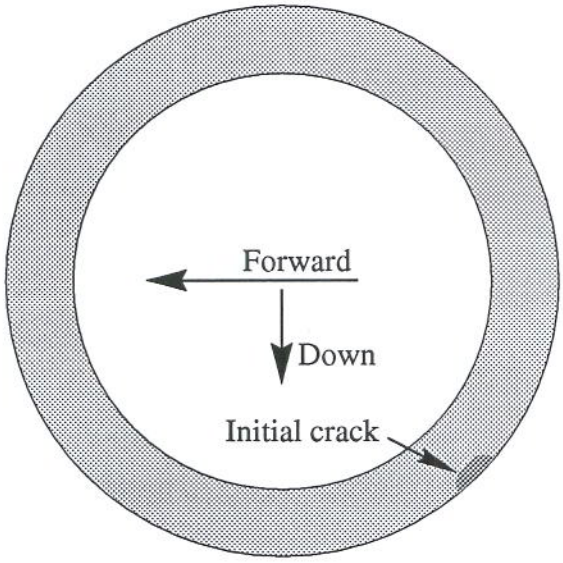
AAIB Bulletin No: 2/95 **Ref: EW/C94/11/2** **Category: 1.1**

Aircraft Type and Registration:	Boeing 747-238B, G-VLAX
No & Type of Engines:	4 Pratt & Whitney JT9D-7J turbofan engines
Year of Manufacture:	1974
Date & Time (UTC):	2 November 1994 at 1100 hrs
Location:	London Gatwick Airport
Type of Flight:	Scheduled Passenger, during turnaround checks
Persons on Board:	Crew - N/K Passengers - N/K
Injuries:	Crew - N/K Passengers - N/K
Nature of Damage:	Forward right-hand body gear axle fractured
Commander's Licence:	N/A
Commander's Age:	N/A
Commander's Flying Experience:	N/A
Information Source:	AAIB Field Investigation

During a routine post-arrival walkaround inspection, the Certifying Engineer noticed that the top of the No 9 wheel (forward inboard on the right-hand body gear) appeared to be leaning towards the gear truck centreline rather than being vertical. Subsequent inspection of the axle bore revealed a wide crack all round its circumference. The aircraft was withdrawn from service and the Right Body Gear Truck assembly changed.

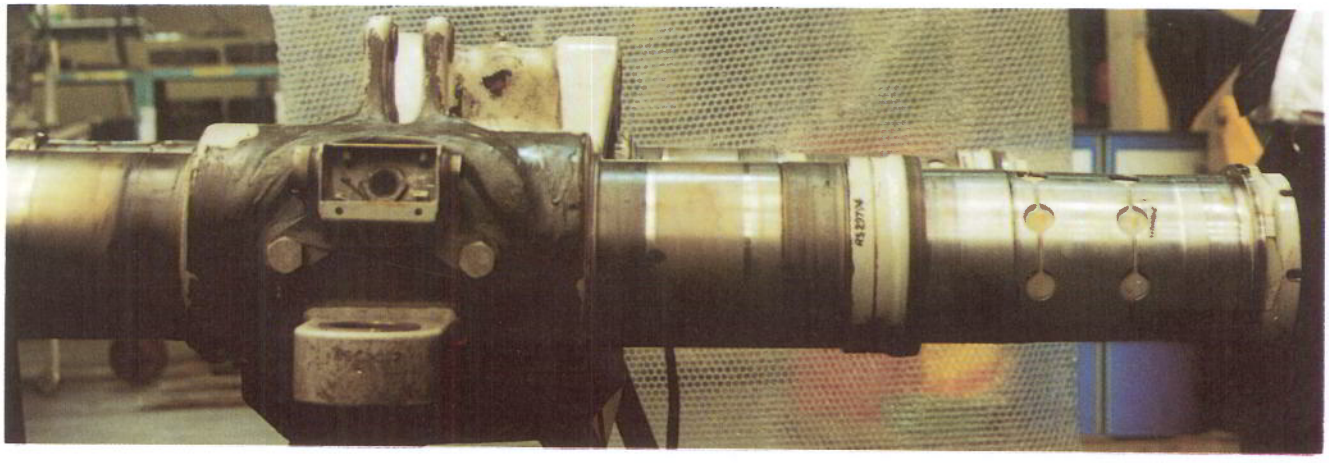
An examination of the axle service records showed that it had been reworked during a scheduled overhaul in February 1992. The rework procedure used approved standard workshop and inspection techniques and involved initial stripping of the chrome surface layer from the axle's central land, followed by grinding of the outer surface of the land to remove some corrosion pitting that was revealed. After an etch inspection, which showed no defects, the centre land was subjected to magnetic particle crack detection, shot peening and chrome plating, using the standard practices. Whilst the new chrome was being machined to the correct size, a grinding error occurred which necessitated the removal of the chrome and a further etch inspection. This revealed three areas of surface temper damage which were removed by local blending, using approved standard practices, and confirmed to be eliminated by further etch and magnetic particle inspections. The manufacturer was then consulted to verify the structural acceptability of the axle and the blended areas were then shot peened before continuing the repair. After peening, the axle central land was restored to round by plating nickel onto the blended areas and machining it, before re-chroming and finishing the land to size. The axle was then returned to service and had done 1,608 landings between this overhaul and the time of fracture.

The axle, which was removed from the truck assembly under AAIB supervision, was found to have fractured completely across a section about $1\frac{1}{2}$ inches from its mid-point, towards the end used as the No 9 stub axle; a position not visible even with the wheels and brakes removed. Metallurgical examination revealed that the initial 0.5% of the fracture had been principally by a stress corrosion mechanism followed by a short period of fatigue, with the remaining 99.5% being by overload.

