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ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2010-027
Final

Operational non-compliances, 9M-XXB Gold Coast Airport, Queensland 4 and 29 May 2010

Abstract

On 4 and 29 May 2010, an Airbus A330-343E aircraft, registered 9M-XXB, was being operated by AirAsia X on scheduled passenger services from Kuala Lumpur, Malaysia to the Gold Coast, Queensland. On both occasions, there was low cloud and reduced visibility on arrival at the Gold Coast.

During non-precision instrument approaches conducted at Gold Coast Airport on both days, the flight crews descended the aircraft below the segment minimum safe altitudes. As a result, the aircraft descended to an altitude where there was no longer separation assurance from terrain and aircraft operating outside controlled airspace.

While those operational non-compliances occurred prior to the final approach fix for the instrument approaches and not below 1,200 ft above aerodrome height, they were indicators of a minor safety issue regarding the operator's training of its flight crews.

In response to this incident, the aircraft operator made a number of changes to flight crew procedures when conducting instrument approaches. The operator also modified the recurrent simulator training program to include more complex non-precision instrument approaches.

FACTUAL INFORMATION

Sequence of events

Operational non-compliance 4 May 2010

On 4 May 2010, an Airbus A330-343E aircraft, registered 9M-XXB (XXB), was being operated by AirAsia X on a scheduled passenger service from Kuala Lumpur, Malaysia to the Gold Coast, Queensland (Qld). On board the aircraft were 258 passengers, nine cabin crew and two flight crew.

There was cloud and rain at the Gold Coast Airport for the aircraft's arrival and at 0722[1], the approach controller cleared the crew to conduct the Gold Coast, Runway 32 VOR[2] approach. The pilot in command was the pilot flying.

The flight crew had intended to conduct the approach using the aircraft's autopilot in 'managed mode'. That mode would fly the aircraft along the pre-planned route, complying with the lateral and vertical navigation requirements for the programmed approach procedure. However, when the autopilot did not intercept the final approach track as anticipated, the crew switched to

1 Eastern Standard Time (EST) was Coordinated Universal Time (UTC) + 10 hours.

2 Very high frequency omnidirectional radio range. A ground-based navigation aid that emits a signal that can be received by appropriately-equipped aircraft and represented as the aircraft's bearing (called a 'radial') to or from the ground based beacon.

'selected mode' and continued the approach. In selected mode, the autopilot flew the aircraft according to target values input by the crew on the autopilot's flight control unit window displays.

When the aircraft was about 5 DME[3] (9 km) from the Gold Coast Airport, and 2,500 ft above mean sea level (AMSL), the aircraft was above the recommended descent profile for that approach. With the selected flightpath angle (FPA) of -4.9°, the aircraft was descending at a rate of about 1,300 ft/min. The flight crew continued descent until the aircraft was about 1,000 ft at 1 DME (2 km). At that point, a landing was not possible and they initiated a missed approach.

The crew was radar vectored at 2,500 ft for a second VOR approach to runway 32. Subsequently, the crew was cleared to make a pilot intercept of the final approach track and to conduct the approach.

The crew used the autopilot in selected mode to fly the approach. At 11 DME (20 km) they commenced descent, selecting an FPA of -3°. At that point, the aircraft was below the recommended descent profile and was descending below the procedure's segment minimum safe altitudes[4] (Appendix B).

Approaching 7 DME (13 km), the flight crew reduced the FPA to achieve level flight at 1,300 ft. At about the same time, the aerodrome controller advised the crew to check their altitude and that the radar lowest safe altitude in that area was 1,500 ft. The controller cleared the crew for further descent in accordance with the runway 32 VOR procedure. The aircraft remained below the segment minimum safe altitude until reaching 5 DME (9 km). Soon after, the controller provided the crew with surface wind information and cleared the aircraft to land.

At about 4 DME (7 km) and 1,300 ft, the crew reselected an FPA of -3° to commence the final descent to 750 ft, which was the minimum descent altitude (MDA)[5] (Appendix D). The aircraft reached the MDA at 2 DME (4 km) but low cloud, rain and reduced visibility prevented the crew from landing and they commenced another missed approach.

The flight crew then conducted a runway 14 VOR approach. Again, due to weather, they were unable to land the aircraft and conducted a missed approach and diverted to Brisbane, Qld. The aircraft landed at Brisbane at 0823.

