INCIDENT

Aircraft Type and Registration:	Airbus A300 B4, TC-MND
No & Type of Engines:	2 CF6-50C2 turbofan engines
Year of Manufacture:	1982
Date & Time (UTC):	13 April 2007 at 2314 hrs
Location:	Manchester 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 Licence
Commander's Age:	54 years
Commander's Flying Experience:	17,640 hours (of which 7,800 were on type) Last 90 days - 172 hours Last 28 days - 43 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

During its final approach to Runway 24L at Manchester, the aircraft descended below the minimum altitudes specified in the VOR/DME procedure for that runway.

History of the flight

The aircraft was cleared to descend in accordance with the Manchester (MCT) VOR/DME approach procedure for Runway 24L at Manchester Airport. The co-pilot contacted the Tower frequency at a range of approximately 10 nm from touchdown and the Tower controller confirmed that the aircraft was cleared for this approach. The commander calculated the Visual Descent Point[1] and at 6 nm commenced the final descent to the Minimum Descent Altitude (MDA)[2] of 660 ft.

The Tower controller observed on radar that the aircraft was 1 nm right of the published approach track. He advised the pilots of this and asked them to report when visual with the lights of Runway 24L. At 5 nm from the touchdown threshold, the Tower controller noticed that the aircraft appeared low on the approach and when this was confirmed by the Approach controller, instructed the aircraft to go around. The aircraft stopped descending and shortly afterwards reported that the runway was in sight. The Tower controller considered the aircraft now

Footnote

[1] The point at which a nominal 3° glide path to the touchdown point coincides with the published MDA.

Footnote

[2] The MDA is the altitude in a non-precision approach below which descent may not be made without the required visual reference.

to be at a suitable altitude and lined up with the correct runway and asked the crew if they were able to continue visually. The commander replied that they were and the aircraft landed without further incident.

Meteorological information

The weather reported at 2250 hrs was a wind of 2 kt with variable direction and a visibility of 4,800 m in haze. The temperature was 10ºC and the QNH was 1022 mb.

Aerodrome information

Manchester Airport has two parallel runways with a south-westerly alignment which at the time of the incident were designated 24L and 24R. A VOR/DME procedure was published for both runways. The final approach track for the Runway 24R procedure was offset 5º to the south of the runway heading, such that an aircraft following the published track would be south of the approach track to Runway 24L. The runway centrelines are 0.21 nm apart and the threshold of the left hand runway is 1.02 nm beyond the threshold of the right hand runway in the landing direction.

Approach procedure

The VOR/DME approach procedure for Runway 24L was published in the UK Aeronautical Information Package (AIP) and is shown in Figure 1. The pilots of TC-MND used a commercially available approach chart which contained information equivalent to that shown in the UK AIP.

According to the published procedure the aircraft was required to maintain an altitude of 2,400 ft until passing the Final Approach Fix (FAF) 6 nm from the MCT. When established on the published approach track the minimum altitude until passing the Step Down Fix at 5 nm from the MCT was 2,080 ft. Thereafter there were no further published altitude restrictions until the aircraft reached the MDA of 660 ft. The recommended vertical profile, given in the form of altitude versus distance from the MCT (and also, from the touchdown threshold) was shown in a table on the same page as the chart.

Recorded information

Due to a delay in notification of this incident the AAIB was unable to recover information from the cockpit voice recorder or the flight data recorder.

Radar recordings indicated the position and altitude of the aircraft as it approached Runway 24L. As it turned it crossed the final approach track and established a track parallel to the north of it. The table below shows the aircraft altitude relative to the profile recommended on the approach chart at intervals of one mile.

Distance to MCT VOR / nm	Recommended Altitude / ft	Aircraft Altitude / ft
6	2,400	1,800
5	2,080	1,300
4	1,770	800
3	1,450	800
2	1,130	800
1	820	800

This information indicates that the aircraft descended below the minimum procedure altitude of 2,400 ft before passing the FAF and below 2,080 ft before passing the associated SDF at 5 nm. As the aircraft passed within 5 nm of the threshold its track began to converge with the published approach track.

Recordings of the Manchester Approach and Tower frequencies indicated that the pilots had received and read back instructions correctly.

