



Australian Government

Australian Transport Safety Bureau

**Air Safety Occurrence Report
200305235**

**Boeing Co
737-700**

**SOCATA – Group
Aerspatiale
Tobago**

24 December 2003



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COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF TRANSPORT AND REGIONAL SERVICES
AUSTRALIAN TRANSPORT SAFETY BUREAU
Air Safety Occurrence Report: 200305235

The Bureau did not conduct an on scene investigation of this occurrence. The information presented below was obtained from information supplied to the Bureau.

Occurrence Number: **200305235** Occurrence Type: **Serious Incid.**
Location: **19km N Launceston, Aerodrome**
State: **TAS** Inv Category: **3**
Date: **Wednesday 24 December 2003**
Time: **1335** hours Time Zone: **ESuT**
Highest Injury Level: **None**

Aircraft Manufacturer: **Boeing Co**
Aircraft Model: **737-700**
Aircraft Registration: **VH-VBV** Serial Number: **33015**
Type of Operation: **Air Transport Domestic High Capacity Passenger Scheduled**
Damage to Aircraft: **Nil**
Departure Point: **Sydney NSW**
Departure Time:
Destination: **Launceston Tas.**

Aircraft Manufacturer: **SOCATA - Groupe Aerospatiale**
Aircraft Model: **TB-10**
Aircraft Registration: **VH-TBA** Serial Number: **18**
Type of Operation: **Non-commercial Pleasure/Travel**
Damage to Aircraft: **Nil**
Departure Point: **Hobart Tas**
Departure Time:
Destination: **Sydney NSW**
Crew Details

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Role	Class of Licence	Hours on type	Hours Total
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Pilot-In-Command

Approved for Release: 16-JAN-04

SUMMARY

On 24 December 2003, a Boeing 737-7BK (737) operating under the instrument flight rules (IFR) was en route from Sydney and descending for a landing at Launceston, Tasmania. A Socata TB10 (Tobago) operating under the visual flight rules (VFR) was en route from Hobart, Tasmania, to Sydney at about 7,500 ft. As the 737 was descending through about 8,300 ft, at around 1333:53 ESuT¹, the crew received a traffic advisory (TA) from their traffic alert and collision avoidance system (TCAS) about the Tobago. This was followed approximately 15 seconds later by receipt of a TCAS resolution advisory (RA) to climb. The crew responded to the RA and after arresting the aircraft's rate of descent, climbed the aircraft to approximately 9,200 ft. The pilot in command of the 737 reported that the TCAS indicated that the Tobago passed the 737 within about 200 ft vertically, slightly to the left, and certainly less than 1 NM horizontally.

Both aircraft were operating in Class E airspace that was introduced as part of the National Airspace System (NAS) phase 2b on 27 November 2003. As no prescribed separation standards are applicable in these circumstances, there was no infringement of separation standards. However, TCAS data and information obtained from the pilots of both aircraft indicate that the aircraft came into such close proximity that a threat to the safety of the aircraft may have existed. Therefore, the occurrence has been classified by the ATSB as an airprox² event, which is a type of serious incident.

FACTUAL INFORMATION

The 737 was inbound from the north to Launceston on the Flinders Island track (009 radial of the Launceston VOR³). At 1330:47 the crew contacted Launceston air traffic control (ATC) at 29 NM north of Launceston and reported that they were on descent to 9,000 ft. The 737 crew was 'cleared on a visual approach, QNH 1008 and when ready track as preferred for final runway 32 left'. They advised 'we'll be overflying for a left circuit'. The controller then provided traffic information on an agricultural aircraft that was operating low level south of the airfield. The crew of the 737 advised 'we can accept a right circuit. We might just join final at about 5 miles. Advise what you prefer'. The controller advised that the agricultural aircraft would not conflict with the 737 and that they could 'overfly for left base, you will be well clear, or right base as you prefer.' The crew of the 737 acknowledged with their callsign.

The co-pilot was the pilot flying and the pilot in command's attention was primarily focussed on maintaining a visual watch for VFR traffic. The pilot in command was also monitoring the aircraft's speed with respect to the high descent profile that was required to remain above the control area steps in Class E airspace.

¹ Eastern Summer Time

² Under the Transport Safety Investigation Regulations 2003, an 'airprox is defined as an occurrence in which two or more aircraft come into such close proximity that a threat to the safety of the aircraft exists, or may exist, in airspace where the aircraft are not subject to an air traffic separation standard, or where separation is a pilot responsibility.

