

Australian Government Australian Transport Safety Bureau

Weather-related operational event involving Boeing 717, VH-NXO

Perth Airport, Western Australia | 1 June 2012



Investigation

ATSB Transport Safety Report

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Addendum

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Safety summary

What happened

At 0027 Western Standard Time on 1 June 2012, a Boeing 717 aircraft, registered VH-NXO and operated by Cobham Airline Services, was conducting an instrument approach to land on runway 03 at Perth Airport after a flight from Paraburdoo, Western Australia.

The approach was being conducted in instrument

meteorological conditions. When the aircraft was at the



Source: Steve Bottom

VH-NXO

decision altitude, the crew initiated a missed approach procedure as they had not obtained visual reference with the runway. Almost immediately, the crew obtained visual reference with the runway, discontinued the missed approach procedure and landed.

What the ATSB found

The onset of fog at Perth Airport at the estimated time of arrival was not forecast until after the aircraft had passed the point in the flight when it had insufficient fuel remaining to divert to a suitable alternate aerodrome. Before that point, there had been no requirement for the aircraft to carry fuel to continue to a suitable alternate.

Under the circumstances, the flight crew considered that the better option was to discontinue the missed approach procedure and land, in spite of the aircraft being in an unstable condition due to the initiation of the missed approach.

Safety message

This occurrence highlights that during a flight, the forecast weather at the destination may change and the advisability of obtaining the most up-to-date weather forecasts. However, pilots should be alert to the fact that the actual weather can differ significantly from forecasts.

The occurrence also highlights the risk of an unstable approach from not following a missed approach through to its conclusion. Unstable approaches are a frequent factor in approach and landing accidents, including controlled flight into terrain. The Flight Safety Foundation has developed an *Approach and Landing Accident Reduction Tool Kit* aimed at reducing the risk of approach and landing accidents. The toolkit can be found at http://flightsafety.org/.

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The occurrence

On 1 June 2012 at 0027 Western Standard Time,¹ a Boeing 717 aircraft, registered VH-NXO and operated by Cobham Airline Services, landed from a runway 03 instrument landing system (ILS)² approach at Perth Airport, Western Australia. The flight crew had initiated a missed approach procedure, due to visual reference not being established at the decision altitude, but discontinued this procedure and landed after the pilot flying (PF)³ saw the runway.

The previous evening, the aircraft was flown from Perth to Paraburdoo, Western Australia and the occurrence took place on the return flight to Perth. Shortly before departure from Paraburdoo for the 90-minute flight to Perth, the flight crew obtained a trend forecast (TTF)⁴ for Perth. They reported assuring themselves that based on this forecast, there was no weather-related requirement to carry sufficient fuel to divert from Perth Airport to an alternate aerodrome.⁵ The aircraft took off from Paraburdoo at 2255.

Despite the lack of a requirement to provide for an alternate for Perth, the aircraft was carrying sufficient fuel to allow for the flight to be diverted to Kalgoorlie until shortly after commencing descent into Perth. Beyond that time, the aircraft was no longer carrying sufficient fuel to divert to another suitable aerodrome.

During the flight, the flight crew did not seek or obtain an amended or updated forecast for Perth. The captain reported that he normally obtained the latest TTF for Perth when overflying the automatic en route information service (AERIS) at Meekatharra, about 360 NM (667 km) north-north-east of Perth. However, the timing of the flight and the delay normally encountered in updating the available weather information on the AERIS meant that he did not expect to obtain the latest TTF at that time. When the aircraft was about 240 NM (440 km) from Perth, the crew obtained the latest automatic terminal information service (ATIS)⁶ weather observation for Perth, which provided no indication of deteriorating weather.

After the aircraft descended below 11,000 ft, air traffic control (ATC) notified the crew of deteriorating visibility at Perth Airport, and the first officer (FO) observed a thin layer of cloud between the airport and the coast. ATC notified the crew of continuing reducing visibility as they manoeuvred the aircraft for a runway 03 ILS approach. While manoeuvring the flight crew heard on the radio that another aircraft had conducted a missed approach procedure from this approach.