Operational non-compliance 29 May 2010

On 29 May 2010, another flight crew was operating the same aircraft on the same flight number/route segment in similar weather conditions. On board the aircraft were 260 passengers, nine cabin crew and two flight crew.

The flight crew conducted a Runway 32 VOR approach but were unable to land due to reduced visibility in low cloud and rain. Following a missed approach, the crew conducted another Runway 32 VOR and landed.

For both approaches, the crew commenced descent from 2,500 ft at about 10 DME (19 km), which was below the recommended descent profile. During each of those approaches, when between 9 and 7 DME (17 and 13 km), the aircraft was below the procedure's segment minimum safe altitude.

Both approaches were conducted in selected mode, with the vertical navigation of the aircraft initially conducted in 'open descent'. In open descent, engine power reduces to flight idle and the aircraft descends at the FPA required to maintain the selected airspeed. The aircraft reached 1,500 ft by about 8 DME (15 km), recording a maximum FPA of -5.6° and a rate of descent of about 1,500 ft/min.

From 1,500 ft, the descent to the MDA was conducted using a selected FPA of -3°, in accordance with the published procedure.

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3 Distance Measuring Equipment (DME) is a ground-based transponder station. A signal from an aircraft to the ground station is used to calculate its distance in NM from the ground station. One NM is equivalent to 1.85 km.

4 Intermediate not below altitude restrictions associated with a non-precision approach (with distance measuring).

5 The minimum descent altitude (MDA) is the lowest altitude to which descent is authorised without obtaining a visual reference to the runway on final approach, or during circle-to-land manoeuvring, in execution of a non-precision approach in non-visual conditions.

Personnel information

Both flight crews held airline transport pilot licences, issued by the Malaysian Department of Civil Aviation. All were appropriately qualified and endorsed to conduct the flight.

Flight crew of the 4 May 2010 flight

The pilot in command had about 19,600 hours aeronautical experience, including 900 hours on the A330. The copilot had about 3,000 hours aeronautical experience, including 300 hours on the A330. Each pilot also had a significant amount of flight time on the A320.

Flight crew of the 29 May 2010 flight

The pilot in command had about 9,300 hours aeronautical experience. The copilot had about 2,500 hours aeronautical experience.

Flight time and duty period

The planned flight time from Kuala Lumpur to the Gold Coast was 8 hours 10 minutes. There was a 2-hour time difference between the departure and arrival time zones. On each occasion, the crews had flown back-of-the-clock operations, departing Kuala Lumpur during the late evening.

All flight crew duty times were within the relevant regulatory limits. Neither of the flight crews considered fatigue to be a factor in the operation of the aircraft during the approaches at the Gold Coast.

Aircraft information

The aircraft was equipped with an enhanced ground proximity warning system (EGPWS). That system provided the crew with alerts and warnings for hazardous flight conditions that suggested the potential for the aircraft to contact terrain. The EGPWS included warnings for excessive rates of descent, excessive rates of terrain closure, and of unsafe terrain clearance when not in the landing configuration. In the event of a potential terrain hazard, an EGPWS 'look-ahead' alert would be provided, based on the estimated time to impact.

The EGPWS did not activate during any of the approaches on 4 and 29 May 2010.

Aids to navigation

Published instrument approach procedures provided an assurance of terrain and obstacle clearance during flight in instrument meteorological conditions (IMC) and enabled flight crews to descend the aircraft to a position where they could see the runway and continue with a landing or conduct a missed approach. Those procedures also ensured that, where the approach was conducted in controlled airspace, the aircraft remained in that airspace.

A VOR approach was a non-precision approach and as such, did not provide glidepath information. In that case, the flight crew was responsible for selecting and maintaining an appropriate vertical profile.

The Gold Coast Runway 32 VOR approach is depicted at Appendix D. The approach comprised an inbound azimuth track to the airport's VOR and a series of descending segment minimum safe altitude 'steps'. Flight crews typically fly the approach as a continuous descent towards the runway, following a recommended descent profile not below the approach segment minimum safe altitude.

For a straight-in approach to runway 32, the initial approach fix (IAF) was at 10 DME (19 km). The final segment of the approach commenced at the final approach fix (FAF) at 5 DME (9 km).