³ VHF omni-directional radio range

As the 737 was passing approximately 8,300 ft, the pilot in command noted an aural TA and then observed a target on the aircraft's TCAS display indicating that it was at a level 500 ft below the 737, between the 11 and 12 o'clock position.⁴ The aircraft's rate of descent was immediately reduced and about 15 seconds later at 1334:08, when the 737 was 14.2 NM north of Launceston, the crew received a TCAS RA to climb. The TCAS traffic was almost on the reciprocal track, approximately 11 NM north of Launceston at that time. The pilot in command took over control and climbed the aircraft in accordance with company standard operating procedures. The aircraft remained above the RA climb indicator throughout the procedure, until a TCAS clear of conflict message was received. The 737 crew did not visually sight the aircraft at any time. However, the 737's cabin crew reported to the pilot in command that passengers saw the aircraft on the left side of the 737. The pilot in command reported that based on the TCAS display, the aircraft passed slightly to the left, and certainly within both 1 NM from the 737 and 200 ft below. It was subsequently established that the aircraft was a Tobago being operated on a VFR flight at about 7,500 ft. At that time, the 737's airspeed was 250 kts and Tobago was travelling at approximately 110 kts.

The crew of the 737 advised Launceston ATC of the event and the crew was advised that there was no known traffic in the area. Radar coverage in the Launceston area, using radar sensors based on the Australian mainland, only existed above approximately 15,000 ft. Launceston ATC provided a procedural control service using information derived from sources other than radar. Without radar, the only way that ATC could have been aware of the presence of the Tobago was if the pilot had made a broadcast.

The Tobago was maintaining around 7,500 ft and its transponder⁵ had been activated on code 1200 with the altitude function selected in accordance with NAS procedures. The pilot of the Tobago had tracked from Hobart to Launceston and after establishing the aircraft north of Launceston, turned the aircraft to intercept the direct track from Launceston to Flinders Island, the reciprocal track to that of the 737. The pilot reported that he had selected 007⁶ on the VOR based on information from the global positioning system (GPS) that was being carried on the aircraft.

The pilot of the Tobago was monitoring the Launceston and Melbourne Centre ATC frequencies and heard the initial transmission from the crew of the 737 to Launceston ATC. He noted from that transmission that the 737 was inbound to Launceston on the 009 radial of the Launceston VOR and also believed that the 737 had been cleared to

⁴ The clock code is used to denote the relative bearing of an aircraft or surface feature relative to the current heading of the observer's aircraft, expressed in terms of position on an analogue clock face. Twelve o'clock is ahead, three o'clock is abeam to the right, six o'clock is behind and nine o'clock is abeam to the left.

⁵ An operational transponder transmitting altitude information enables air traffic secondary surveillance radar (SSR) to detect aircraft and for the controller to provide accurate location and altitude information to other pilots where appropriate. There was no SSR coverage in the area where the 737 and Tobago were operating. Operational transponders also enable pilots of aircraft equipped with a TCAS to detect possible conflicting aircraft.

⁶ The pilot reported that he was tracking direct from Launceston to Flinders Island. The investigation could not resolve the 2 degrees discrepancy between use of the 007 VOR radial by the pilot and the 009 VOR radial annotated on navigation charts. However, the promulgated navigational tolerance for the VOR was +/-5.5 degrees (Manual of Air Traffic Services, 4-4-50).

track direct to right base runway 32L. As the pilot of the Tobago was tracking via the 007 VOR radial he considered that there would be sufficient lateral spacing with the 737 on the 009 VOR radial at the point where they were likely to pass each other⁷. He also considered that the lateral distance between them would increase if the 737 was tracking direct to right base rather than tracking inbound on the 009 VOR radial.

The pilot of the Tobago reported that he had selected the aircraft's navigation, strobe and landing lights 'ON'. He subsequently saw the 737 and he believed that it would pass safely to his right. The pilot reported that he flashed the Tobago's landing lights at the 737 several times, but become concerned when the 737 appeared to turn to the right across the nose of the Tobago. The Tobago pilot reported that he observed the 737 climbing above him 'appearing to come from starboard to port'. However, he said that, as the 737 was ascending in front of the Tobago and at his 11 o'clock position, there was no need to consider whether there should be an alteration of course or a decision to descend. A review of track and heading information from the 737's flight data recorder (FDR) did not reveal any indication of a tracking change⁸, although there was a minor heading change of 4 degrees. The wind at 8,500 ft recorded on the 737's FDR was about 266 degrees M at 43 kts. Appendix A shows the track of the 737 obtained from the FDR. The ATSB also examined the data recorded on the GPS carried on the Tobago, however, by the time the ATSB requested access to the GPS, the data for the incident flight had been overwritten by data from a subsequent flight. The Tobago pilot subsequently advised ATSB investigators that he was aware that the appearance of cross-tracking was probably an illusion which resulted from the strong wind.