As the aircraft started the ILS approach, it flew through small patches of cloud until it descended below 1,000 ft, when it entered continuous cloud. At the decision altitude of 320 ft the FO, who was the pilot monitoring (PM) called 'nil sighting'. That statement indicated that the FO had not obtained visual reference with the runway. The captain, who was the PF, called 'going around' and initiated a missed approach procedure by pressing the go-around switches and advancing the thrust levers. It was reported that the captain had not initiated the next actions for the missed approach procedure

¹ Western Standard Time (WST) was Coordinated Universal Time (UTC) + 8 hours.

² A standard ground aid to landing, comprising two directional radio transmitters: the localizer, which provides direction in the horizontal plane; and the glideslope, for vertical plane direction, usually at an inclination of 3°. Distance measuring equipment or marker beacons along the approach provide distance information.

³ Pilot Flying (PF) and Pilot Monitoring (PM) are procedurally assigned roles with specifically assigned duties at specific stages of a flight. The PF does most of the flying, except in defined circumstances. The PM carries out support duties and monitors the PF's actions and aircraft flight path.

⁴ The trend forecast is an aerodrome weather report (METAR/SPECI) to which a statement of trend, for the elements wind, visibility, weather and cloud is appended, forecasting the weather conditions expected to affect the aerodrome for the validity period of the TTF, which is normally the 3 hours following the time of the report.

⁵ The aircraft was suitably equipped for special alternate weather minima operations in accordance with the requirements specified in Aeronautical Information Publication Australia section ENR 1.5, 6.2 *Special Alternate Weather Minima*.

⁶ An automated pre-recorded transmission indicating the prevailing weather conditions at the aerodrome and other relevant operational information for arriving and departing aircraft.

when the aircraft flew clear of cloud and both crew members obtained visual reference with the runway. The captain called 'landing', disconnected the autopilot and the autothrottle, and manually landed the aircraft without exceeding any flight or landing tolerances (Figure 1).



Figure1: Plot of selected aircraft parameters during the approach and landing

Source: ATSB

The captain later reported being concerned about the unforecast weather deterioration with limited fuel remaining, and not knowing if the weather would deteriorate further after going around and repositioning for a second attempted approach and landing. He reported that this concern influenced his decision to land after initiating the missed approach, during which the aircraft exceeded the operator's stabilised approach criteria for a landing.

Context

Pilot information

The flight crew consisted of two pilots who held endorsements on the aircraft type.

The captain had been flying with the operator for 17 years and had a total of about 17,000 hours aeronautical experience in a range of different aircraft types. The captain had been flying this aircraft type for about 18 months, and a different jet airliner type for 8 years before that.

The first officer (FO) had been with the operator for about 5 years and had a total of about 10,000 hours aeronautical experience, with about 2,500 hours on this aircraft type. Before then, he had been flying turboprop aircraft.

Meteorological information

When planning for the return flight at Paraburdoo, the Perth aerodrome forecast (TAF)⁷ and the trend forecast (TTF) did not contain any forecast operational requirements for this aircraft to carry sufficient fuel to fly to an alternate aerodrome. At 2300, 5 minutes after take-off, the Perth TTF changed with the forecast onset of fog 65 minutes after the estimated time of arrival (ETA).

At 0010, which was about the time when the aircraft commenced its descent and shortly before the aircraft no longer had sufficient fuel to divert safely to a suitable landing aerodrome, the Perth TAF was amended to indicate a requirement for the carriage of sufficient fuel to divert to an alternate airport on the basis of more than four OKTAS⁸ of cloud with a base below the alternate minimum of 700 ft above the aerodrome reference point. The forecast also predicted that 35 minutes after the aircraft's ETA, there was a 30 per cent probability of fog reducing the visibility to 300 m, which was below both the alternate and landing minimums for runway 03.

