Australian Government
Australian Transport Safety Bureau

Flight below the minimum permitted altitude involving Boeing 737-376, VH-XMO

Launceston Airport, Tasmania | 17 June 2016

Investigation

ATSB Transport Safety Report
Aviaiton Occurrence Investigation
AO-2016-061
Final – 28 November 2017

Cover photo: Victor Pody

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Publishing information

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Addendum

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Safety summary

What happened

On 17 June 2016 at about 0055 Eastern Standard Time, a Boeing 737-376, registered VH-XMO and operated by Express Freighters Australia, departed Melbourne Airport, Victoria, on a freight service to Launceston, Tasmania. After arriving overhead Launceston, the flight crew proceeded to conduct an instrument approach for runway 32L. However, due to adverse weather condition, the crew were unable to land and a missed approach was conducted.

On completion of the missed approach, the captain (CA) initiated a left turn to re-position the aircraft for a second approach. A short time later, while responding to a call from the airport groundsman about the weather conditions, the CA handed control of the aircraft to the first officer (FO).

While the captain instructed the FO to maintain the turn, subsequent manoeuvring had not been discussed. The resultant flight path led to the aircraft entering an area with a minimum permitted altitude of 5,800 ft. While the crew had commenced a climb, the aircraft had not reached that minimum altitude and entered the area at about 4,400 ft. In response, air traffic control issued a safety alert for terrain and instructed the crew to climb the aircraft above the minimum safe altitude.

What the ATSB found

The ATSB found that the instrument approach briefing conducted by the flight crew did not ensure that there was a shared understanding of how the aircraft would be manoeuvred on completion of the published missed approach. That resulted in the aircraft being operated in an area below the prescribed minimum safe altitude.

The ATSB also identified that flight path monitoring and safety alerts issued by air traffic control, provided the flight crew with clear and timely minimum altitude requirements and ensured the aircraft was operated well clear of terrain.

What's been done as a result

In response to this occurrence the operator issued a flight standing order that drew flight crew's attention to the runway 32L instrument approach procedure's missed approach and the requirements for subsequent manoeuvring. In addition, the approach briefing requirements were amended to include intentions for manoeuvring following the completion of a published missed approach.

The effective management and manipulation of the aircraft, following a missed approach, was included as a discussion item and exercise in the operator's recurrent simulator training program.

Safety message

This occurrence highlights the value of having a clear, and where appropriate, shared plan. A common understanding between flight crew prevents additional workload associated with clarifying intentions during busy events, such as during and after missed approaches.

Operators and flight crew should consider including appropriate missed approach considerations, such as intended flight path, crew actions, terrain clearance and air traffic control requirements, into their approach briefings, regardless of the existing environmental conditions.

The occurrence

On 17 June 2016 at about 0055 Eastern Standard Time[1], a Boeing 737-376, registered VH-XMO and operated by Express Freighters Australia, was scheduled to operate a freight service from Melbourne, Victoria, to Launceston, Tasmania. The flight crew consisted of a training captain (CA) as the pilot flying[2] and a first officer (FO) under training as the pilot monitoring. This flight was the FO's ninth sector operating the B737 aircraft.

The flight crew signed on for duty in Melbourne at about 1910. The duty included a return flight to Sydney, New South Wales, followed by a return flight to Launceston. A review of the weather for the duty indicated relatively benign conditions for Melbourne and Sydney. However, the Launceston forecast included cloud at 1,500 ft above the ground and periods of light rain. A temporary reduction in visibility to 4,000 m and cloud down to 1,000 ft were also forecast, together with heavier rain showers. Those weather conditions required the flight crew to carry an alternate. In this case, the aircraft carried sufficient fuel to operate to Launceston and return to Melbourne.

