

Boeing 737-236, G-BGDI

AAIB Bulletin No: 7/98 Ref: EW/C98/5/2 Category: 1.1

Aircraft Type and Registration: Boeing 737-236, G-BGDI

No & Type of Engines: 2 Pratt & Whitney JT8D-15A turbofan engines

Year of Manufacture: 1980

Date & Time (UTC): 6 May 1998

Location: Dusseldorf, Germany

Type of Flight: N/A (pre-flight inspection)

Persons on Board: Crew - None - Passengers - None

Injuries: Crew - N/A - Passengers - N/A

Nature of Damage: Small crack in left side fuselage skin

Commander's Licence: N/A

Commander's Age: N/A

Commander's Flying Experience:

Last 90 days - N/A

Last 28 days - N/A

Information Source: AAIB Field Investigation

During the pre-departure check, a longitudinal crack approximately 11 cm long was found on the left side of the fuselage, below the window belt and reportedly at a station just aft of the main wheel well. The Operator's engineering personnel in the United Kingdom were informed and raised an Engineering Order to carry out an approved temporary repair before a non-revenue flight, empty and unpressurised, was conducted back to the aircraft's maintenance base at Gatwick. The temporary repair included 'stop drilling' the crack and the application of 'speed tape', in accordance with the Boeing Structural Repair Manual (SRM).

On arrival at Gatwick, it became apparent that there had been some misunderstanding regarding the exact location of the crack. In the event its actual position was just forward of fuselage Frame No 727B, above Stringer No 16. This placed it in a zone familiar to Boeing 737 structural engineers,

since such cracking was the subject of a Service Bulletin (SB), No. 737-53-1065, which was originally issued in 1985 to counter the problem of skin cracks, in addition to disbonding and wrinkling between the skin and doubler in this area. The accompanying drawings illustrate this area.

The SB (which was one of those selected by the FAA - sponsored Ageing Fleet 737 Structures Working Group for incorporation on older Boeing 737 aircraft) details a structural modification to be embodied at, or before, the accumulation of 75,000 flight cycles. The SB also calls for an inspection of the zone after the accumulation of 16,000 flight cycles, with repeat inspections at 3,000 flight cycle intervals. The inspections can be visual if both the internal and external surfaces of the skin panels are examined. If non-destructive test (NDT) techniques are employed, then the inspection can be confined to the external surfaces, thereby eliminating the need to remove the interior trim. Any cracks are repaired in accordance with the SRM, these usually taking the form of a 'scab patch'. Embodiment of the structural modification constitutes terminating action for the SB.

In the case of G-BGDI, the SB 737-53-1065 inspections were arranged to be conducted at every P1 check, which occurred at approximately 2,100 flight cycle intervals. The most recent check was carried out in October 1997, when the aircraft had achieved 35,117 flying hours and 28,040 cycles. The incident occurred when the aircraft had accumulated 36,285 hours and 28,907 cycles. However, it was found that the operator's inspections had consisted of a visual examination of the external surface only.

The fuselage skin in the area of interest had a doubler bonded onto the inner surface. The doubler was in the form of a lattice which followed the lines of the stringers and frames. The crack in the skin had followed the line of the doubler above Stringer 16 in an aft direction, and had then started to turn upwards, still following the edge of the doubler, immediately ahead of Frame 727B. It was thus apparent that the doubler had fulfilled its function as a 'tear stopper'. At its forward end, the crack was still following the edge of the doubler above the stringer, and had not yet reached the next frame.

The piece of skin that included the upper fracture face was cut out and subjected to metallurgical examination. However, it was apparent that flexing of the skin had caused the two halves of the fracture face to rub against each other, thus removing microscopic evidence. It was therefore not possible to perform a striation count which may have indicated the number of flight cycles over which the crack had grown. However, it was clear that there were multiple fatigue origins over the inside edge of the central 61 mm of the crack. Either side of this relatively slow growth region, the failure had progressed in a shear process, with crack growth somewhat more rapid. The general appearance of the area of fatigue propagation suggested that the crack had been growing over a considerable period of time, and hence was probably present when the area had been inspected at the last P1 check. However, it was additionally noted that the external paint was poorly bonded to the primer, and could easily be peeled away. This raised the possibility of the paint initially remaining intact, thus masking the crack from visual detection in its early stages.

As a result of this incident, the operator intends to conduct a fleet inspection and to employ NDT methods in future periodic inspections, as required by SB 737-53-1065.