No: 7/90 **Ref: EW/C1149** **Category: 1a**

Aircraft Type and Registration:	Boeing 737-300, G-BLKD
No & Type of Engines:	2 CFM 56-3-B1 turbofan engines
Year of Manufacture:	1985
Date and Time (UTC):	25 February 1990 at 1353 hrs
Location:	East Midlands Airport
Type of Flight:	Public Transport
Persons on Board:	Crew - 7 Passengers - 146
Injuries:	Crew - None Passengers - None
Nature of Damage:	Wrinkling and creasing of the underside forward fuselage skin above the nose landing gear, both nose wheels distorted and internal structural damage.
Commander's Licence	Airline Transport Pilot's Licence
Commander's Age:	47 years
Commander's Total Flying Experience:	10,500 hours (of which 4,960 were on type)
Information Source:	AAIB Field Investigation

Following an ILS approach to runway 27 at East Midlands Airport, in a strong and gusty crosswind, the aircraft was landed normally on the main landing gear and almost immediately afterwards the nose pitched down, and the nose landing gear made a hard contact with the runway. The handling pilot had no problems in stopping the aircraft and taxying to the terminal area where the passengers disembarked through the normal channels. It was subsequently discovered that the aircraft had sustained substantial damage to the nose landing gear assembly and the underside of the forward fuselage section.

History of the Flight

The flight deck crew of three, comprising aircraft commander, first officer and a company base training captain, had reported for duty at East Midlands Airport at 0635 hrs to fly the sectors East Midlands to Malaga and return. The commander and first officer were to undergo company line competency checks, with the first officer as handling pilot on the outbound sector to Malaga, and the commander as handling pilot on the return sector. Prior to reporting for duty all three pilots had had rest periods in excess of 14 hours.

The aircraft departed East Midlands on schedule and the sector to Malaga was completed without incident and no unserviceabilities were recorded. After a turn round at Malaga the aircraft took off at 1127 hrs for the return flight. The regulated take off weight from Malaga was 57000 kg. The actual take off weight was 54455 kg and the centre of gravity was within prescribed limits and remained so for the rest of the flight. After a normal cruise and descent, the aircraft was positioned for an ILS approach to runway 27 at East Midlands Airport. The regulated landing weight was 51709 kg with an actual landing weight of 48400 kg, which, using 30 degrees of flap, required a Vref of 132 knots. All this information was correctly noted and placarded by the flight crew. The last recorded weather actual before the aircraft commenced its approach was surface wind 210/24 gusting 35, visibility in excess of 10 kilometres, weather rain showers, cloud 3 oktas at 1200 feet, 7 oktas at 2000 feet. The runway surface was wet. The operating company's cross-wind limit for landing on a wet runway is 30 knots.

The ILS to runway 27 was carried out in gusting conditions, and the commander elected to fly a manual 30 flap approach and landing, and selected auto-brake 2. The approach was flown normally, albeit in turbulence, with the aircraft going slightly below the glidepath at about 250 feet aal. From this point the rate of descent was marginally shallower than normal as the aircraft was flown towards the 1000 feet touch down aiming point. The cross-wind technique and flare seemed normal to all three pilots and the touch down on the main landing gear was described as firm but not hard. However immediately after the main landing gear contacted the runway the nose pitched down rapidly and a much harder contact was made by the nose landing gear. There was no problem with braking and the aircraft was brought to a halt and taxied to the parking area where the passengers disembarked through the normal channels.

After engine shut down and completion of checks, the flight crew discussed between themselves the landing sequence with particular reference to the rapid pitch down after main landing gear contact, and the resulting firm contact by the nose landing gear. All crew members considered the approach, crosswind technique, and flare to have been normal in the wind conditions reported, and all were equally perplexed to explain the subsequent rapid downward change of pitch. After examining the nose landing gear oleo extension and nose wheel rims and tyres, and seeing no evidence of stress or damage, the commander, with the agreement of his other crew members, did not consider that an entry in the aircraft's technical log requireing a 'heavy landing check' was warranted.

During a subsequent inspection of the airframe it was apparent that the aircraft had sustained substantial airframe damage around the nose section and it was withdrawn from service for examination and repair.