Intermediate altitude restrictions between the IAF and FAF required the crew to not descend below 2,200 ft until passing 8 DME (15 km), not below 2,000 ft until passing 7 DME (13 km) and not below 1,400 ft until passing the FAF. After the FAF, the aircraft could descend to the MDA. The published procedure included altitudes and DME distances to achieve a recommended descent profile of 3°.

There was no aircraft technical malfunction identified, nor any anomalous operation of the ground-based navigation aids.

Recorded information

Data downloaded from the aircraft's quick access recorder (QAR) and relevant to individual approaches is depicted at Appendices A, B and C. That data has been overlaid with the relevant segment minimum safe altitudes for the runway 32 VOR approach.

Organisational and management information

Aircraft operator

The A330 flight crew operations manuals (FCOM), flight crew training manuals (FCTM) and the operational information that was contained in the standard operating procedures (SOP) manual provided flight crews with relevant guidance and standardised procedures.

The aircraft operator's preference was for instrument approaches, whenever possible, to be conducted in autopilot managed mode. At the time of these occurrences, the operator's recurrent training sequences included approaches that were conducted in managed mode and in selected mode. The operator reported that some pilots preferred using selected mode to conduct approaches.

The operator's simulator training at the time of the occurrence was predominantly based on Kuala Lumpur approaches. The Kuala Lumpur VOR approaches were relatively simple procedures that comprised an IAF and a FAF, with no intermediate segment minimum safe altitudes. The other VOR approach listed in the operator's training syllabus was of a similar design. The operator's recurrent training did not include any approaches to the Gold Coast.

The A330 FCOM and FCTM included procedures to be used when conducting non-precision instrument approaches in both managed and selected modes. In addition, those procedures also included the use of the various vertical and lateral navigation modes.

The operator's SOP required the pilot not flying to monitor the conduct of the approach and provide standard calls to the pilot flying. During the conduct of a non-precision approach, those procedures included monitoring the aircraft's vertical navigation relevant to the published approach procedure and calling out deviations from the nominated check altitudes.

Additional information

Similar occurrences – other operators

The Australian Transport Safety Bureau reviewed notification data that had been collected between July 2003 and July 2011 for similar occurrences involving high capacity aircraft. That review identified 21 additional reported occurrences of aircraft descending below the relevant segment minimum safe altitude while conducting an instrument approach in IMC. Six of those occurrences involved foreign-registered aircraft and the remaining 15 involved aircraft that were Australian registered. That data had not been normalised for the number of approaches being flown.

ANALYSIS

Sequence of events analysis

4 May 2010 occurrence

On the second approach, at an altitude of 2,500 ft and about 11 NM (20 km) from the distance measuring equipment (DME), the aircraft was already at the segment minimum safe altitude and about 900 ft below the recommended descent profile. Although the flight crew had been radar vectored to the final approach track at an altitude of 2,500 ft, the aircraft would not intercept the recommended descent profile until about 8 DME (15 km).

The descent from 2,500 ft to 1,300 ft at the selected flight path angle (FPA) of -3° was continuous and was conducted without apparent regard for the published segment minimum safe altitudes. That resulted in the aircraft operating below the segment minimum safe altitude prior to the aircraft reaching the final approach fix at 5 DME (9 km), with the effect that separation from terrain and other aircraft operating in non-controlled airspace was no longer assured.

It was not clear why the flight crew commenced descent prior to the aircraft intercepting the recommended profile for the approach. Being above the recommended flightpath on the first approach might have influenced the crew to descend earlier to avoid being similarly high during the second approach. Unfamiliarity with the conduct of non-precision approaches, and especially those that incorporated intermediate segment minimum safe altitudes, was another possibility.

29 May 2010 occurrence

In both approaches on 29 May 2010, the crew initiated descent at about 10 DME (19 km) and before the aircraft had intercepted the recommended descent profile for the non-precision approach. Those descents were conducted without apparent regard for the published segment minimum safe altitudes. As a result, separation from terrain and other aircraft operating in non-controlled airspace was no longer assured.

It was not clear why the flight crew commenced descent prior to the aircraft intercepting the recommended profile for the approach and descended below the segment minimum safe altitudes. However, unfamiliarity with the conduct of VOR approaches that included intermediate segment minimum safe altitudes was again a possibility.

Safety considerations

When conducting an instrument approach in instrument meteorological conditions (IMC), the flight crew must ensure that it is conducted in accordance with the prescribed procedure. In the case of the Gold Coast runway 32 VOR approach, the flight crew were required to manage the vertical profile so that the minimum safe altitudes were not infringed, thereby ensuring clearance from terrain and that the aircraft remained within controlled airspace.

