

No: 12/92

Ref: EW/C92/8/3

Category: 4

Aircraft Type and Registration:	DC-9-83 (MD-83), G-JSMC	
No & Type of Engines:	2 Pratt & Whitney JT8D-219 turbofan engines	
Year of Manufacture:	1990	
Date & Time (UTC):	18 August 1992 at 0727 hrs	
Location:	Runway 26L London Gatwick Airport, Sussex	
Type of Flight:	Public Transport	
Persons on Board:	Crew - 7	Passengers - 165
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Minor to wingtip, landing light and strobe	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	53 years	
Commander's Flying Experience:	8,555 hours (of which 2,792 were on type) Last 90 days - 204 hours Last 28 days - 82 hours	
Information Source:	AAIB Field Investigation	

History of the flight

The crew reported for duty at 1915 hrs to operate a two sector return night flight from Gatwick to Dalaman, Turkey. Both the commander and co-pilot were on their fifth consecutive period of duty, the commander having operated a night flight the previous evening. Both pilots held current licences which were valid for the MD-83 and they had been rostered for sufficient rest prior to the flight.

The aircraft was scheduled to depart Gatwick at 2015 hrs on 17 August 1992 but was delayed for one hour and fifty minutes due to technical problems involving engine 'rigging'. This delay meant that the crew were now likely to exceed their normal maximum Flight Duty Period (FDP) of eleven hours and fifteen minutes by the time they returned to Gatwick. The commander, however, was satisfied with his crew's ability to extend the duty and, in accordance with guidelines issued in Civil Aviation Publication 371 (CAP 371), exercised his discretion in allowing the crew to operate

for a further two hours if necessary. In the event the crew exceeded their normal FDP by one hour and five minutes, which was within the two hour discretion period allowed.

The outbound flight to Dalaman was completed without incident and the aircraft landed from a VOR approach at 0205 hrs. Whilst on the ground at Dalaman pre-flight autoland checks were completed with both Digital Flight Guidance Systems (DFGS) selected to the Gatwick ILS frequency. The checks indicated a serviceable system and the aircraft departed for Gatwick at 0305 hrs.

Prior to departure from Gatwick the commander had offered the co-pilot the choice of sector as operating pilot (Pilot Flying = PF). The co-pilot elected to act as PF for the return sector to Gatwick and complete an autoland. Facilities for autoland did not exist at Dalaman. This was in accordance with the Operation Manual which stated that co-pilots could act as PF during autolands in conditions in which they (co-pilots) would normally be qualified to perform manual landings.

During the inbound flight the crew discussed the autoland procedures with reference to the Flight Crew Operating Manual (FCOM) and Company Route Manual. The commander briefed the co-pilot that, with the exception of following through on the controls, he (the co-pilot) must perform all the standard co-pilot (PNF) duties associated with CAT 3 operations. The co-pilot questioned this procedure and expressed the opinion that as he was the PF he should carry out the normal PF duties and not those of the co-pilot but he was overruled by the commander.

Prior to descent the crew calculated the Vref landing speed with 40° of flap as 130 kt and noted the airfield weather which was surface wind calm, visibility 18 km, one octa of cloud at 2,000 feet and temperature of 13°C. As the aircraft descended to 4,000 feet it was transferred to Gatwick Radar. The commander informed ATC " ...DESCENDING TO FOUR THOUSAND ONE ZERO ONE SEVEN AND WE'D LIKE A PRACTICE AUTOLAND". The radar controller vectored the aircraft to intercept the final approach track and replied "THAT'S APPROVED...AND THE RUNWAY WILL NOT BE SAFEGUARDED". The commander acknowledged this message. At 0722 hrs the aircraft was established on the localiser and was transferred to Gatwick Tower frequency with the instructions to "CONTINUE ON THE ILS SPEED NOT LESS THAN ONE SEVEN ZERO KNOTS TO FOUR MILES".

Ahead of the MD-83, also carrying out an ILS approach, was a Boeing 737 (B737) and waiting for departure at the runway 26L hold was a further B737. At 0723 hrs the B737 was cleared to land by ATC and the departing B737 was given clearance to line-up after the landing aircraft. At 0724 hrs the departing B737 was given take-off clearance and told to expedite the take-off with an inbound aircraft at 3 nm. The ATC controller, appreciating the spacing between the departing

B737 and the landing aircraft, instructed the MD-83 "IN THE EVENT OF A GO-AROUND BE A LEFT TURN TWO ONE ZERO CLIMB THREE THOUSAND FEET B737 STARTING HIS ROLL NOW". Several seconds later the ATC controller transmitted "YOUR DISCRETION LAND AFTER THE DEPARTING SEVEN THREE SEVEN IF YOU DO ELECT TO GO-AROUND PREVIOUS INSTRUCTIONS APPLY". The commander replied "THAT'S COPIED I THINK WE'LL BE OKAY".