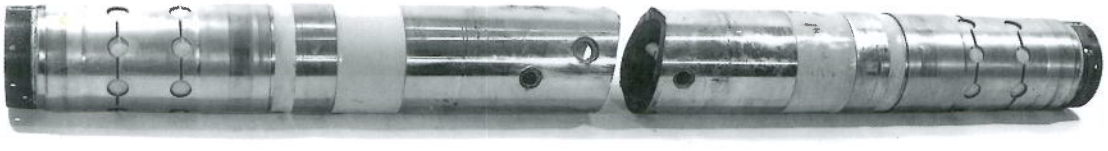


The stress corrosion origin was at a position which was about 45° below and aft from the axle axis. It had initiated in the base steel of the axle, below the nickel fill layer, in one of the areas which had been blended during its last overhaul. In the same blended area, nearer to the axle mid-point, a succession of small, circumferentially orientated, intergranular cracks was found.

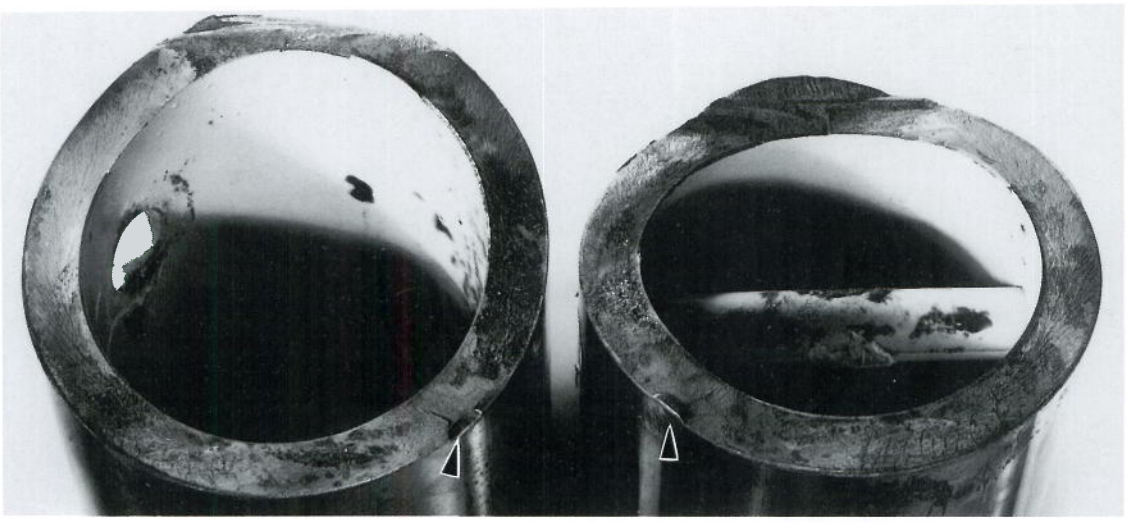
One of the other two blended areas, which was also in the lower half of the axle and a little further away from the axle mid-point, was also examined and some subsurface peculiarities were indicated using an ultrasonic inspection technique. The chrome and nickel plate layers were removed and a group of small circumferentially orientated cracks, similar to that in the blended area at the fracture origin, was found. These were revealed clearly by a magnetic particle inspection check and would not have been acceptable had they existed at the time of rework. Examination of this area using the standard inspection methods which had been employed during the rework procedure showed that there was no residual grinding induced distress. The axle has been returned to the manufacturer for further investigation.



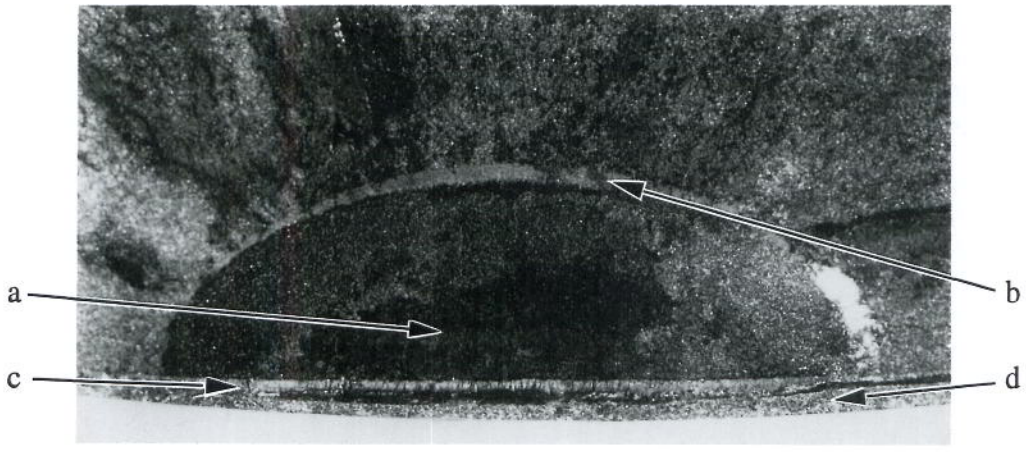
View on front of truck before disassembly; No 9 axle on right of picture



Axle after removal from truck; No 9 axle on right of picture



View on fracture faces; No.9 end of axle on right of picture.
Note:- (a & b) Stress corrosion origin



Area of initial fracture
Note:- (a) Area of stress corrosion fracture in steel of axle
(b) Area of fatigue extending inwards from it
(c & d) Layers of nickel and Chromium plating