After the Tobago pilot heard the crew of the 737 report the TCAS RA event to ATC, he advised ATC that his was the aircraft involved and that he had been operating in accordance with NAS procedures. The controller advised him that he should maintain a listening watch on the relevant ATC frequency and announce himself to traffic that he may be in conflict with. The pilot advised that he:

thought that I wasn't supposed to speak on the frequency now.

Educational material associated with the NAS phase 2b implementation stated that an:

important change is that the pilot of a VFR flight should not make broadcasts on ATC frequencies.

It also stated that:

Pilots of VFR flights may monitor the ATC frequency to enhance situational awareness

⁷ The pilot calculated that the aircraft would pass each other at about 15 NM from Launceston, at which point, with 2 degrees between their respective tracks, there would be 0.5 NM lateral spacing between the aircraft with the Tobago passing to the right of the 737. The available evidence suggests that the aircraft passed each other about 12 NM from Launceston which, using the same calculation method, would lead to 0.4 NM lateral spacing between the aircraft. However, these calculations do not take into account navigation aid or tracking tolerances and the actual spacing may have been significantly closer.

⁸ The 737 maintained tracking via the 009 radial to Launceston and joined the circuit on a left downwind leg.

Please do not make broadcast transmissions or engage in chatter on an ATC frequency. The safety of others depends on you not doing this

Pilots are not precluded from responding to any ATC or pilot transmission when they believe their safety is at risk from another aircraft.

The NAS 2b education/training material contains requirements and recommendations relating to VFR airmanship in NAS airspace including:

remain vigilant when operating in the vicinity of arrival/departure tracks to runways and navigation aids

remain clear of instrument approaches

remain clear of GPS approaches

avoid when practicable areas where IFR flights may be in a holding pattern

if possible avoid transiting these areas [large IFR aircraft holding areas]

avoid RPT [regular public transport] approach and departure tracks

apply “lights on”, where practicable, within 30 NM of any aerodrome below 10,000FT (both day and night).

The NAS phase 2b implemented on 27 November 2003 introduced significant changes to the Australian aviation system, including:

- some frequencies and all frequency boundaries being removed from the charts
- expansion of Class A airspace
- establishment of Class E airspace to replace significant portions of Class C airspace
- establishment of Class E airspace to replace significant portions of Class G airspace, and
- introduction of stricter requirements for mandatory transponder carriage and use.

In Class E airspace, the pilots of aircraft operating under IFR and VFR are required to:

maintain vigilance so as to see, and avoid other aircraft⁹.

Educational material associated with NAS phase 2b stated that pilots of domestic and international regular public transport flights should:

maintain a vigilant lookout, using TCAS as a secondary means of detecting traffic.

From 27 November 2003, the airspace in which the 737 and Tobago were operating at the time of the occurrence was classified as Class E airspace (see Appendix B). In the Class C airspace operative prior to 27 November (see Appendix C), both aircraft

⁹ Civil Aviation Regulation 163A

would have been subject to an ATC airways clearance and would have been separated in accordance with prescribed standards.

The limitations of see-and-avoid have been identified in accident and incident investigations both in Australia and in the US. The ATSB (then Bureau of Air Safety Investigation (BASI)) 1991 research report *Limitations of the See-and-Avoid Principle*, evaluates the practicability of the see-and-avoid principle and in particular summarises research relevant to ‘unalerted’ see-and-avoid.^{10,11}

ANALYSIS

Throughout this analysis it should be noted that the pilots of the aircraft involved in this incident were operating in accordance with the rules and procedures for operation in Class E airspace associated with the NAS phase 2b, implemented on 27 November 2003. The closing speed of the aircraft was approximately 360 kts. The reason the Tobago passed to the left of the 737 could not be conclusively determined (see footnotes 6 and 7).