During the approach the co-pilot had been guarding the controls and making all the standard PNF calls as instructed, even though he was in fact the PF. The Built-in Test Equipment (BITE) check of the auto flight system, which is automatically carried out at 1,500 feet, was satisfactory and all the Flight Mode Annunciations (FMAs) were correct. The co-pilot reported that, although the approach continued normally, trying to make the standard calls in an environment of numerous ATC transmissions and instructions resulted in a high work load.

At 50 feet on the radio altimeter the co-pilot called "DECIDE" and remained, as briefed, on flight instruments. At this point he reported that the aircraft, which had followed the localiser signals without deviation throughout the approach, was positioned correctly as indicated on the instruments. The commander replied "AUTOLAND". This call was followed almost immediately by the call "GO MANUAL".

With the aircraft now about 30 feet agl and already in the landing flare with the throttles retarding, the co-pilot looked up and was surprised to see the aircraft well to the right of the runway centreline and drifting rapidly towards the grass. The commander did not take control of the aircraft leaving the recovery of the situation under the control of the co-pilot who disconnected the autopilot and took corrective action to regain runway alignment. In doing so the left wing tip contacted the runway surface causing minor damage to the skin and shattering the landing and strobe lights. The commander stated that during the later stages of the autoland, between approximately 100 feet and 50 feet agl, his concentration may well have been degraded or misdirected by looking inside the flight deck to monitor the Flight Mode Annunciator (FMA). He also stated that it had never crossed his mind that the co-pilot would not be looking out below 50 feet, even though this is effectively how he had briefed for the CAT 3 approach. He further reports that he was certainly not aware for several seconds that the aircraft was deviating to the right of the normal approach path.

The aircraft continued its landing ground roll and cleared the runway. Moments later ATC queried the situation as they had received a report from another aircraft crew who had seen the wing tip touch the runway. The commander replied "NEGATIVE IT WAS DEFINITELY WHEELS DOWN FIRST". The aircraft continued taxiing to its stand and shutdown. The crew were only aware of

the damaged wingtip when they examined the aircraft after shutdown. An extensive area of broken glass was found on the runway which was closed for eleven minutes for sweeping.

At the time of the incident the ILS transmissions for both the localiser and glide path on runway 26L were within the specifications laid down for satisfactory CAT 3 operations. It was also learned that, as the MD-83 reached 50 feet before touchdown, the departing B737 was probably close enough to the localiser transmitter so as to affect the beam.

Shortly after the incident the commander sought medical examination which revealed a condition that may have existed for several months prior to the incident. It is thought that this medical condition could have had a detrimental effect on the commander's performance.

Aircraft Examination

G-JSMC ('MC') was examined initially at London Gatwick shortly after the event. This revealed that relatively minor damage had been caused to the underside of the left wing tip by contact with the runway. Abrasion of the logo light fairing and one anti-static wick had occurred. The landing light, which was extended at the time, and the glass strobe light cover had been shattered.

The autopilot/autoland system on the aircraft is centred on two Digital Flight Guidance Computers (DFGC), either of which may be selected by a switch on the Flight Guidance Control Panel (FGCP) on the glare shield, to perform the primary task of an autoland. At the time of this incident it was selected to the co-pilot's (No 2) position. The Flight Guidance Control System (FGCS) has an integral self checking and defect recording system, which may be interrogated by maintenance personnel following a defect occurring in flight, or after replacement of any part of the FGCS. In that case a Return To Service (RTS) check must be passed before the system is allowed to fly again.

This system on 'MC' was interrogated after the incident and, although it had not logged any apparent in-flight defects for the particular flight, the system failed to pass its RTS check on the No 2 system. In fact, the test stopped during checkout of the No 2 autopilot. Further interrogation of the system caused it to show that the systems affected were, flight director, auto throttle, speed control, mach trim, autopilot and DFGC No2. The equivalent test on No 1 system revealed no defects.

Following replacement of the No 2 DFGC 'MC' passed the RTS check three times, despite one minor defect being logged with the No 2 heading system which subsequently cleared itself. The

aircraft was returned to service, but initially with only a Cat 1 autoland clearance. The suspect DFGC was taken to a repair and test facility and subjected to a two hour automatic checkout by its manufacturer. The unit passed this test with no apparent defects. A few days later, this DFGC was refitted to 'MC' in the No 2 position and the RTS checks carried out again, the aircraft DFSG in the meantime having recorded no significant malfunctions. Of four checks carried out, the system passed on only one occasion, failures being recorded variously due to autopilot, autothrottle and yaw damper.

The apparent failures in the DFGC of 'MC' appeared to be random in nature and so the DFGP was replaced. Following this, both systems on the aircraft consistently passed the RTS checks, and the aircraft was again released into service. The DFGP was also subjected to comprehensive bench checks at its manufacturer's test facility, but also passed with no apparent defects being revealed. During these tests it was noted that two solder connections on a power switching relay within the FGCP were almost touching, but there was no evidence that they had ever been shorted out.

In order to resolve the previously described RTS failures, the subject No 2 DFGC, the FGCP, rudder servo actuator and position sensor were all removed from the aircraft and despatched to the manufacturer's facility in the US for testing as a system. Any relevant results will be reported by the AAIB when they are known. Since this incident, there have been no reported significant problems with respect to the autopilot/autoland system fitted to 'MC'.

