Lockheed L1011-385-1, EI-COL

AAIB Bulletin No: 12/98 **Ref: EW/C98/5/10** **Category: 1.1**

Aircraft Type and Registration:	Lockheed L1011-385-1, EI-COL
No & Type of Engines:	3 Rolls Royce RB211-22B turbofan engines
Year of Manufacture:	1973
Date & Time (UTC):	31 May 1998 at 1424 hrs
Location:	Manchester Airport
Type of Flight:	Public Transport
Persons on Board:	Crew - 12 - Passengers - 300
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Minor damage to drain mast, antennae, tail bumper and small area of skin on rear fuselage underside
Commander's Licence:	Airline Transport Pilots Licence (USA with Irish Certificate of Validation)
Commander's Age:	59 years
Commander's Flying Experience:	20,000 hours (of which 6,000 were on type) Last 90 days - 129 hours Last 28 days - 11 hours
Information Source:	AAIB Field Investigation

History of flight

At 0730 hrs the aircraft departed from Manchester for Menorca where it arrived at 1005 hrs. It left Menorca at 1215 hrs. The flight was uneventful and the aircraft was positioned for an ILS approach to Runway 24R at Manchester. The Commander was the handling pilot and the approach was flown manually with the autothrottle disengaged. The landing data card showed the landing weight as 304,000 lb which gave a V_{REF} of 129 kt.

The Commander recalled that the approach was normal until the landing flare which was entered at the correct height and at the placarded speed. The rate of descent did not reduce as he expected and so he continued to increase the pitch attitude to an estimated 13_. The aircraft landed firmly in a steep nose up attitude which caused the tail area to make contact with the runway surface. The company Flight Handbook advises that attitudes in excess of 12½_ will result in a tail strike.

The crew considered that the landing was firm rather than heavy and only minor damage occurred to a drain mast, antennae, tail bumper and a small area of skin on the rear fuselage underside.

Airfield information

The ILS localiser track on Runway 24R at Manchester Airport is 236°(M) and the glideslope angle is 3°. The ILS DME reads zero at the displaced threshold. The ILS was fully serviceable at the time of the accident. Runway 24R has a displaced threshold the elevation of which is 249 feet amsl. The width is 46 metres and the usable length for landing beyond the glideslope is 2,544 metres. The runway surface was dry.

The anemograph trace showed that the surface wind was from about 200° at a speed generally less than 7 kt. There was no other significant weather.

Aircraft operation

The service was normally operated by a major British inclusive tour airline who had a 'wet lease' agreement with an Icelandic airline to provide backup aircraft and crews as and when necessary. On this occasion the Icelandic company, for technical reasons, could not provide this backup. The company therefore applied to DETR for permission for the service to be operated on their behalf by the Icelandic airline using an Irish registered aircraft operated by an Irish airline. The appropriate permission and waiver were granted for this and a subsequent rotation. A 'wet lease' agreement was in place between the Icelandic and Irish airlines.

Flight recorders

A 30 minute duration cockpit voice recorder (CVR) and a 25 hour duration digital flight data recorder (DFDR) were fitted. The CVR contained a good quality recording of the final approach

and accident landing, the DFDR contained no data. There was an entry in the aircraft technical log to the effect that the DFDR fail light in the cockpit was illuminated throughout the accident flight.

The CVR recording began whilst the aircraft was at about 5,000 agl on the approach to Runway 24R at Manchester. Height calls from 700 feet agl until touchdown were made. After touchdown the flight engineer commented that the pitch attitude at touchdown was a bit high at about 15_.

A final approach profile was constructed using a time history of the height calls from the CVR and recorded radar data. It was clear from the profile that the rate of descent increased below 100 feet agl and that the aircraft flare before landing appeared to be ineffective.

EI-COL was an ex-TWA aircraft and as such it was fitted with an airborne integrated data system (AIDS) complying with ARINC 563; a recording format unique to TWA. The DFDR was tested and found to contain a recording that consisted of binary zero's on tracks 1, 2 & 3. The amplitude and shape of the recorded signal corresponded accurately to the 'zero's' signal produced by the DFDR bench test equipment. This test signal is fed to the recorder after major overhaul and is subsequently overwritten during normal aircraft operation; its presence is a conclusive indication that the DFDR had not operated while fitted to this aircraft. An electrical open circuit to the track 4 magnetic recording head prevented data being recorded on track 4. This defect would not have prevented data being recorded on the remaining 3 tracks, however, it would have resulted in the cockpit 'Bite' light being illuminated during the accident flight as track 4 was the track in use on that flight. The operator with assistance from TWA engineers conducted extensive testing to determine the reason for the non-operation of the DFDR. It was discovered that a fault existed in the AIDS central electronics unit (CEU). The CEU was replaced, the system functionally checked and a test flight carried out. Data from the test flight was successfully recovered from the DFDR.

Weight and balance

It was company practice for the Commander to prepare the Loadsheet and for the flight engineer to prepare the Take Off and Landing Data Cards; both were calculated in pounds.

The Loadchit and Load message form was given to the Commander at Menorca. It was annotated "All weights kilos" and contained the following information:

Passengers

Male 93

	Female	108
	Children	88
	Infants	11
Total passenger weight		18,251 kg
	Baggage	3,692 kg
Total traffic load		21,943 kg

On the Loadsheet the Commander had converted the baggage figure into pounds but had entered the passenger weight as '18251', the weight in kilograms recorded on the Loadchit. Using the conversion multiple 2.2046, this figure should have been '40236' which would have increased the zero fuel weight by 21,985 lb.

The error meant that the calculated take-off weight at Menorca, 338,247 lb, was significantly lower than the actual take-off weight of 360,232 lb. The maximum weight for the flexible thrust take off was 362,737 lb. The planned landing weight at Manchester was 304,000 lb which gave a VREF of 129 kt, however, the actual landing weight was about 325,985 lb which would have given a VREF of 136 kt.

The Loadsheet for the first sector from Manchester to Menorca showed a similar passenger load and the Commander had made the same error. In the opinion of the crew, this had not resulted in an abnormal landing because the First Officer had flown the approach at a speed slightly higher than ideal.

The error was identified at an early stage of the investigation and, on 2 June 1998, the Chief Flight Engineer sent a memorandum to all L1011 flight deck crew bringing the error to their notice. The following day the Chief Pilot L1011 issued a Crew Brief No B22 which expanded this memorandum and advised that:

> "A gross error check of No of pax x 201 lb (289 x 201 lb) would have indicated a load of approximately 58,000 lb hopefully highlighting the problem."