No: 1/93 **Ref: EW/C92/11/1** **Category: 1a**

Aircraft Type and Registration:	Airbus Industrie A320-211, D-AIPS
No & Type of Engines:	2 CFM56-5-A1 turbofan engines
Year of Manufacture:	1990
Date & Time (UTC):	4 November 1992 at 1401 hrs
Location:	Runway 27L London Heathrow Airport
Type of Flight:	Public Transport
Persons on Board:	Crew - 6 Passengers - 59
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to wheel rim and brake hydraulic system
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	45 years
Commander's Flying Experience:	9,500 hours (of which 930 were on type) Last 90 days - 195 hours Last 28 days - 36 hours
Information Source:	AAIB Field Investigation

The aircraft was due to depart on its fourth sector of the day from London Heathrow to Munich with 59 passengers and 6 crew. The weather at the time was fine, the runway surface was dry, the surface wind was 250°/8 kt with a temperature of 12°C. On the previous three turnrounds it had spent 33, 71 and 50 minutes respectively on chocks. The aircraft was loaded with 9,800 kg of fuel giving a take-off weight of 59,204 kg (MTOW authorised 73,500 kg).

The aircraft left its stand at 1353 hrs for a departure using the full length of runway 27L. At approximately 100 kt during the take-off roll, with the first officer as the pilot flying, the crew heard a bang and felt vibration. The commander abandoned the take-off at 115 kt (V_1 149 kt) and brought the aircraft to rest on the centre line in block 83 with half the runway remaining. The fire services, who were on the scene almost immediately, advised the commander that the aircraft appeared to have suffered a burst tyre and hydraulic leak. This appeared to be confirmed by flight deck indications that showed a No 3 low tyre pressure warning. Satisfied that the aircraft was able to move under its own power the commander taxied the aircraft, escorted by the fire services, back to the stand where the passengers were deplaned.

Immediately after the incident the runway was closed for 19 minutes to allow for a runway inspection. Debris from the No 3 wheel rim was recovered and retained for examination by the AAIB.

Technical examination

When the aircraft was inspected by the AAIB, it was apparent that the failure at the right-hand main landing gear had been of the inner (*ie* next to oleo leg) rim of the inboard wheel and not of the tyre itself. Failure of the rim had resulted in deflation and distortion of the inboard tyre, with some damage to the oleo leg, the brake hydraulic lines attached to the leg and the tread of the tyre on the outboard wheel. The separated portion of the wheel rim, comprising about 200° of the wheel circumference, was found in three pieces on runway 27L.

Visual examination of the fracture surfaces of the rim and wheel showed an area of fatigue fracture, originating in one of the nine torque lugs spaced around the inner circumference of the wheel (Figure 1). These nine torque lugs carry the steel 'drive inserts', which engage the 'rotors' in the brake pack. The fatigue fracture (Figure 2) also passed through the torque lugs adjacent to the lug displaying the primary fatigue initiation point, but these lugs showed no fatigue initiation themselves. In this examination, there was no evidence of corrosion which would have initiated the fatigue mechanism.

The aircraft Technical Log showed no recent history of air leakage from this wheel. Measurement of the wheel, and the rubber markings on the outer circumference, showed that the fatigue portion of the fracture had been under the 'foot' portion of the tyre tread, preventing air leakage from the wheel through the fatigue crack. It would appear, therefore, that when the wheel failed, the tyre was close to its normal pressure.

Service history

A number of Service documents apply to this model of wheel (part number 3-1491) on the A320. Most relevant to this particular occurrence are B F Goodrich Service Letter SL1540 (October 1990) and B F Goodrich Service Bulletin 3-1491-32-4 (SB 571) (Rev 1: October 1991).

The Service Letter (SL1540) detailed the inspection procedures in the areas adjacent to the pin-holes and screw-holes in the torque lugs of the inner wheel halves. However, service experience showed that it was difficult to detect cracks in this area of the wheel.

The Service Bulletin (3-1491-32-4) was subsequent to SL1540 and detailed a procedure by which this area of the torque lugs would be inspected. Those wheel halves with any indication of cracks would be discarded (and those with previous SB524 'Cold Expansion Rework' would be retired); the remainder would be returned to the manufacturer for rework of the torque lugs. This rework would include removal of the pin-hole and screw-hole area of the torque lugs and replacement by self-locking inserts.

Information from the operator shows that the average tyre service life for mainwheels on the A320 is 295 cycles and this is identical to the wheel inspection interval. The failed wheel had been installed on D-AIPS about 30 days previously; at the time of the failure the wheel had accumulated 264 cycles since this last inspection, 3693 total cycles in its life. The evidence of the fracture suggested that the fatigue crack had been present for rather longer than this one inspection interval.

This model of wheel (3-1491) is no longer manufactured by B F Goodrich Aerospace. It has been replaced in production by a new design (3-1530) which reduces the number of fuse plugs and deletes the pin-holes and screw-holes from the torque lugs, fastening the 'drive inserts' at an unloaded area of the wheel.

AAIB recommendation

The following recommendation has been made to the CAA:

92-112 The CAA should ensure that Service Bulletin 3-1491-32-4 (SB 571), issued by B F Goodrich Aerospace, is being fully implemented by UK operators of the A320 using this model of wheel. This safety information should also be transmitted to other regulatory authorities responsible for A320 operators.