Flight Recorders

The Cockpit Voice Recorder (CVR) was a Sundstrand 4-Channel 8 Track 'Hot Mike' recorder, with a recording duration of thirty minutes using an endless loop of plastic based magnetic tape. The CVR circuit breaker was not pulled after the aircraft reached the parking area, and, as electical power was maintained the recorder continued to run and thus erased the information recorded during the approach and landing. However it did record the flight crew's conversation immediately after engine shut down and confirms their comments that the approach and flare had appeared to be normal and their surprise at the rapid nose down change of pitch.

The Flight Data Recorder (FDR) was a Sundstrand UFDR which recorded 13 analogue parameters and 4 discrete events. A satisfactory replay was obtained except that there was occasionally some random corrupt data from the 'normal g' trace. A plot of the data on the final approach and landing is included at the end of this report, and an explanation of the data is as follows.

Flap 30 degrees was achieved 56 seconds before touchdown as the aircraft passed 600 feet AGL, with the N1 at 40% and 45% on the No1 and No2 engines respectively and a rate of descent of about 1200ft/min. Power was increased to about 60% on each engine at around 560 feet AGL which reduced the rate of descent and the approach stabilised at about 600ft/min. The average airspeed on the approach was 148 knots (Vref 132 knots), but there were considerable variations from this which can directly be attributed to the gusty wind conditions. The maximum normal acceleration recorded at touchdown was 1.89G, with a second peak value one second later of 1.88G. The airspeed at touchdown was 143 knots.

The aircraft's pitch attitude at the first touchdown was 4 degrees nose up, deceasing to around zero degrees one second later at the second peak recorded on normal acceleration. The mean heading during the final approach was 265 degrees M, and after touchdown on the runway the heading stabilised at 273 degrees M, indicating the significant crosswind component. At the first touchdown the aircraft's heading was 266.4 degrees M, at the second peak normal acceleration the heading was 270.7 deegrees M, and one second later the heading was 275 degrees M.

Engineering examination

When the aircraft was first examined by the operating company's engineering staff it was considered to be difficult to decide whether the degree of damage was sufficient to merit an accident report. A heavy landing check was carried, the nose wheels were replaced, and, after agreement with the aircraft manufacturer, who stipulated some interim repairs, it was decided to fly the aircraft un-pressurised, landing gear down, to the maintenance base at Luton. However as a result of possible industrial action by the company's engineering staff the aircraft was moved again, and flown un-pressurised, landing gear down, to Tel Aviv where repairs were initiated. It was only after this that, on 7 March 1990, the company appreciated the precise details of the damage and notified a reportable accident. The aircraft was not therefore examined by AAIB Inspectors (Engineering).