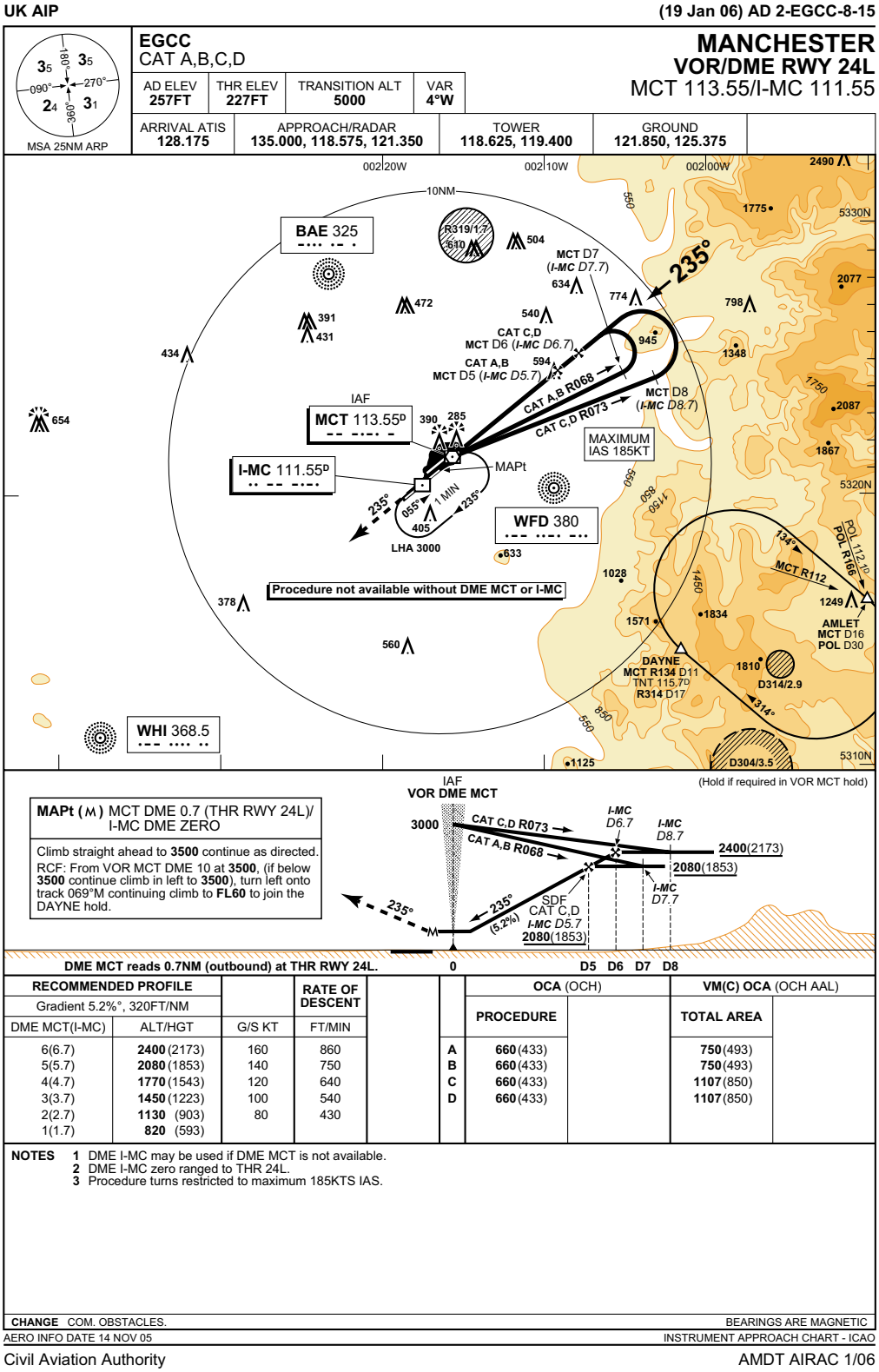

Figure 1

Manchester VOR/DME RWY 24L procedure

Approach techniques

Several studies by national aviation authorities and independent flight safety organisations have demonstrated that a stabilised approach technique is more desirable than a stepped descent from the FAF to the MDA. A stepped descent profile involves descending immediately to the lowest permissible altitude for a given sector of the approach, even if this means flying level for some distance at the MDA. A stabilised approach is conducted by descending at a constant angle, mimicking the profile that would result from following the glide slope of an instrument landing system. Such an approach can be flown without the need to change the configuration of gear and flap, resulting in fewer power changes and reduced pilot workload. The UK AIP and commercially available approach charts provide information to assist with determining the appropriate vertical profile.