On 4 and 29 May 2010, the respective flight crews flew three instrument approaches during which the aircraft's descent was not managed in accordance with the prescribed procedure. In particular, each flight crew descended their aircraft below the published segment minimum safe altitudes. Although the aircraft in each case was in no immediate danger of collision with terrain, the occurrences were non-compliances that exposed the aircraft to non-controlled airspace.

Although there were no clear reasons for the non-compliances, the three occurrences on two separate flights with different flight crews indicated that there may be a systemic factor(s) in the operator's conduct of non-precision approaches.

It was apparent that the flight crews were not monitoring the vertical profile between the initial and final approach fixes to ensure compliance with the segment minimum safe altitudes. Given that the operator's recurrent simulator training for VOR approaches was based on an approach with no segment minimum safe altitudes, it is likely that crews were not regularly exposed to intermediate vertical profile restrictions during the conduct of non-precision instrument approaches. Similarly, over time, the operator's preference for automatic management of the descent profile in managed mode probably reduced the importance placed by crews on vertical profile monitoring. Based on that information and the three non-compliances, the operator's flight crews were probably not adequately equipped to manage the vertical profile of non-precision approaches in other than autopilot managed mode.

The use of open descent by the flight crew on 29 May 2010 resulted in a rate of descent that was greater than that required to maintain the recommended profile. High rates of descent during an instrument approach can be destabilising and increase the risk of significant altitude excursions.

FINDINGS

From the evidence available, the following findings are made with respect to the operational non-compliances at Gold Coast Airport, Queensland on 4 and 29 May 2010 and involved Airbus A330-343E aircraft, registered 9M-XXB. They should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The flight crews did not manage the descent of their aircraft in accordance with the prescribed instrument approach procedure, resulting in descent below the applicable segment minimum safe altitude, and on those occasions, being exposed to non-controlled airspace.

Other safety factors

- The aircraft operator's flight crews were probably not adequately equipped to manage the vertical profile of non-precision approaches in other than autopilot managed mode. *[Minor safety issue]*

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety Actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

AirAsia X

Management of vertical profile

Safety Issue

The aircraft operator's flight crews were probably not adequately equipped to manage the vertical profile of non-precision approaches in other than autopilot managed mode. *[Minor safety issue]*

Action taken by the aircraft operator

In response to these occurrences, AirAsia X developed a simulator training session that specifically targeted the Gold Coast approaches and emphasised the preference for pilots to conduct managed approaches. All flight crews were required to complete this training prior to further operations into the Gold Coast.

In addition, AirAsia X:

- Issued a 'flight operations circular' advising that open descent mode should not be used when performing an instrument approach.
- Issued revised Gold Coast approach charts.
- Implemented additional training and checking of crews operating to the Gold Coast.
- Implemented a policy recommending a maximum of two approaches before diverting to an alternate airport.
- Reduced the incidence of mixed-fleet flying such that pilots only fly either the A320 or the A330/A340 during a roster period.
- Implemented an instructor standardisation and enhancement program.

SOURCES AND SUBMISSIONS

Sources of Information

The sources of information during the investigation included the:

