Altimeter setting error and altitude excursion, McDonnell Douglas MD-11, N701GC, December 3, 2005

Micro-summary: **This MD-11 descended to a lower altitude than cleared due to having omitted to set the altimeters.**

Event Date: **2005-12-03 at 0205 UTC**

Investigative Body: **Aircraft Accident Investigation Board (AAIB), United Kingdom**

Investigative Body's Web Site: **http://www.aaib.dft.gov/uk/**

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INCIDENT

Aircraft Type and Registration:	McDonnell Douglas MD-11, N701GC
No & Type of Engines:	3 GE CF6-80 turbofan engines
Year of Manufacture:	1991
Date & Time (UTC):	3 December 2005 at 0205 hrs
Location:	On approach to Nottingham East Midlands Airport
Type of Flight:	Commercial Air Transport (Cargo)
Persons on Board:	Crew - 3 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Certificate
Commander's Age:	57 years
Commander's Flying Experience:	25,000 hours (of which 2,500 were on type) Last 90 days - 242 hours Last 28 days - 83 hours
Information Source:	Field Investigation by the AAIB and a company investigation

Synopsis

The incident occurred during an approach to Nottingham East Midlands Airport when the crew were distracted and omitted to set the arrival QNH of 974 mb on any of the three altimeters despite having acknowledged the setting to ATC. When the crew levelled at 2,000 ft, ATC questioned the aircraft's pressure setting because the radar display indicated that the aircraft was much lower than cleared. At the time, the crew were visual with the approach lights.

History of the flight

The crew were on a flight from Cologne (Bonn) Airport to Nottingham East Midlands Airport with the first officer in the right cockpit seat as 'Pilot Flying' (PF). The commander, as 'Pilot Non-Flying' (PNF) was in the left cockpit seat and another first officer qualified pilot was seated on the 'Jump Seat'.

The flight was uneventful and the crew obtained ATIS information 'F' prior to descent. This included the information that the cloud was BKN at 2,500 ft amsl and that the QNH was 973 mb. The crew briefed for an ILS approach to Runway 27 and subsequently they all agreed that the QNH was included in the brief. Then, once the crew had checked in with 'East Midlands Approach' at FL80, the controller advised N701GC that the current ATIS was now information 'G'; the crew responded that they would check the latest information. The only

change from 'F' to 'G' was that the QNH had increased by 1 mb to 974 mb.

At 23 nm range, the aircraft was cleared by ATC to descend to 3,000 ft on the QNH of 974 mb. This clearance was correctly acknowledged by the crew who also requested and were given clearance to intercept the localiser on the aircraft's current heading. At about this time, the crew selected approach mode on the autopilot but the aircraft then started a turn to the left, which was away from the localiser centre-line. The crew reselected the required heading and then reselected the approach mode. Thereafter, the crew configured the aircraft for landing whilst closely monitoring the heading and localiser indication. As the aircraft descended to a new cleared altitude of 2,000 ft, the handling pilot stated that he had the PAPIs in sight. Then, once the crew had reported that the aircraft was established on the ILS, N701GC was transferred to 'East Midlands Tower'. When the crew checked in on 'Tower' with the information that they were established on the ILS, the controller asked for confirmation of the aircraft's altitude; the crew responded with 2,000 ft. ATC then asked the crew to check that 974 mb was set on the altimeter and the crew acknowledged the message. On the flight deck, the three altimeter settings were corrected and the subsequent landing was uneventful.

After landing, the crew discussed the event and then the commander telephoned ATC. He confirmed to ATC that they had received the correct pressure setting but that they had not set it on the altimeters which were, therefore, still on the standard setting of 1013 mb. The crew then contacted their company to report the event and completed the appropriate national reporting procedures.

Recordings

The AAIB were advised of the incident by the CAA on 14 December 2005, 11 days after the incident, following the submission of a Mandatory Occurrence Report (MOR). By then, no relevant information was available from the Flight Data Recorder or the Cockpit Voice Recorder. However, information was obtained from RTF and telephone voice recordings made available by East Midlands ATC, and from a radar recording of the Clee Hill area radar head made available by National Air Traffic Services.

The RTF voice recordings confirmed that the correct QNH was passed by ATC and acknowledged by the crew. Initial contact with 'East Midlands Approach' was at 0159 hrs and, at 0206 hrs the crew reported that they were established on the ILS and were then transferred to 'East Midlands Tower'. The initial call by the crew on 'Tower' was that they were "ESTABLISHED ON THE ILS" and ATC responded by asking for an altitude report and then questioning the altimeter setting. Thereafter, landing clearance was given and acknowledged at 0210 hrs.

When the 'Tower' controller had looked for the aircraft on handover, he had a visual impression that it was lower than normal and checked the Air Traffic Monitor (ATM) radar. This indicated the aircraft's altitude as 900 ft amsl at approximately 7 nm range and so the controller initiated the altitude check with N701GC.

The telephone recording confirmed that the commander contacted ATC at 0230 hrs to readily acknowledge that although the setting had been passed by ATC, the crew had not set the QNH.

The radar recording showed that the aircraft levelled at an altitude of 918 ft amsl (718 ft agl) at 7 nm from the

runway threshold and maintained that altitude until the glideslope was intercepted at just under 2 nm range.