Flight Recorders

The Flight Data Recorder (FDR), a Sundstrand UFDR was removed and a satisfactory replay carried out. The digital parameters from No 2 Digital Air Data Computer (DADC-2), including airspeed and altitude were found to be unserviceable. Investigation revealed a number of wiring discrepancies to the Flight Data Acquisition Unit (FDAU).

The Cockpit Voice Recorder, a Sundstrand AV557, was replayed satisfactorily, although the area microphone track had very low levels of recording. Subsequent investigation revealed a short circuit in the wiring between the area microphone panel and the CVR.

Interpretation of Data

Figure 1 shows some of the parameters during the final approach with the aircraft lined up at 200 feet onto R/W 26 at Gatwick, Flap 40 and Landing Gear DOWN selected; the Autopilot in use was No 2. At about 100 feet Radio Altimeter the localiser started to show a Fly Right indication,

and the aircraft drifted to the right as shown by the recorded magnetic heading. By 18 seconds the aircraft was still drifting to the right, the localiser deviation showed a Fly Right signal of almost 1 dot at between 15 and 33 feet Radio Altimeter, and the EPR started to reduce from 1.2.

The localiser deviation then returned to centre and the rudder position moved to around 21.6° trailing edge left at 20 seconds (maximum rudder deflection is $\pm 23^\circ$). The autopilot was disconnected at about 20 seconds; it is not possible to determine the exact time of disconnect as the autopilot discrete is sampled only once per second. The heading started to reduce from 262.6° M at 20 seconds, to a minimum of 255° M at 23 seconds, co-incident with a roll attitude of 10.8° left wing down. Touchdown occurred on the left gear at between 23 and 24 seconds, with the right gear touching about one second later.

Unserviceability of Flight Data Recorder System

The aircraft first flew on 26 November 1990 and a data dump of the FDR carried out by the manufacturer showed all the parameters to be serviceable. The aircraft was then modified to include the additional items for CAA certification including modification of the FDR system to Specification 10A. On the 5 March 1991 the FDR was removed for readout by the maintenance organisation in the UK. No results were available from this readout until June 1991 because the Dataframe Layout and Conversion Equations had not been received from the manufacturer. It was then apparent from this readout that there were 8 parameters missing, ie recording zero values. These comprised Altitude (fine and coarse), Airspeed, Mach No, Total Air Temperature, Coarse Radio Altimeter, Maximum Allowable Airspeed, and the non functioning of the Stick Push discrete which was a fleet wide problem.

Component changes were requested but, by August 1991, the aircraft wiring was suspected and relevant wiring diagram information was requested. It was not made available by the manufacturer until June 1992 when rectification work was planned for 20 August 1992, however the autoland incident preceded the work being carried out. Investigation following the incident showed several wiring discrepancies to the FDAU.

Company operating procedures

The company route manual contained a summary all of the CAT 2 and 3 operating procedures, together with some background information to enable crews to understand fully the environment in

which these operations are carried out, and the special precautions and logic required. It also detailed procedures to be used when carrying out automatic approaches for practice purposes. The route manual described crew duties for Airfield Low Visibility Procedures as follows:

CREW DUTIES ON APPROACH

The company philosophy regarding the duties to be performed by each pilot on approach is as follows:

The commander will control the aircraft using the A/P and Auto Throttle System (ATS) throughout the approach and landing/go-around. He will monitor his flight instruments until the "100 feet above" call by the F/O, at which point he will look outside to assess the visual cues available, making a continuous assessment of his visual reference so that when the F/O calls "Decide" at Decision Height (DH) he can immediately respond either "Land" if he has the required visual reference, or "Go-around" if he does not.....

The F/O will monitor his flight instruments throughout the approach and landing to the end of the landing roll, or through the missed approach. At no time will he seek any visual reference, except at the commander's request when clearing the runway.

On the 19 August 1992, the day after the incident, the operator issued a Flying Staff Instruction to remind all crews that autoland approaches, including practice autoland in Category 1 conditions, were only to be carried out by the commander. Furthermore, when a practice autoland was planned, all requirements for testing and briefing were to be met in accordance with the Operations Manual.

Safety Recommendations

The following Safety Recommendations have been made to the CAA:

Safety Recommendation 92-109

The CAA, together with the FAA and JAA, should ensure that information on the FDR system is available at initial issue and renewal of the Certificate of Airworthiness. This information should include details of the parameters recorded, their position within the data frame and the appropriate conversion algorithms together with the associated wiring information.

Safety Recommendation 92-110

The CAA should ensure that, before an aircraft in this category is accepted onto the UK Register, the manufacturer has carried out the appropriate tests to confirm the correct functioning of the FDR system.

Safety Recommendation 92-111

The CAA, together with the FAA and JAA, should review the advisory material associated with the proposed JAR OPS 1-057 and define those primary parameters, the loss of any one of which would render the data recorder ineffective for investigation purposes. Without these primary parameters the recorder would be classed as unserviceable.

FIGURE 1