Soon after, at 0014, a TTF SPECI⁹ was issued for Perth Airport indicating that the visibility had reduced to 7,000 m and the airport was partially covered in fog. The observed visibility, as reported on the TTF SPECI issued at 0030, which was soon after the aircraft's landing time, was 900 m in fog.

Operational information

Information sources relating to alternate aerodrome requirements

Aeronautical Information Publication Australia (AIP) section ENR 1.1, 58.2 *Weather conditions*, paragraph 58.2.9 related to the application by crews of forecast weather conditions when determining the need to allow for an alternate aerodrome. In this regard the AIP stated that:

Flights which will be completed within the time of validity of the TTF may be planned wholly with reference to the destination TTF.

Operator procedures relating to fuel flight planning

The operator's procedures for domestic operations for planning minimum fuel requirements were based on Civil Aviation Advisory Publication (CAAP) 234-1 (1) *Guidelines for Aircraft Fuel Requirements*. Those procedures allowed for fuel remaining to be recalculated before an aircraft passed its diversion point to a suitable alternate aerodrome. If crews undertook this calculation they

Aerodrome Forecasts are a statement of meteorological conditions expected for a specific period of time, in the airspace within a radius of 5 NM (9 km) of the aerodrome.

⁸ Cloud cover is normally reported using expressions that denote the extent of the cover. The expression four OKTAs indicates that cloud was covering half of the sky.

⁹ Special Reports (SPECI) are aerodrome weather reports that are issued whenever weather conditions fluctuate about or are below specified criteria.

were then authorised to continue to their destination if sufficient fuel remained to meet all of the fuel requirements for the contemplated flight at that time.

Specifically, section 5.17.2 of the operations policy and administration manual, titled *Fuel Requirements* stated, in part that an aircraft may continue:

...to the destination aerodrome from the diversion point only after it has been determined that the fuel on board the aircraft at that point is sufficient, in accordance with the fuel requirements detailed above [allowing for the recalculation of fuel remaining], to enable to aircraft to complete the flight to that destination aerodrome.

The flight crew reported reviewing the forecast weather at the destination before take-off by obtaining the most recent trend forecast for Perth Airport.

Alternative landing options at Perth

AIP section ENR 1.5, 1.10 *Missed Approach – Standard Procedures* paragraph 1.10.1 listed the circumstances in which an instrument approach was to be discontinued and a missed approach carried out. In the case of a runway approach at Perth such as the runway 03 instrument landing system (ILS) approach, these included:

- the pilot not having clear visibility of the runway threshold, or approach lighting or other markings identifiable with the runway
- once an aircraft reached the decision altitude of 320 ft, a visibility of less than 1,500 m.

ILS approaches were also available for use on runways 21 and 24 at Perth. These approaches could be accomplished in slightly worse weather conditions than for a runway 03 ILS, with a minimum visibility requirement of 800 m once reaching the decision altitude of 250 ft and 260 ft respectively. Unlike runway 03, runways 21 and 24 were also equipped with high intensity approach lighting that would have helped the crew obtain visual reference with the runway.

It would have taken some time to manoeuvre to conduct an ILS approach to a different runway, and there were a number of aircraft in the vicinity also intending to land, which could have delayed any subsequent approaches. In the event, when the aircraft landed after discontinuing the missed approach, it was carrying about 30 minutes more fuel than the operator's minimum planned fuel for arrival at Perth.

Operator's missed approach criteria

A missed approach procedure is initiated by conducting a go-around. During a go-around a number of actions are coordinated by the flight crew to reconfigure the aircraft and its systems for a climb away from the airport. The operator's operating procedures for this aircraft type stated:

A go around can be as a result of not being visual at the missed approach point of an instrument approach or if the approach is not stable or becomes destabilised.

and that:

Before committing to a further approach following a Missed Approach/Go Around, the crew must review the factors that led to the preceding Missed Approach/Go Around and ensure that those factors are alleviated in the subsequent approach.