The investigation found that the aircraft came within such close proximity at about the time of the RA alert provided by the TCAS on board the 737 as to constitute an ‘airprox’ serious incident and the response by the crew to that alert, may have averted a mid-air collision. In this regard, the fact that the transponder on the Tobago was functioning normally and that the 737 was equipped with TCAS allowed for timely immediate action by the crew of the 737.

It is noted that some air transport aircraft engaged in freight, low capacity passenger transport and other operations such as air ambulance are generally not equipped with TCAS. Recent reports to the ATSB have shown that transponder failures have occurred without the pilot being aware and at times pilots have inadvertently not activated the transponder.

While the radio transmissions from the crew of the 737 may have assisted the Tobago pilot’s situational awareness, it was also influenced by his sighting of the aircraft, his belief that there was 2 degrees difference between the aircraft tracks and his belief

¹⁰ It is important to distinguish between unalerted and alerted see-and-avoid. In alerted see-and-avoid, the pilot of an aircraft is assisted to sight traffic through information provided by other pilots or through third party operators such as ATC or Unicom (Unicom, or Universal Communications, is a non-air traffic services communications service provided on the MBZ frequency or CTAF to enhance the value of information normally available about a non-controlled aerodrome). Unalerted see-and-avoid on the other hand, presents a potentially greater safety risk because it relies entirely on the ability of a pilot to sight other aircraft without prior warning or alerting.

¹¹ The BASI report made six recommendations including with respect to implementation of TCAS and education initiatives and that ‘... The CAA should take into account the limitations of see-and-avoid when planning and managing airspace and should ensure that unalerted see-and-avoid is never the sole means of separation for aircraft providing scheduled services’. In 2001, the ATSB classified the CASA response to that recommendation as CLOSED - ACCEPTED on the basis that CASA agreed that the limitations of see-and-avoid should be taken into account when planning and managing airspace and the Authority had indicated that appropriate risk management techniques will be used to establish airspace regulatory safety requirements. The ATSB agreed that the use of the absolute ‘never’ was overtaken by risk assessment subsequent to the 1995 Standards Australia AS/NZS4360 Risk Management Standard.

that the 737 was tracking direct to right base for runway 32L. Although the pilot had the 737 in sight and was initially of the opinion that it would pass with sufficient spacing to the right of his aircraft, he became concerned when the 737 appeared to turn to the right across his path. The investigation could not conclusively determine why the 737 appeared to make such a heading change. Although the pilot of the Tobago has a clear recollection of a significant right turn having been made by the 737, the FDR data at Appendix A shows the 737's consistent and straight track over the ground. The minor heading change was possibly due to wind effect. The head-on aspect of the two aircraft may have given the illusion of a more significant heading alteration having been made.

The lack of radar coverage in the Launceston area and the absence of broadcasts from the pilot of the Tobago created an unalerted see-and-avoid environment for the crew of the 737. This limited their situational awareness and precluded them from the decision making process in terms of assessment of the potential conflict between the two aircraft until the TCAS alerts. The procedures and training material associated with operations in Class E airspace under NAS phase 2b indicate that there is a shared responsibility by pilots of IFR and VFR flights to see-and-avoid each other in Class E airspace. However, use of the ATC frequency by pilots operating under the VFR to initiate broadcasts is discouraged under NAS. While unnecessary broadcasts can be counter-productive, if the pilot of an aircraft operating under the VFR in non-radar Class E airspace does not perceive the need to broadcast a position report, pilots of other aircraft may not have critical information necessary to see-and-avoid other aircraft.

The investigation noted that the education material used a variety of terminologies when referring to airmanship by VFR pilots and did not clearly differentiate with respect to what constituted a requirement and what constituted a recommendation.

While a single occurrence does not provide the basis for a major change to the US-based NAS, which is yet to be fully implemented, the circumstances of this serious incident are indicative of a need for further review and analysis by the responsible authorities in consultation with industry.