Operational aspects

Crews were required to operate in accordance with the company 'Flight Crew Operating Manual'. Relevant procedures were as follows:

1. The PF calls for the 'Descent/ Approach' checklist 'to the line' at or prior to the top of descent. The checks 'below the line' comprise 'Altimeters' and 'Exterior Lights'.
2. For altimeters, the crew are required to set the QNH on the primary and standby altimeters at transition level.

The crew of N701GC confirmed that they completed the 'Descent/ Approach' checklist 'to the line' but acknowledged that they were distracted and did not complete the rest of the check. The commander also commented that ATC did not inform the crew of the transition level.

Two of the MD 11s in the company fleet have an automated radar altimeter callout at 1,000 ft. N701GC was not equipped with this feature. There was no company requirement to call when the radar altimeter became 'Alive'. All company MD 11s are equipped with automated callouts at intervals from "APPROACHING MINIMUMS" to "TEN FEET". Additionally, all company aircraft have GPWS installed and the crew confirmed that the system had been tested as serviceable prior to take off at Cologne.

The transition level throughout continental USA is FL180. Within the UK, the transition altitude is 3,000 ft unless otherwise notified.

The Manual of Air Traffic Services (MATS) Part 1 required that controllers were not to pass information on transition level to crews unless the crews asked for the information. It also required controllers to include the appropriate QNH in any transmission when an aircraft was cleared from a flight level to an altitude. Thereafter, all reference to vertical position was to be in terms of altitude until the aircraft commenced final approach.

The Jeppesen STAR[1] chart, dated 23 September 2005 for Nottingham East Midlands contained notes to the effect that the transition altitude was 4,000 ft and that the transition level would be given by ATC. This information on the transition level was also included in the UK Aeronautical Information Publication (AIP) STAR charts for most major UK airports.

Company actions

On receipt of the commander's report, the company removed the crew from flying status and required them to undergo additional ground and simulator training before subjecting them to a 'Line' check. The crew were also required to develop and conduct a briefing for other company crews on the incident, including appropriate 'lessons learnt'. The company concluded that the crew had been distracted from primary aircraft control by a navigation problem, with a subsequent loss of situational awareness.

Additionally, the company circulated a Flight Operations Bulletin 1205-03 dated 27 Dec 05 to all crews. This included a comprehensive summary of the incident and concluded that fixation on a particular problem had led to a deviation from Standard Operating Procedures (SOPs). The Bulletin also emphasised the importance of the following:

Footnote

[1] Standard Terminal Arrival Route

1. The completion of all checklists as a crew and ensuring that each checklist was complete before moving to the subsequent checklist. In particular, when the 'Descent/ Approach Checklist' had only been completed 'to the line' the checklist should not be re-stowed until the actions 'below the line' had been requested and completed.
2. The setting of QNH once ATC had cleared the aircraft to an altitude.
3. Inclusion of the radar altimeter in each crew member's 'scan', thereby maintaining good vertical awareness.

At a subsequent regular safety meeting in February, the company reviewed the incident and considered the following additional aspects:

1. It was noted that the crew had informed ATC that N701GC was established on the ILS when they were only established on the localiser. It was agreed that the training department would emphasis the correct terminology during recurrent ground school when discussing the Flight Operations Bulletin.
2. The possible inclusion of a "RADALT ALIVE" call during any approach. This was decided against because of the many airports into which the company operates and the fact that some involved undulating terrain which would require more than one such call.
3. A change of procedure to set the QNH on the standby altimeter once the destination airfield pressure setting had been obtained from ATIS information. However, the company decided not to incorporate this as a company procedure but to leave it as an individual crew technique.

Full assistance was provided to the AAIB by the operating company during the investigation.

Analysis

The incident resulted from an omission by the crew to set the QNH on the altimeters even though it was correctly passed by ATC and acknowledged by the crew. Shortly after acknowledging the correct QNH, the crew noticed the aircraft, on autopilot, turning away from the expected heading. Thereafter, their attention was primarily on monitoring the aircraft's lateral position and no-one realised that the 'Descent/ Approach' checklist had not been completed. At night and in sight of the PAPIs, it would then have been difficult for any of the crew visually to appreciate that they were much lower than required by the procedure. Furthermore, the two main and the single standby altimeters would have indicated the same altitude and raised no concerns. The main indication of a discrepancy available to the crew would have been the radar altimeter and it was therefore apparent that the instrument had not been part of any crew member's 'scan'.

The radar recording confirmed that the aircraft remained at a level altitude, albeit more than 1,000 ft lower than required, until glideslope intercept. Close monitoring and effective action by the 'Tower' controller enabled the true situation to be identified and resolved. Whilst there was no possibility of the incident progressing to an accident, the investigation, by both the company and the AAIB, indicated ways to reduce the probability of a similar incident.

The investigation and action by the operating company were thorough and ensured that all their crews were fully aware of the incident together with the factors involved. The importance of ensuring that appropriate checklists are fully completed has also been re-emphasised

together with the need for the radar altimeter to be included in the 'instrument scan'.

During the investigation, it was noted that there was a discrepancy between the instructions within MATS Part 1 and the information included on the approach charts for some UK airfields. Although this discrepancy was not considered pertinent to the incident involving N701GC, the Directorate of Airspace Policy has been informed.