Approach and landing Accident Reduction Tool Kit

The Flight Safety Foundation has developed a tool kit to help manage the risks of approach and landing accidents. The kit highlights that unstabilised approaches were a factor in a high proportion of approach and landing accidents,¹⁰ and recommends the use of stabilised approach criteria to mitigate this risk.

¹⁰ Available at <u>www.flightsafety.org</u>

The criteria for a stabilised approach promoted by the Flight Safety Foundation were the same as those specified in the company's operational procedures. In respect of the risk of continuing an unstable approach, the operator's procedures stated:

In order to provide maximum opportunity for a well executed landing to be completed, a consistent and stable approach path is necessary. Continuing to land from an unstable approach has been shown to be the precursor of many landing accidents.

The initiation of the missed approach procedure by the captain resulted in the aircraft being outside the operator's parameters for a stabilised approach. Continuing the landing from this profile increased the risk to the aircraft during the landing sequence.

Previous occurrences

The following occurrences were investigated by the ATSB and are available for download at <u>www.atsb.gov.au</u>. Together with the crew's experience in this occurrence, each provides an example of the landing risks/threats associated with bad/deteriorating destination weather and its management.

BO/200605473: Autoland at Perth

On 16 September 2006 at 0038 Western Standard Time, an Airbus A330 landed on runway 21 at Perth Airport in weather conditions that were below the applicable landing minima. The aircraft, registered VH-QPJ, was being operated under the instrument flight rules on a scheduled passenger flight from Singapore to Perth.

Before departure from Singapore, the TAF for Perth Airport predicted a 30 per cent probability of fog after 0200. The aircraft was due at Perth at 0020 so, in accordance with the operator's fuel policy, fuel was not specifically carried for a diversion from Perth to an alternate aerodrome. While the aircraft was in cruise, the TAF was revised to forecast fog from 2400, but the TTFs that superseded the TAF trended fog from 0030.

At about 2350, when the flight crew commenced descent, the aircraft passed the point where it had sufficient fuel to divert to Learmonth, Western Australia. About 10 minutes later, the TTF was amended to forecast fog before the aircraft's arrival time. The fog occurred at about 0015. The crew attempted two ILS approaches before they used autoland to land on runway 21 in weather conditions that were below the prescribed landing minima for the ILS.

The aircraft was certificated to conduct an autoland and the flight crew held the necessary qualifications. However, the airport's ILS facilities were not approved for autoland operations in low visibility conditions. At that time, there were no autoland capable airports in Australia.

BO/199904538: Discontinued missed approach procedure

On 23 September 1999, a Boeing 747 was landing in adverse weather conditions at Bangkok Airport, Thailand. Shortly before touchdown, a missed approach was initiated but the aircraft's wheels contacted the runway. The missed approach procedure was then discontinued, with a lack of clarity between the flight crew. The sequence of control inputs by the crew meant that not all the available aircraft equipment and systems that might have assisted its deceleration on the runway were operating to their maximum efficiency. In this configuration, there was insufficient runway remaining to stop and the aircraft overran the runway.

Safety analysis

Introduction

The flight proceeded normally until just after commencing descent to Perth Airport, when visibility reduced due to the rapid onset of fog. This deterioration in the weather conditions occurred after the last diversion point to a suitable alternate aerodrome for the flight and resulted in the crew being committed to landing the aircraft at Perth. The following analysis will consider the role of weather and procedural factors in this occurrence and assess the safety implications for future operations in similar conditions.

Weather factors

The aerodrome and trend forecasts for Perth Airport did not predict weather conditions that required the carriage of sufficient fuel to fly to a suitable alternate landing airport, until after the aircraft no longer had sufficient fuel to divert to a suitable alternate aerodrome. This committed the crew to landing at Perth where a safe landing could no longer be assured.