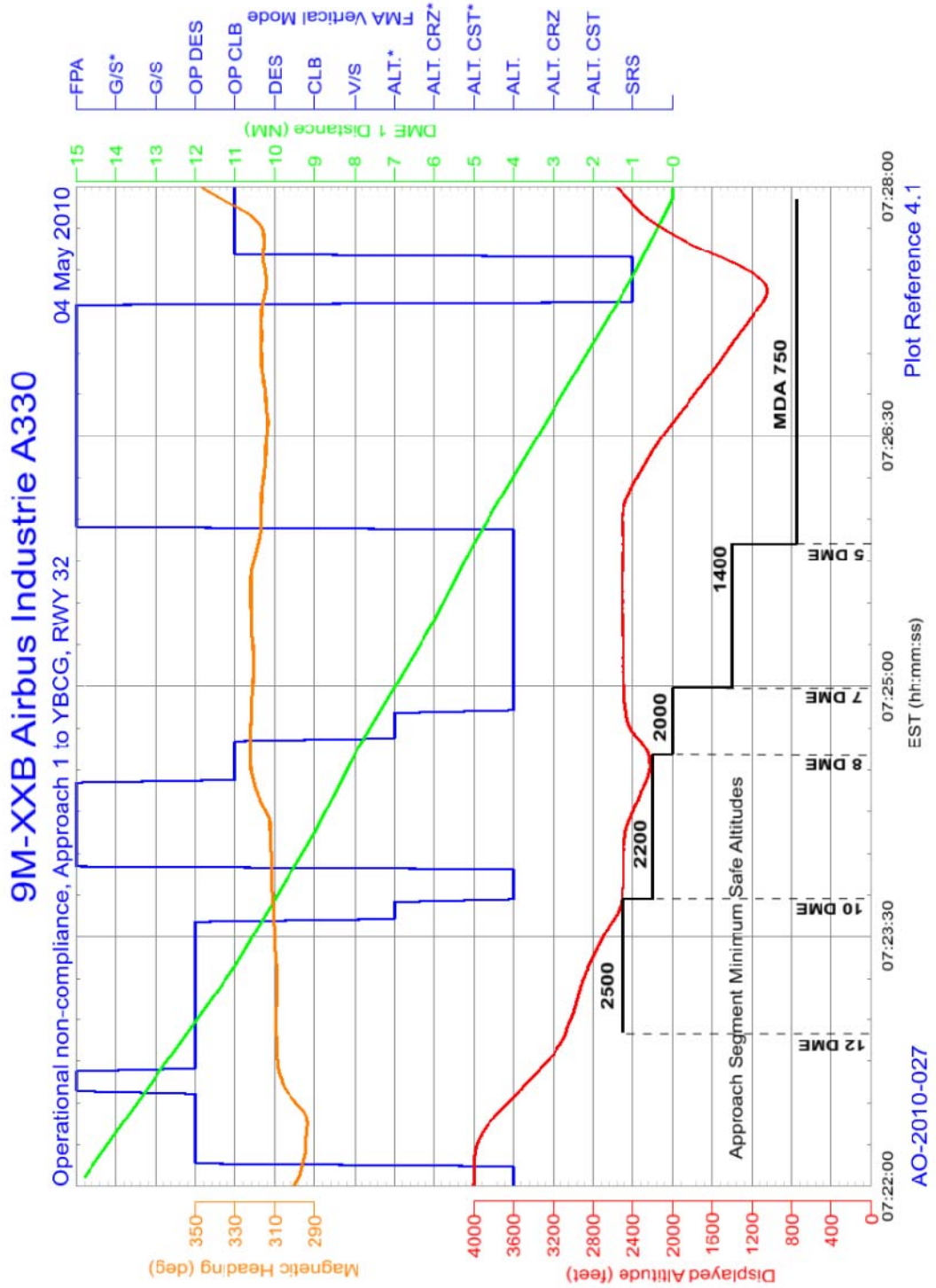
- flight crew
- aircraft operator
- aircraft manufacturer
- Bureau d'Enquêtes et d'Analyses (French BEA)
- aircraft's quick access recorder
- Airservices Australia (Airservices)
- Bureau of Meteorology.

