFICATES ineffective (not valid) for any aircraft with the defects because the aircraft does not conform to TYPE DESIGN nor is it in CONDITION FOR SAFE OPERATION**. NOTE: A pilot of a U.S. Registered aircraft doesn't need to refer to the Federal Aviation Regulations to read those words; they are printed on the Airworthiness Certificate. By the way, WIKIPEDIA has a good entry for AIRWORTHINESS!

I have posed the following questions to our COMPOSITES SCIENTIST (*GURU*).

The first message was in response to my question regarding the use of fasteners to correct the *delamination* of the composite parts. (He had earlier stated NO DELAMINATION is ALLOWABLE.)

Usually a variant of Hi Lock but, critically, you need about around a four thou interference fit to prevent fretting and working and loosening in service and possibly even excessive heat build-up. They are usually or at least I used 6AL-4V Titanium with a big gob of Zinc chromate to (attempt) to kill galvanic couple. Torque levels are much lower than metallics as you are

squeezing bloody glue, nothing structural. A lot of us old farts usually prefer no or bare minimum of fasteners due to all these fastener issues. For example, first drive shafts that I did for Ford were adhesively bonded and worked fine, but Ford did not think feasible for unskilled assembly workers, So we did interference fit fasteners as another option. Our neatest solution, well to this bloke, was A. Reinforcing ends with some hoop wraps and then B. dunking knurled steel ends in liquid nitrogen and shoving them in as a tight press with no glue or no fasteners. Ford did not think would work but they did fine and took all reverse fatigue tests with zero slippage or failures, the trick was to reinforce with correct hoop wrap amount and locations. I think Boeing as I have checked on V-22 et al, is bloody stupid by using so many fasteners. I was appalled by the V-22 in Philadelphia as was just black riveted aluminum in my book. All you need is one or two anti -peel fasteners to take the normal to plane loads or better still, use some hoop wraps and no fasteners. In summary fasteners are a huge headache in CFRP and should only be used as last resort. Usually straight shank as taper loks get buggered up by thickness variations which always occur in CFRP. And some of we old farts use thickness as a quick indicator or fiber volume and correct resin flow and bleed during cure. And if you over-torque the fastener you only options are to bush after drilling out oversize or just oversize if you have plenty of edge distance and you need more in CFRP than metallics remember, Jim. It is usually 3D min and lots prefer towards 4D. And before you do anything with a buggered up hole, you had better check that in buggering it you parked all haven't delaminated it, in which case you and all of Boeing and its customers are rightly and forever buggered.

Hope that makes sense, stainless also, but not all I stainless steels, in fact only one alloy, to my knowledge, are created equal regarding minimizing galvanic couple between CFRP and fastener. NOTE: Mine - A galvanic couple means CORROSION (see Wikipedia - Galvanic Corrosion).

Allow me to introduce our *GURU*. Better yet, you can read various documents he has sent to the FAA re THE USE OF COMPOSITES. Merely *browse* AVIATION -DEREK YATES.

We haven't seen any *media news* re the current status of the 787. A friend was at Paine Field to pick up a new 777-300 last week; he said they were parked al over the place!

THE NEWSLETTER IS COPY WRITED BUT YOU MAY USE IT IF YOU PROVIDE CREDIT TO TATSCO. **THERE IS MORE TO DISCUSS** --SEE YOU SOON -JIM