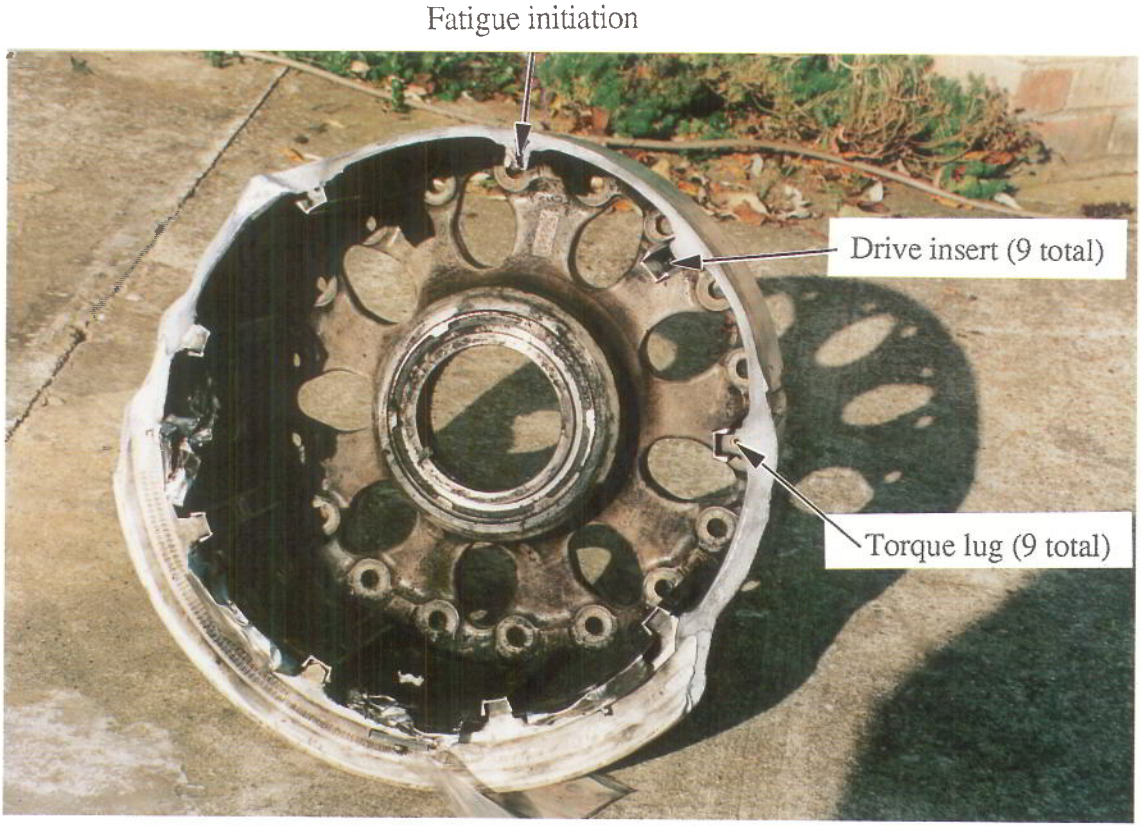

Figure 1 - Inner wheel half - (D-AIPS)

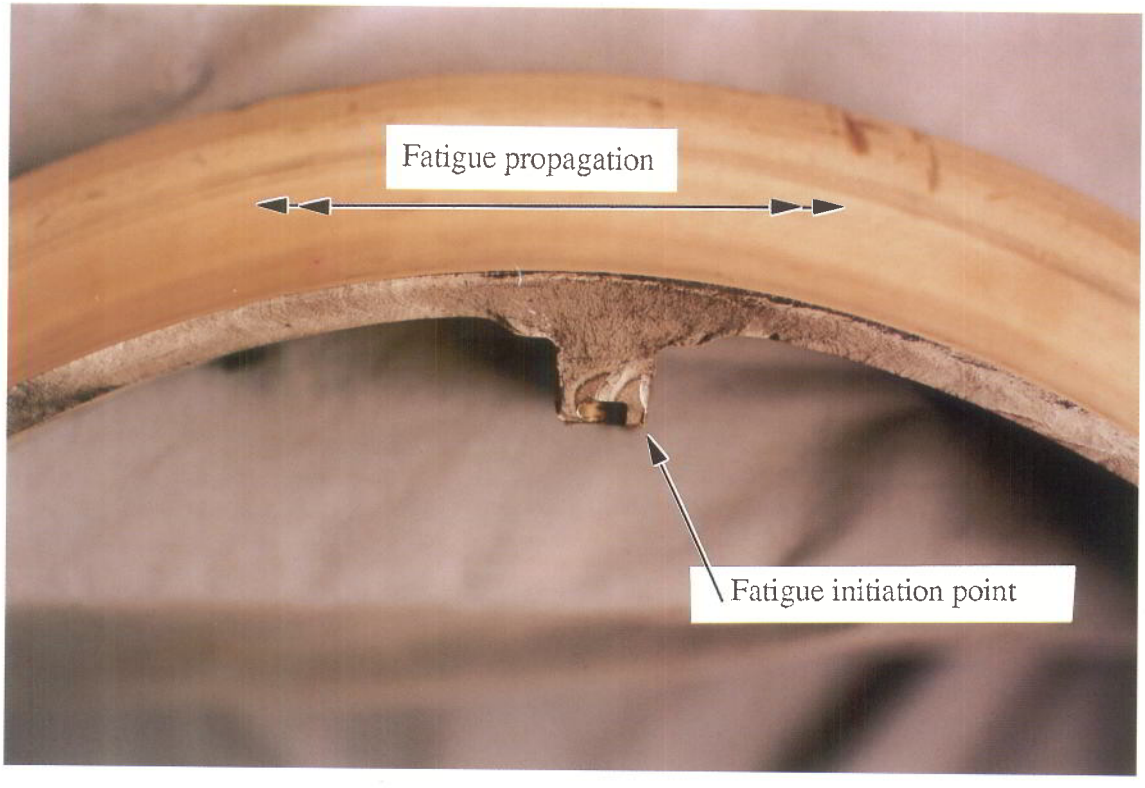

Figure 2 - Wheel rim fatigue detail - (D-AIPS)