The flight to Sydney and return was uneventful. Approaching Melbourne, the flight crew obtained a weather update for Launceston. That update forecast cloud at 1,000 ft, reducing temporarily to 500 ft with continuing rain showers. Automated weather observations for Launceston at 0000, recorded visibility of 5,000 m in rain and overcast cloud at 100 ft. While the observed weather conditions were below those required to land, the CA reported that adverse weather conditions at Launceston historically fluctuated.

The flight departed Melbourne for Launceston at about 0055. On board the aircraft was sufficient fuel to operate the flight to Launceston, conduct three instrument approaches and, if required, return to Melbourne. The flight crew continued to monitor the Launceston weather conditions en route. Subsequent automated observations showed little or no improvement to the weather.

Prior to descent, the flight crew conducted an approach briefing for Launceston. That briefing included discussions covering the expected instrument landing system[3] (ILS) approach for runway 32L (Figure 1), and the missed approach should it be required. The operator's low visibility procedures were also covered. Those procedures required that, approaching the minima, the CA was to scan both the aircraft instruments and outside for the runway. The FO's primary task was to monitor instruments and the aircraft's flight path.

Descent was commenced at about 0125. Automated weather observations for Launceston at 0113, recorded visibility of 9,000 m in rain showers and overcast cloud at 200 ft. At about 0131, air traffic control (ATC) advised the crew that, based on the latest automated weather observations, conditions on the ground were, 300 m visibility and overcast cloud at 200 ft. The crew were subsequently cleared to leave controlled airspace on descent and to conduct an instrument approach to runway 32L.

Launceston tower control services were generally available between the hours of 0600 and 2200. As the tower was closed, the controlled Class D airspace below 1,500 ft above mean sea level (AMSL) had reverted to non-controlled Class G airspace. In the event of a missed approach, the aircraft would re-enter Launceston Class C and D controlled airspace above 1,500 ft AMSL and a clearance would be required prior to any subsequent manoeuvring on completion of the published missed approach.

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

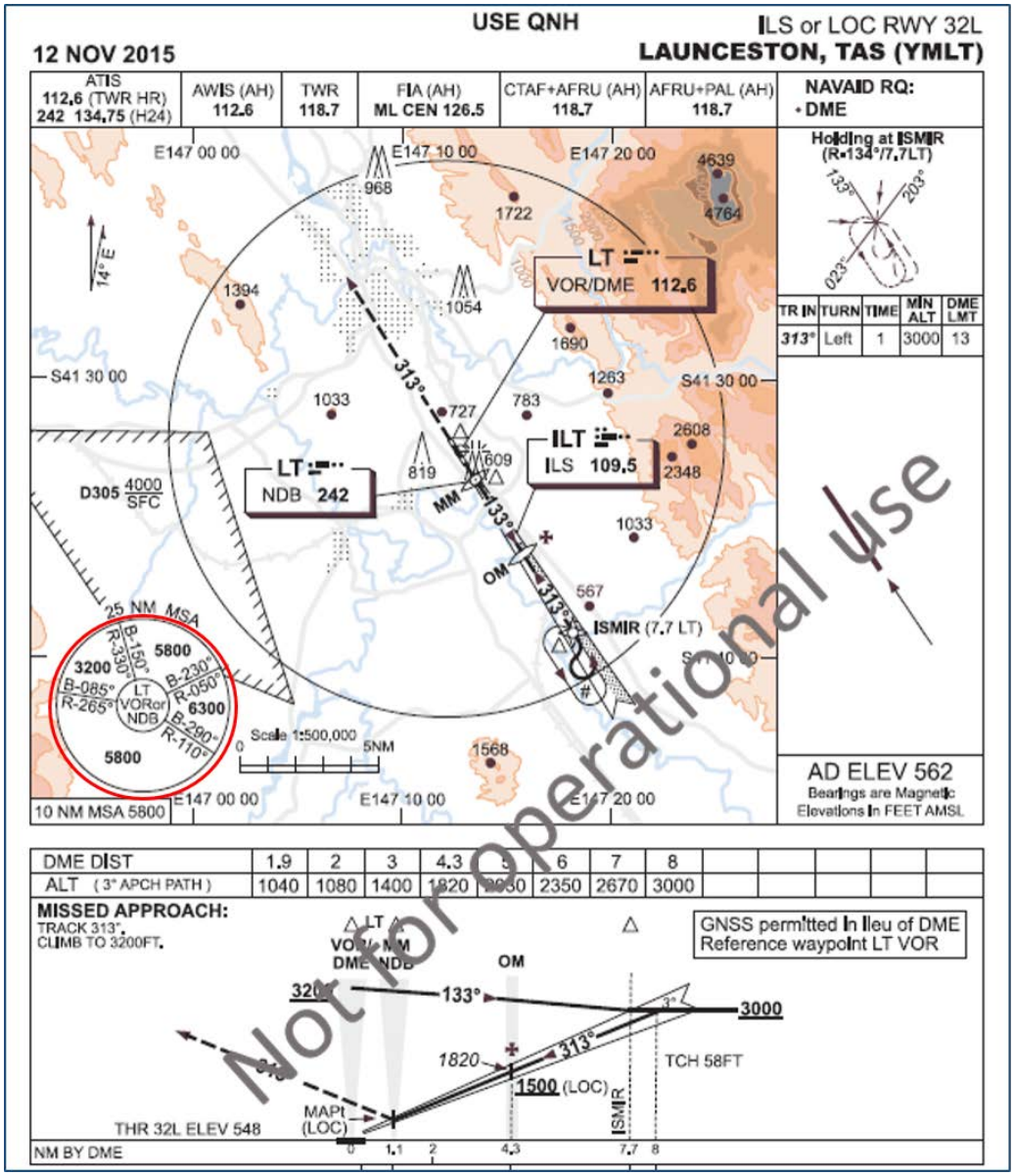
2 Pilot Flying (PF) and Pilot Monitoring (PM): procedurally assigned roles with specifically assigned duties at specific stages of a flight. The PF does most of the flying, except in defined circumstances; such as planning for descent, approach and landing. The PM carries out support duties and monitors the PF's actions and the aircraft's flight path.