Submissions

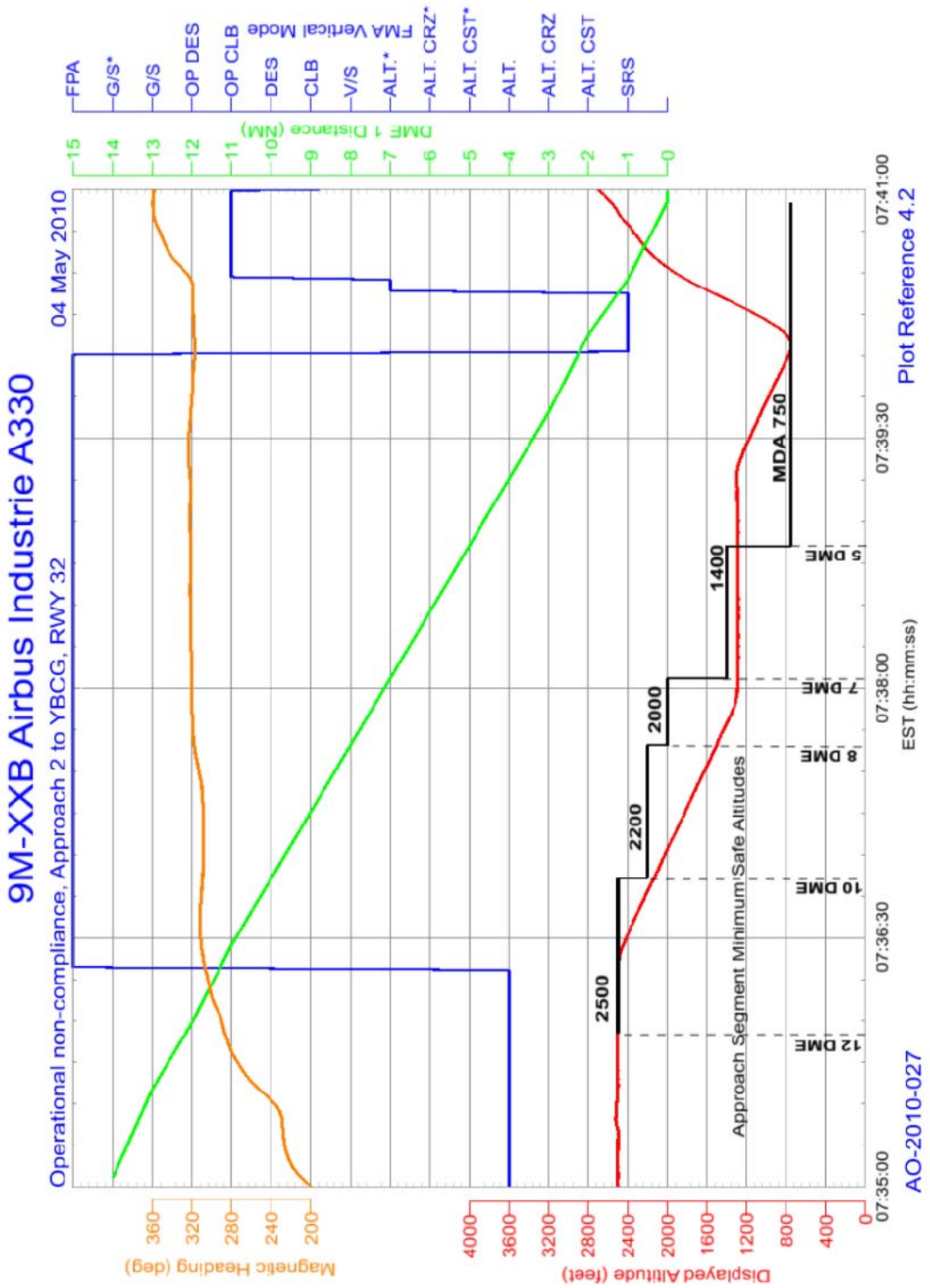
Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the flight crew, the aircraft operator, the aircraft manufacturer, the French BEA, Airservices and the Civil Aviation Safety Authority (CASA). A submission was received from CASA and, where considered appropriate, the text of the report was amended accordingly.

