Lockheed Electra L188C, EI-CET

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Aircraft Type and Registration:	Lockheed Electra L188C, EI-CET
No & Type of Engines:	4 Allison 501-D13 Turboprop engines
Year of Manufacture:	1961
Date & Time (UTC):	4 October 1996 at 0500 hrs
Location:	Coventry Airport
Type of Flight:	Cargo
Persons on Board:	Crew - 3 - Passengers - 1
Injuries:	Crew -None - Passengers - None
Nature of Damage:	Fracture of wheel rim from mainwheel, separation of tyre
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	47 years
Commander's Flying Experience:	8,200 hours (of which 780 were on type)
	Last 90 days - 117 hours
	Last 28 days - 40 hours
Information Source:	AAIB Field Investigation

The aircraft is understood to have shed the No 2 tyre whilstbacktracking Runway 23 prior to take off at Coventry. Therewere no indications of abnormality at the time or during the subsequenttake-off run, although the First Officer saw a tyre on the runwayas the aircraft rotated. Air Traffic Control were able to confirmthat the tyre was L188 equipment. The flight continued to BelfastAldergrove where a flypast was carried out to enable a visualinspection to be made. It was confirmed that the No 2 tyrewas missing. A normal approach and landing then took place atBelfast with the emergency services in attendance. Inspectionafter landing revealed that the complete inboard rim of the No 2mainwheel was missing, its loss having allowed the tyre to leavethe wheel. The rim was found on the runway at Coventry.

A metallurgical examination of the failed wheel half revealedthat the hardness and conductivity remained in the correct rangefor the specified forged aluminium alloy (2014 T6). Examinationof the fracture faces showed two relatively large areas of fatiguetogether with one smaller area, all being typical of medium cycle,medium stress tension fatigue. All three areas of fatigue originatedat

the the inner cylindrical face of the wheel half, the two largerareas exhibitting multiple origins (See Photograph). This faceis loaded in compression when the relevant area of the wheel isat the bottom and the wheel is supporting the aircraft weight. It is understood, however, that the loading becomes tensile asthe relevant area rotates towards the top of its travel, thusproducing a once per revolution fatigue cycle, in addition toany tensile loads arising in this area from stress distributionin the wheel created by landing loads. More complex loads arepresumed to occur during any rapid turning manoeuvres on the ground.

One of the two larger fatigue areas was observed to have propagatedalmost through the section before overload failure had causedseparation of the rim. The multiple initiations in the largerareas of fatigue did not appear to be associated with significantsurface damage or corrosion.

Examination of the two fracture faces under ultra-violet lightrevealed evidence of long standing fluorescent dye penetrant onthe faces of the two larger fatigued regions. Penetrant was visiblethroughout the depth of the smaller of the two major fatigue areasand extended to approximately 60% of the depth of the largestarea.

The fluorescent dye penetrant inspection method is used to inspectthe general surface condition of this wheel type when it is overhauledby the UK agents for the wheel manufacturer, the last organisationto carry out such an overhaul. An eddy-current inspection ofthe rim bead area is normally carried out before the fluorescentdye penetrant is applied, since this area is assumed to be theregion most prone to cracking. The origins of all the fatigueareas identified were all in the part of the wheel which is notsubjected to the eddy-current testing at overhaul. At the timeof the incident the operator was carrying out only visual examinationof the wheels at the time of tyre changes. The total number offlight cycles of the wheel from new are not recorded.

The remaining UK operators of the aircraft type became rapidlyaware of the general nature of the problem and instituted appropriateinspections on their aircraft. Soon after these inspections began,two wheels from other L188 aircraft were identified as cracked. Examination of these by the wheel manufacturer's UK agents andAAIB revealed that the cracks were in the same general areas asthe fatigue damage on the failed wheel of EI-CET.

The failed wheel half from EI-CET has been returned to the manufacturerfor more detailed analysis.