3 Instrument Landing System (ILS): A precision instrument approach system which normally consists of the following electronic components: VHF Localiser, UHF Glideslope, VHF Marker Beacons.

The aircraft passed overhead Launceston at about 0136. The flight crew then proceeded to descend the aircraft in accordance with the prescribed ILS approach procedure. The minimum altitude for landing of 750 ft (202 ft above the runway threshold) was reached at about 0145. As the crew could not see the runway, a missed approach was conducted.

At about 0147, the aircraft levelled off at the missed approach altitude of 3,200 ft. About 20 seconds later, the CA initiated a left turn by selecting the autopilot heading bug to a south-westerly heading. The CA's intention was to continue the left turn and position the aircraft overhead the airport for a second instrument approach. The FO reported being surprised by the turn and immediately thought that they should climb the aircraft.

Figure 1: Launceston instrument landing system approach chart for runway 32L with relevant minimum safe altitudes required for manoeuvring, in instrument meteorological conditions or at night, circled in red.



Source: Airservices Australia modified by the ATSB

After advising ATC that they had conducted a missed approach, ATC asked the crew to confirm that they were on the published missed approach. The flight crew confirmed this and advised ATC that they were turning back towards Launceston. At about the same time, the CA responded to a radio call from the Launceston Airport groundsman and handed control of the aircraft to the FO.

While the CA did instruct the FO to keep the turn going, to where, or onto what heading was not discussed.

While the CA was talking to the groundsman about the weather, the FO observed the radio altimeter become active. The radio altimeter provides an indication of aircraft height above the ground up to 2,500 ft. In response to the radio altimeter activation, the FO advised the CA that they should climb the aircraft.