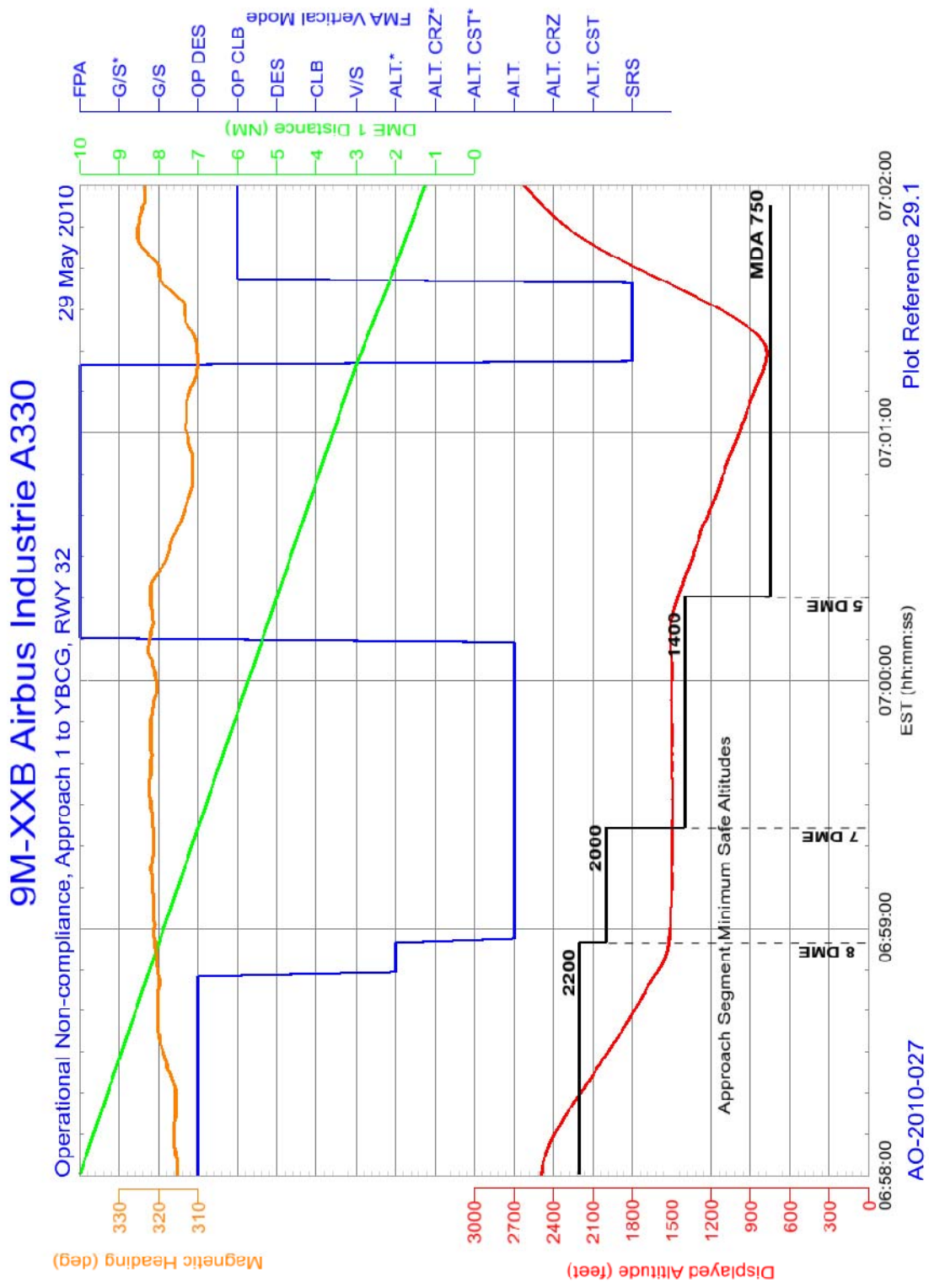
APPENDIX A: PLOT OF QUICK ACCESS RECORDER DATA - FIRST APPROACH 4 MAY 2010

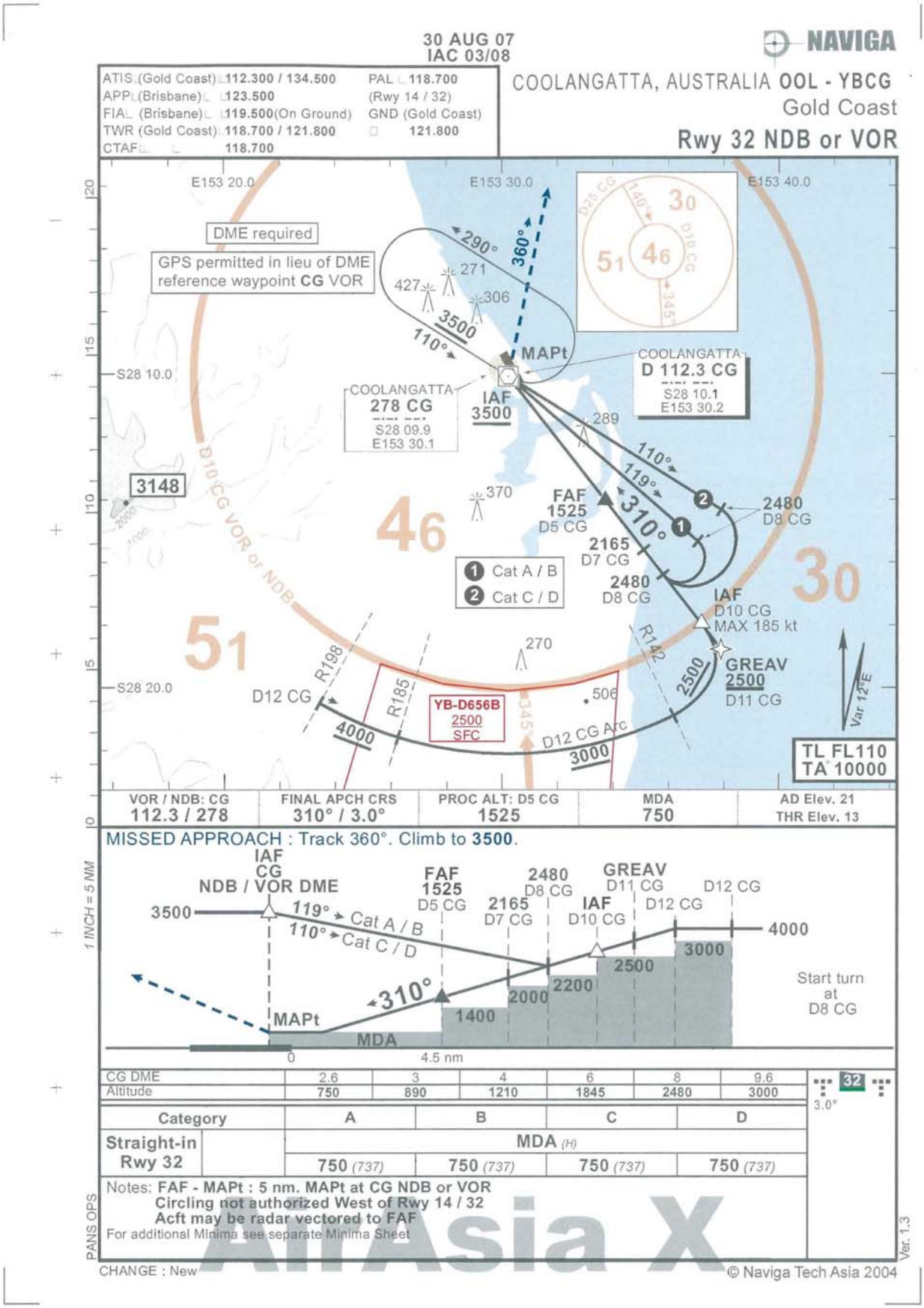


APPENDIX B: PLOT OF QUICK ACCESS RECORDER DATA - SECOND APPROACH 4 MAY 2010



APPENDIX C: PLOT OF QUICK ACCESS RECORDER DATA - FIRST APPROACH 29 MAY 2010




30 AUG 07
IAC 03/08
NAVIGA
COOLANGATTA, AUSTRALIA OOL - YBCG
Gold Coast
Rwy 32 NDB or VOR
ATIS (Gold Coast) 112.300 / 134.500
APP (Brisbane) 123.500
FIA (Brisbane) 119.500(On Ground)
TWR (Gold Coast) 118.700 / 121.800
CTAF 118.700
PAL 118.700
(Rwy 14 / 32)
GND (Gold Coast)
121.800
DME required
GPS permitted in lieu of DME
reference waypoint CG VOR
MAPt
IAF 3500
COOLANGATTA D 112.3 CG
S28 10.1
E153 30.2
COOLANGATTA 278 CG
S28 09.9
E153 30.1
FAF 1525
D5 CG
2165
D7 CG
2480
D8 CG
IAF
D10 CG
MAX 185 kt
GREAV
2500
D11 CG
D12 CG
Cat A / B
Cat C / D
YB-D656B
2500
SFC
D12 CG Arc
TL FL110
TA 10000
VOR / NDB: CG
112.3 / 278
FINAL APCH CRS
310° / 3.0°
PROC ALT: D5 CG
1525
MDA
750
AD Elev. 21
THR Elev. 13
MISSED APPROACH : Track 360°. Climb to 3500.
IAF
CG
NDB / VOR DME
3500
119° Cat A / B
110° Cat C / D
310°
MAPt
MDA
4.5 nm
Start turn
at
D8 CG
CG DME
Altitude
Category
A
B
C
D
Straight-in
Rwy 32
MDA (H)
750 (737)
Notes: FAF - MAPt : 5 nm. MAPt at CG NDB or VOR
Circling not authorized West of Rwy 14 / 32
Acft may be radar vectored to FAF
For additional Minima see separate Minima Sheet
PANS OPS
CHANGE : New
Ver. 1.3
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