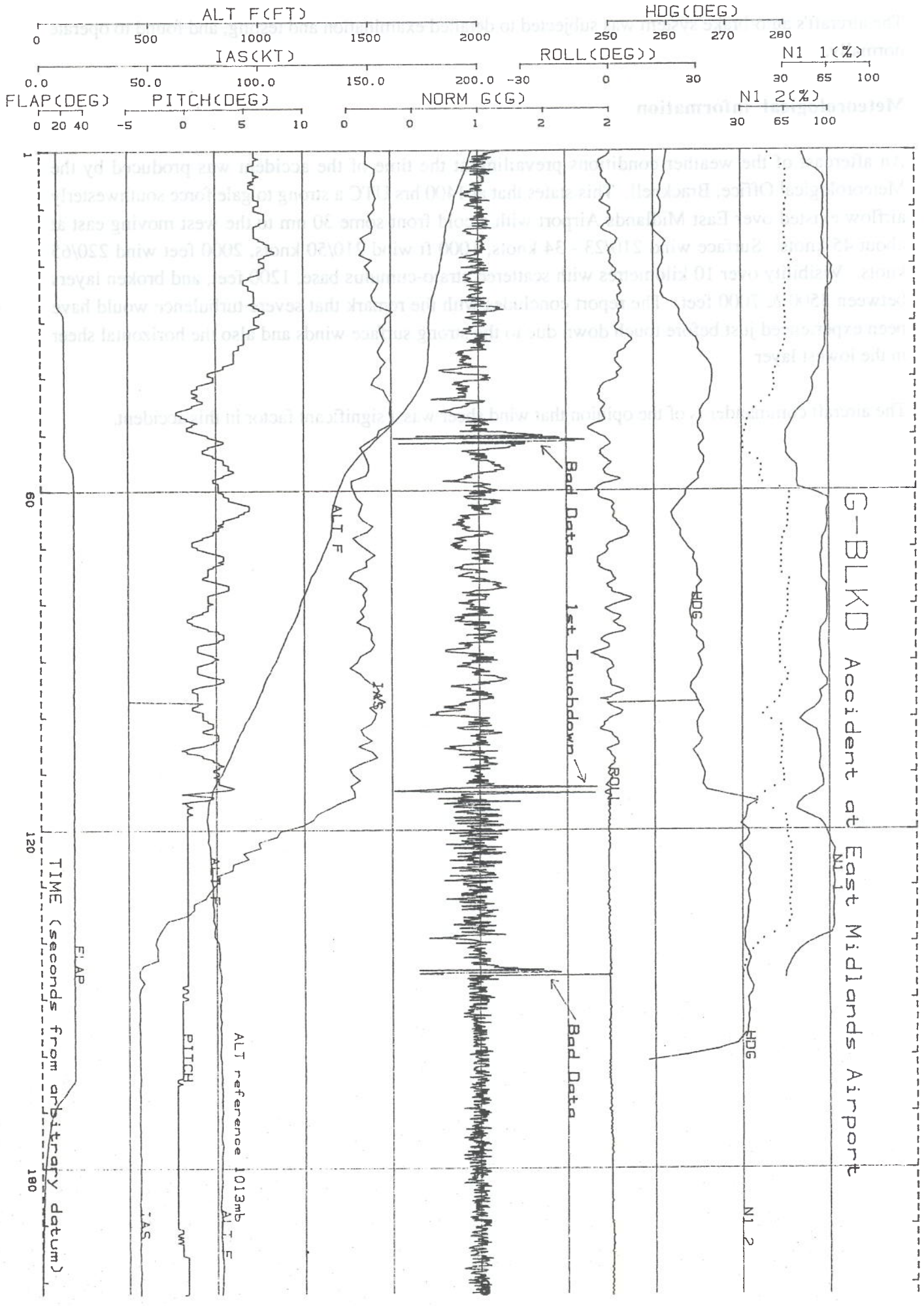
The engineering report provided by the company that completed the aircraft's repairs indicates the high degree of damage that the aircraft had sustained during its landing at East Midlands Airport. It records the necessity to remove and replace the aircraft's nose landing gear, together with a detailed list of repairs to other structural components. The damage report to the conditiion of the underside fuselage skin, which records compressive skin wrinkling on the left side and tensile stress to the right side, indicates that on touch down the nose landing gear had been subjected to a significant side load to the left.

The aircraft's auto-brake system was subjected to detailed examination and testing, and found to operate normally.

Meteorological information

An aftercast of the weather conditions prevailing at the time of the accident was produced by the Meteorological Office, Bracknell. This states that at 1400 hrs UTC a strong to gale force southwesterly airflow existed over East Midlands Airport with a cold front some 30 nm to the west moving east at about 45 knots. Surface wind 210/23 - 34 knots, 1000 ft wind 210/50 knots, 2000 feet wind 220/65 knots. Visibility over 10 kilometres with scattered strato-cumulus base, 1200 feet, and broken layers between 3500 & 7000 feet. The report concludes with the remark that severe turbulence would have been experienced just before touch down due to the strong surface winds and also the horizontal sheer in the lowest layer.

The aircraft commander is of the opinion that wind sheer was a significant factor in this accident.


Air Accidents Investigation Branch.....plotted on Wed Apr 04 17:01:01 1990
cal file u7373 sel file b7373 data file gblkd
ALT F(FT)
0 500 1000 1500 2000
HDG(DEG)
250 260 270 280
IAS(KT)
0.0 50.0 100.0 150.0 200.0
ROLL(DEG))
-30 0 30
N1 1(%)
30 65 100
FLAP(DEG)
0 20 40
PITCH(DEG)
-5 0 5 10
NORM G(G)
0 0 1 2 2
N1 2(%)
30 65 100
1
60
120
180
TIME (seconds from arbitrary datum)
G-BLKD Accident at East Midlands Airport
Bad Data 1st Touchdown
Bad Data
ALT F
IAS
HDG
ROLL
N1 1
N1 2
FLAP
PITCH
ALT reference 1013mb