**INCIDENT**

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| **Aircraft Type and Registration:** | Avro 146-RJ85, OH-SAI |
| **No & Type of Engines:** | 4 Honeywell LF507 Turbofan engines |
| **Year of Manufacture:** | 2001 |
| **Date & Time (UTC):** | 17 June 2007 at 1820 hrs |
| **Location:** | Stratford St Andrew, Suffolk |
| **Type of Flight:** | Commercial Air Transport (Passenger) |
| **Persons on Board:** | Crew - 4 Passengers - 83 |
| **Injuries:** | Crew - None Passengers - None |
| **Nature of Damage:** | Panel from wing/fuselage fairing detached in flight, minor damage to fin |
| **Commander's Licence:** | Airline Transport Pilot's Licence |
| **Commander's Age:** | 32 |
| **Commander's Flying Experience:** | 5,208 hours (of which 2,688 were on type)<br>Last 90 days - 193 hours<br>Last 28 days - 83 hours |
| **Information Source:** | AAIB Field Investigation |

**Synopsis**

The aircraft was inbound to Stansted and descending to below FL200 when a loud bang was heard. A composite panel had become detached from the aircraft and landed on the roof of a house. The panel was attached by 25 bolts which were located inside 25 stainless steel grommets; all 25 grommets had failed. The failure of these grommets was attributed to abrasion during repainting.

There have been several similar incidents and the manufacturer has responded by updating an Airworthiness Directive to include a more rigorous inspection process.

**History of the flight**

The aircraft was descending to below FL200 whilst inbound to Stansted when a loud bang was heard and the flight crew noticed a change in the airframe noise. The only other change noticed was that the aircraft required slight additional right trim. The descent to Stansted was continued and the flaps and gear deployed slightly earlier than usual to confirm normal operation. The aircraft landed uneventfully.

After parking the aircraft, the crew noticed that a panel was missing from the wing-to-fuselage fairing and there was minor damage to the fin (Figure 1).

The aircraft panel had landed on the roof of a house in the

village of Stratford St Andrew in Suffolk causing minor damage to the roof. The panel was recovered by the police; no one was injured as a result of the incident.

**Aircraft information**

The wing-to-fuselage fairings consist of several composite panels which are attached to the aircraft by a series of regularly spaced bolts. The bolts pass through stainless steel grommets which are permanently fitted into the panels. During manufacture these grommets are inserted into the panels, prior to the grommet flanges being peened over on the upper surface of the panel using a special tool. The resulting grommets provide holes in the panels for the attachment bolts. The thickness of the grommet flanges on the upper surface of the panel is 0.018 inches. The panel that became detached was secured by 25 bolts (through 25 grommets).

When aircraft are repainted it is common practice to strip the metal surfaces. However composite structures, such as the panel that became detached, are usually abraded prior to repainting.

**Engineering investigation**

The aircraft was inspected at Stansted and the 25 bolts that secure this panel to the aircraft were all still on the aircraft located in their respective grommets (Figure 2 shows an example). The bolts and grommets were then removed and in all cases the grommets were found to have failed (Figure 3 shows several failed grommets). The failure of the grommets differed in detail but the upper flange in all 25 had failed, and there was evidence that the flanges in the region of the failures were of reduced thickness. There was also evidence of paint on the grommet flanges.

**Figure 1**

The panel that became detached was inspected and there was no evidence of damage to the panel in the region of the 25 holes where the grommets had been.

The similar panel on the right wing to fuselage joint was inspected. The grommets and bolts on this panel had all been painted and it was therefore very difficult to inspect the grommets (Figure 4). Four areas of the right panel in the region of grommets were then stripped of paint and it was determined that the flange thickness on these four grommets was less than specification and importantly, there were marks on the grommets consistent with the flanges having been abraded.

**Figure 2**


**Figure 3**

Another aircraft of the same type was inspected and the grommets on a similar panel were all unpainted making inspection much easier.

**Previous occurrences**

There have been nine broadly similar occurrences of panel attachment problems for this family of aircraft recorded by the manufacturer. Seven of these cases involved overwing panels and in two of these, the overwing panel became detached in flight.

In the majority of these previous occurrences, grommet failure was an issue. The manufacture has issued the following documents relating to this:

a) All Operator Message AOM 05/025V, 30 September 2005 – recommending that operators inspect grommets

b) All Operator Message AOM 06/014V, 13 March 2006 – recommending that operators inspect grommets prior to painting

c) Electronic Service Information Leaflet eSIL 51-146-RJ-413-8, 9 April 2007 – advising operators that Inspection Service Bulletin 53-202 was being written, as well as reinforcing the messages contained in AOM 05/025V and AOM 06/014V

d) Inspection Service Bulletin ISB 53-202 – inspection of grommets and fasteners within 4,000 flights or two years whichever is later. This ISB was the subject of an EASA Airworthiness Directive consultation.

There is also a redesigned grommet which is inserted into the panel from the external side (and not from the internal side of the panel) and this is more tolerant to damage during the paint removal process.

**Figure 4**

**Maintenance activity**

In July 2006 the grommets on this aircraft had been inspected in accordance with AOM 05/25V and AOM 06/014V.

This aircraft was fully repainted on 31 March 2007, and it was recorded that the fuselage was stripped and that the composite panels were abraded, prior to painting.

**CAP 747: Mandatory Requirements for Airworthiness**

The CAA's CAP 747 *'Mandatory Requirements for Airworthiness'* has at Appendix 1 GR10 "Painting of Aircraft" and it notes likely damage and hazards to be avoided, such as reduction of fastener head size during surface preparation.

**Analysis**

All the retaining bolts were intact and found on the aircraft located in their respective damaged grommets. There was no evidence of the panel having failed in the region of the grommets. It was therefore concluded that the panel became detached because the grommet flanges had failed. The grommet flanges were of reduced thickness, and this is likely to be due to abrading prior to painting given that:

a) there was evidence of abrasion and reduced thickness on a similar panel on the other side of the aircraft

b) the aircraft had been repainted 11 weeks before the incident and this included abrasion of composite panels

This incident reinforces the requirement not to paint the grommets so that effective inspection can be performed.

**Manufacturer's response**

The manufacturer halted the Inspection Service Bulletin ISB 53-202, which was in the Airworthiness Directive consultation process with the EASA, so they could update it to include paint removal from a sample of grommets prior to grommet inspection. In view of this response no recommendation has been made. This is a known problem that applies to all aircraft types when being repainted.