By about 0148, the aircraft was turning left through a heading of 140 degrees and climbing through 3,900 ft. The aircraft was also approaching the boundary of the 3,200 ft minimum sector altitude[4] (MSA). At about the same time, ATC asked the crew to confirm that they would be remaining within the 3,200 ft sector and advised that otherwise they needed to be at 5,800 ft. The crew responded by advising they were climbing to 5,800 ft.

The aircraft subsequently entered the 5,800 ft MSA sector at about 4,400 ft, on a steady heading of about 110 degrees, and about 3.5 NM (6.5 km) southwest of the airport. As the aircraft was below the required MSA, ATC issued a safety alert for terrain and instructed the crew to climb immediately to 5,800 ft.

In response, at about 0149, the crew advised ATC that they were climbing to 6,000 ft. ATC acknowledged the call and asked the crew if they would be entering the holding pattern overhead Launceston. The crew reported that they were maintaining 6,000 ft and asked ATC to standby.

At about 0150, the aircraft was in a left turn, maintaining 6,000 ft and about 5 NM (9 km) to the southeast of the airport. ATC advised the crew that they were about to enter an area with a higher MSA and to climb immediately to 6,300 ft or higher. The crew acknowledge the altitude requirement and advised ATC that they would be returning to Melbourne. A short time later, as the aircraft had not yet reached 6,300 ft, ATC reissued the instruction to climb immediately to 6,300 ft.

The aircraft was subsequently cleared to climb to its cruise altitude and returned to Melbourne.

[4] Minimum Sector Altitude (MSA): The lowest altitude which may be used which will provide a minimum clearance of 1,000 ft above all objects located in an area contained within a sector of a circle of 25 NM or 10 NM radius centred on a significant point, the aerodrome, or helicopter, reference point.

Safety analysis

Flight below the minimum sector altitude (MSA) occurred following a missed approach that was conducted due to poor weather conditions. While the flight crew assessed that the safety of the aircraft was never in doubt, there was confusion as to how the aircraft was to be manoeuvred on completion of the missed approach.

This analysis will examine the aircraft's flight path following the missed approach, and factors that contributed to the flight below MSA.

Prior to commencing descent, the crew conducted a normal approach briefing. The prevailing weather conditions at Launceston airport were such that the flight crew were required to conduct an instrument landing system (ILS) approach. The weather conditions also meant that it was reasonably foreseeable that they would need to conduct a missed approach. While an instrument approach briefing was conducted prior to descent, and covered the standard components including the missed approach segment, there was no discussion of how the aircraft would be subsequently manoeuvred.

A missed approach following an ILS approach is not common as the associated low weather minima usually permits the landing to be completed. As such, planning how the aircraft is to be manoeuvred in the event of a missed approach may not always be considered in detail. Additionally, tracking and altitude requirements following a missed approach are often provided by air traffic control (ATC), particularly in the case of larger commercial aircraft such as VH-XMO.

Additionally, with the exception of situations such as simulator training, missed approaches are often unexpected. Consequently, the safe conduct of a go-around and subsequent manoeuvring relies on a shared appreciation to avoid the need to clarify intentions during an already busy period. Irrespective of the weather conditions, a thorough go-around briefing, that gives consideration to factors such as initial and subsequent flight paths, crew actions and co-ordination, terrain clearance and ATC requirements, offers an effective means of ensuring that a common appreciation exists.

Although air traffic control (ATC) services were available en route and during descent, Launceston Tower was closed when the aircraft arrived. Consequently, the normally tower-controlled Class D airspace below 1,500 ft became non-controlled Class G airspace. This meant that, in the event of a missed approach, the aircraft would re-enter Launceston Class C and D controlled airspace at 1,500 ft and an ATC clearance would be required prior to manoeuvring beyond the published missed approach.

The approach and missed approach flight paths were aligned to enable the aircraft to descend and climb clear of terrain. The missed approach path positioned the aircraft within a sector that had an MSA of 3,200 ft. Any manoeuvring outside of that sector required the crew to climb the aircraft to the relevant sector MSA prior to entry. In this case, the left turn was towards a sector that had an MSA of 5,800 ft. Alternatively, climbing straight ahead on the missed approach track to 5,800 ft would have enabled the crew to manoeuvre the aircraft as required within 10 NM (19 km) of the airport.