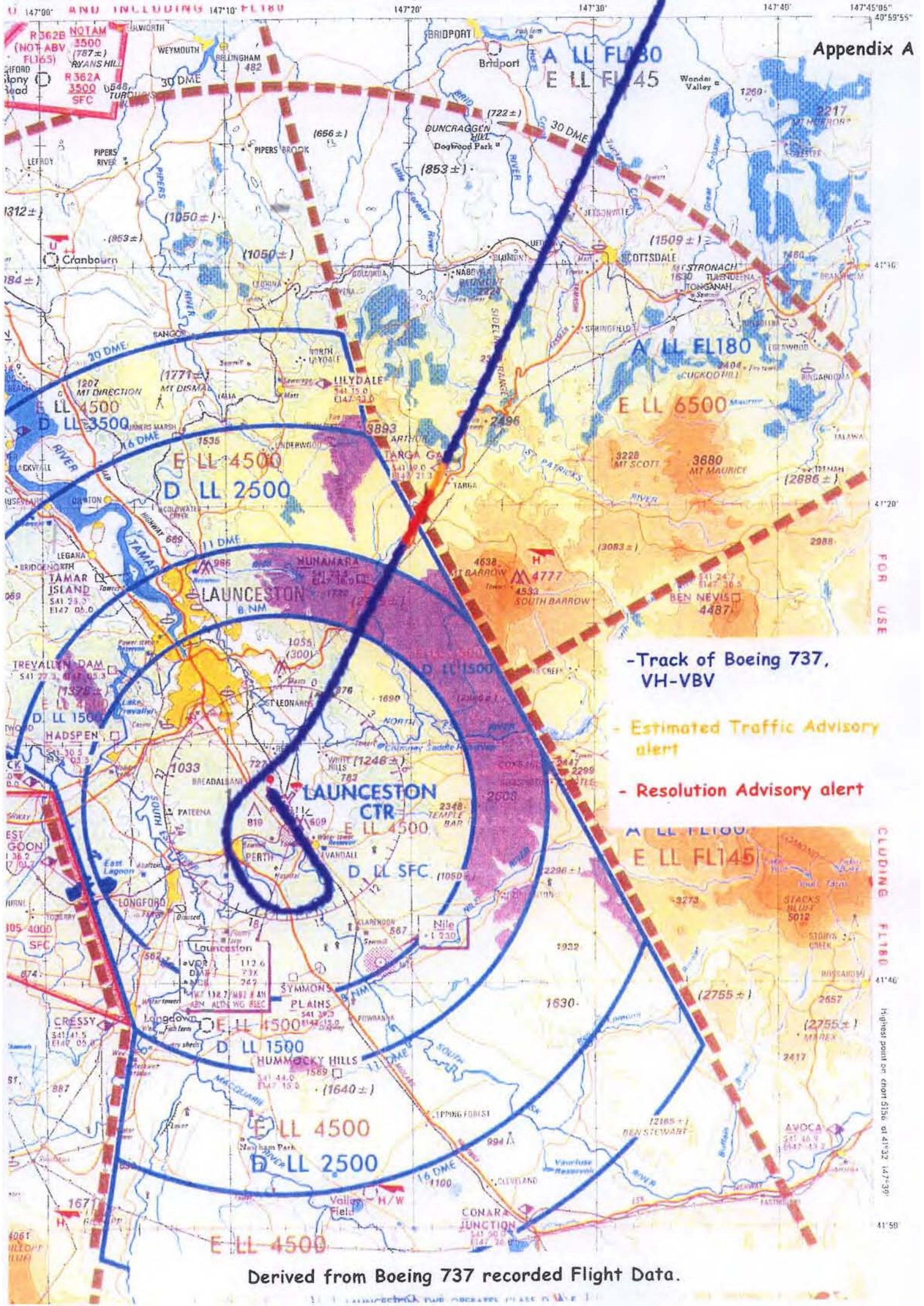
SAFETY ACTION

Recommendation 20040013

The ATSB recommends that the Civil Aviation Safety Authority, in consultation with Airservices Australia and the NAS Implementation Group, review NAS procedures and communications requirements for operations in Class E airspace, with particular emphasis on air transport operations during climb and descent in non-radar airspace, with a view to enhancing situational awareness of pilots operating in that airspace. The review should include examination of, and where necessary revision and updating of, education, training and chart frequency material.

Recommendation 20040014

The ATSB recommends that Airservices Australia, in consultation with the Civil Aviation Safety Authority and the NAS Implementation Group, review NAS procedures and communications requirements for operations in Class E airspace, with particular emphasis on air transport operations during climb and descent in non-radar airspace, with a view to enhancing situational awareness of pilots operating in that airspace. The review should include examination of, and where necessary revision and updating of, education, training and chart frequency material.