ICAO Document 8168, PANS-OPS – *'Procedures for Air Navigation Services – Aircraft Operations'*, Volume I - *Flight Procedures*, describes operational procedures recommended for the guidance of flight operations personnel. The introduction to this document states, in relation to the construction of visual and instrument flight procedures, that it:

> *'illustrates the need for operational personnel including flight crew to adhere strictly to the published procedures in order to achieve and maintain an acceptable level of safety in operations.'*

In 2004 the progress report on the ICAO program for the prevention of controlled flight into terrain (CFIT) showed that, according to information available up to 2003, 67% of instances of CFIT occurred during the approach and landing phase of flight and indicated that of those, approximately 60% (or 40% of the total), occurred during non-precision approaches. The report highlighted the approval in 2001 of an amendment to PANS-OPS Volume I which contained:

> *'guidance for pilots to fly a constant approach descent gradient on non-precision approaches'.*

At the time of the occurrence to TC-MND, the relevant section of PANS-OPS contained the following statement:

> *'Operators may specify two types of approach procedures for non-precision approaches. The first is that described as: "descend immediately to not below the minimum stepdown fix altitude/ height or MDA/H as appropriate". This method is acceptable as long as the achieved descent gradient remains below 15 per cent and the missed approach is initiated at or before the MAPt (missed approach point). Alternatively, operators are encouraged to use a stabilised approach technique for non-precision approaches. This technique requires a continuous descent gradient to a point 15 m (50 ft) above threshold, taking due regard of the minimum crossing altitudes/heights specified for the FAF (final approach fix) and any prescribed stepdown fix.'*

Track error

The greatest track error shown by the recorded radar occurred at 5 nm from touchdown, when the aircraft was approximately 0.5nm north of the published final approach track. This is equivalent to a track error of 5.7º. The data processing accuracy of the radar itself, which is located on the aerodrome, is up to 0.07º. Accordingly, the aircraft could have been slightly less than 5.7º off track.

PANS-OPS states that the accuracy of a VOR, when used to define the final approach segment of an approach procedure, is considered to be ± 7.8º.

Altitude error

The altitude indicated on the radar record is derived from the aircraft transponder, which reports to the nearest 100 feet, such that an aircraft which reports its altitude as 1,300 ft could in fact be flying at 1,349 ft.

The radar makes 15 sweeps each minute, so the recorded position of a moving object at a particular time may be inaccurate by as much as the distance that the object can travel during one sweep. The average speed of TC-MND during the final approach was approximately 145 kt and the average rate of descent approximately 1,000 ft/min, resulting in lateral and vertical inaccuracies of up to 0.16 nm and 67 ft respectively. Consequently, whereas TC-MND was reported to be at 1,300 ft at the SDF, 5 nm from the MCT, it could have been at 1,349 ft at 4.84 nm from the MCT. Assuming a constant rate of descent the aircraft could then be assumed to have been at 1417 ft at the SDF.

If the pilots had misidentified the approach and descended the aircraft in accordance with the VOR/DME procedure for Runway 24R, they would have expected to be approximately 300 ft lower at a given distance from the MCT than was required for the approach to Runway 24L.

ATC instructions

Instructions to carry out a missed approach may be given to avert an unsafe situation. If instructed to go around, an aircraft on an instrument approach is expected to carry out the published missed approach procedure and an aircraft operating VFR is to continue into the normal traffic circuit unless instructions are issued to the contrary.

Conclusion

The radar record showed that the aircraft was north of the published approach track of the VOR/DME approach procedure for Runway 24L at Manchester. It was, however, within the prescribed final approach segment as defined by PANS-OPS. Nevertheless, the aircraft commenced its descent before the FAF and, at the SDF 5 nm from the MCT VOR, was below the minimum altitude required by the procedure, even when known inaccuracies are taken into account. It did not descend below the MDA, however, and having passed the SDF did not at any time thereafter operate outside the parameters of the published procedure.

Although their initial approach was north of track and more closely aligned with Runway 24R, it is unlikely that the pilots were following the approach procedure for Runway 24R. Neither pilot recalled any runway ambiguity and the more southerly final approach track of the procedure for Runway 24R does not correspond to the track followed by TC-MND.

The vertical profile followed by TC-MND indicates that the pilots did not intend to use a stabilised approach technique. Although this technique is widely regarded as more desirable than a stepped descent technique, under existing regulations the choice remains that of the operator and crew. Whichever technique is employed, an aircraft must not descend below the published minimum altitude relevant to each approach fix.

Safety action by the operator

As a result of this incident, the operator's Flight Safety Manager issued flight crew Notice 002/007 on 23 May 2007. This notice stated that:

'The Minimum Altitudes which are on approach charts or given by ATC have to be maintained during an Instrument Approach, even in VMC. As a precaution we have to;

- *Review altitude restrictions precisely during approach briefing,*
- *Maintain altitude which is given by ATC even if different from published altitudes,*
- *Request visual approach from ATC if VMC exists and visual approach is preferred by the crew.*
- *Follow ATC instructions strictly.'*

The operator's training department is also planning to review current instruction on non-precision approaches and perform more of these approaches during recurrent training.