On completion of the missed approach, the captain commenced a left turn with the intention of positioning the aircraft for a second approach. While a continuous left turn may have maintained the aircraft within the 3,200 ft sector, this manoeuvre had not been discussed during the approach briefing. As a result, when the CA handed control of the aircraft to the FO, the left turn was stopped on a south-easterly heading.

The south-easterly flight path resulted in the aircraft tracking towards a sector with a MSA of 5,800 ft while at an altitude of 3,200 ft. Although the crew had commenced a climb, the aircraft had only achieved an altitude of 4,400 ft when it entered the 5,800 ft sector. As a result, ATC

issued a safety alert for terrain proximity. ATC also issued instructions for an immediate climb to 5,800 ft and later, to 6,300 ft.

Although the aircraft was never in immediate danger of colliding with terrain, it was operated over an area and at an altitude less than that prescribed for safe flight. Had the required clearance been obtained prior to manoeuvring, ATC would have provided the crew with appropriate tracking and altitude requirements. Additionally, without the flight path monitoring and timely altitude alerts provided by ATC, the risk of collision with terrain may have increased.

Had the approach briefing included a discussion about subsequent manoeuvring, both crew members would have had a shared understanding of the expected flight path. Such a discussion would have provided the crew with an opportunity to discuss alternative tracking, minimum safe altitude requirements, and the need to obtain a clearance.

Findings

From the evidence available, the following findings are made with respect to the flight below lowest safe altitude involving Boeing 737, registered VH-XMO at Launceston Airport, Tasmania on 17 June 2016. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- The instrument approach briefing conducted by the flight crew did not ensure there was a shared understanding of how the aircraft would be manoeuvred following completion of the published missed approach.
- The absence of an established, and shared, manoeuvring plan, resulted in the aircraft being operated in an area below the prescribed minimum safe altitude.
- On completion of the missed approach, the flight crew did not obtain an onwards airways clearance prior to further manoeuvring. That negated the terrain clearance assurance that would otherwise have been provided and increased the risk of conflict with other aircraft.

Other findings

- The flight path monitoring and safety alerts issued by air traffic control, provided the flight crew with clear and timely minimum altitude requirements and ensured the aircraft was operated well clear of terrain.

Safety issues and actions

Proactive safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

The aircraft operator, Express Freighter Australia, has made the following amendments to their training and procedures:

- A flight standing order was issued that drew flight crew's attention to the runway 32L instrument approach procedure's missed approach and the requirements for subsequent manoeuvring.
- The approach briefing requirements were amended to include intentions for manoeuvring following the completion of a published missed approach.
- A 'Hot Topic' discussion item – post missed approach manoeuvring and management, was added to the recurrent simulator training program.
- The recurrent simulator training program, released in December 2016, included exercises that reinforce the enhanced arrival and approach briefing requirements. Crews were required to demonstrate appropriate inflight management and manipulation subsequent to completion of a published missed approach.

General details

Occurrence details

Date and time:	17 June 2016 – 0148 EST
Occurrence category:	Incident
Primary occurrence type:	Flight below minimum safe altitude
Location:	Launceston Airport, Tasmania

Aircraft details

Manufacturer and model:	The Boeing Company 737-376	
Year of manufacture:	1987	
Registration:	VH-XMO	
Operator:	Express Freighters Australia	
Serial number:	23488	
Type of operation:	Air Transport High Capacity	
Persons on board:	Crew – 2	Passengers – nil
Injuries:	Crew – nil	Passengers – nil
Damage:	None	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- flight crew
- aircraft operator
- Airservices Australia.

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 and operator of VH-XMO, Airservices Australia and the Civil Aviation Safety Authority (CASA).

Submissions were received from CASA and the aircraft operator. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The ATSB is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

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