- Track of Boeing 737, VH-VBV
- Estimated Traffic Advisory alert
- Resolution Advisory alert

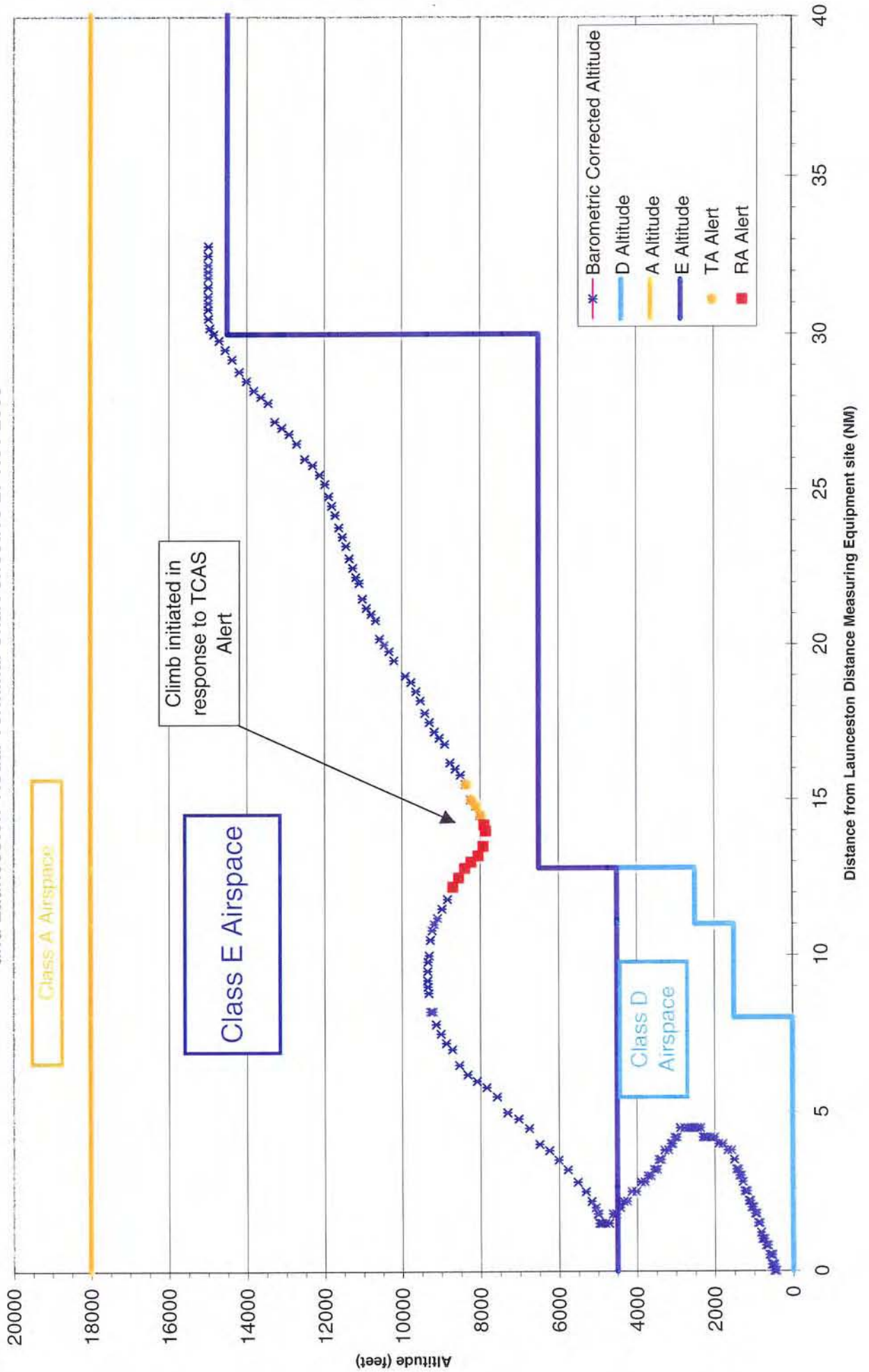
Derived from Boeing 737 recorded Flight Data.

FOR USE

INCLUDING FL180 Highest point on chart 5160 at 41°32' 147°39'

41°50'

VH-VBV Boeing 737 approach to Launceston on Airways Route J22
 Airspace boundaries are as represented on EnRoute Chart Low, ERC L1,
 and Launceston Visual Terminal Chart effective 27 Nov 2003



VH-VBV Boeing 737 approach to Launceston on Airways Route J22
Airspace boundaries are as represented on EnRoute Chart Low, ERC L1,
and Launceston Visual Terminal Chart effective 12 Jun 2003