In the few minutes before landing, the flight crew observed a rapid deterioration in the weather conditions, and their observations were reinforced by information heard on the aircraft radio. The flight crew were confronted with rapidly deteriorating unforecast weather conditions, and uncertainty about how much further the weather might deteriorate.

Procedural factors

The crew updated their knowledge of the weather observations for Perth Airport as soon as the broadcast of those observations from the airport could be received. Observations with a trend forecast appended were available previously from the automatic en route information service facility at Meekatharra. However, the delay normally encountered by the captain in obtaining updated weather from this facility and the timing of this particular flight influenced the captain to not access that information in this case.

Weather observations do not predict expected weather conditions. In contrast, a weather forecast is intended to provide the best approximation of future weather conditions. Knowledge of any changes to forecast weather at the destination is assured when flight crews request or obtain the latest version of the relevant forecast. For safety purposes, the most relevant time to ensure that the destination's forecast weather remains suitable for an assured landing is shortly before the aircraft no longer carries sufficient fuel to divert to an alternate aerodrome where a landing can be assured.

The crew had a reasonable knowledge of the point in the flight when they were committed to a landing in Perth because of the fuel remaining, and an amended forecast was not issued for Perth Airport before this time. However, by not confirming the latest weather forecast for Perth, and its potential effect on the flight, the crew could not assure themselves of the validity of that understanding.

Conduct of the approach and landing

The flight crew commenced the instrument landing system (ILS) approach to runway 03 and encountered unforecast and rapidly deteriorating weather, the extent and duration of which was unknown. Similar instrument approaches were available to runways 21 and 24 that allowed for landing in slightly worse weather conditions, but the time taken to change to either of these approaches would, given the traffic situation, have impacted further on the crew's now less-than-ideal fuel situation.

In the event, the captain was confronted with a short-notice choice between completing the missed approach, with an indeterminate outcome, and landing from a discontinued missed approach. He was aware of the risk associated with continuing the landing in what amounted to an unstabilised configuration, but considered this option represented lower risk.

Findings

From the evidence available, the following findings are made with respect to the weather-related operational event involving a Boeing 717, registered VH-NXO, which occurred at Perth Airport on 1 June 2012. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- The weather forecast for Perth Airport was amended to include the requirement to carry sufficient fuel to divert to a suitable alternate aerodrome when the aircraft no longer had that amount of fuel remaining.
- The captain, as the flying pilot, continued an approach to land after the approach had been destabilised by initiating a go-around procedure.

Other factors that increased risk

• The flight crew did not update the weather forecast for Perth Airport en route which, although in this instance did not indicate an operational requirement, was a missed opportunity to update pertinent operational information prior to the aircraft being committed to its destination.

Other findings

- Given the circumstances, when confronted by a choice between completing the missed approach with an indeterminate outcome and landing from a discontinued missed approach, the captain chose the option that was considered to represent lower risk.
- The operator's procedures in the case of an unstabilised approach were unambiguous and reflected those promoted by the Flight Safety Foundation.

General details

Occurrence details

| Date and time: | 01 June 2012 – 0025 WST | |
|--------------------------|-----------------------------------|-------------------------|
| Occurrence category: | Incident | |
| Primary occurrence type: | Weather-related operational event | |
| Location: | Perth Airport, Western Australia | |
| | Latitude: 31° 40.1' S | Longitude: 116° 00.9' E |

Aircraft details

| Manufacturer and model: | Boeing 717-200 |
|-------------------------|-----------------------------|
| Registration: | VH-NXO |
| Operator: | Cobham Airline Services |
| Serial number: | 55096 |
| Type of operation: | Air Transport High Capacity |
| Damage: | None |

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- flight crew of VH-NXO
- Cobham Airline Services (Cobham).

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, Cobham and the Civil Aviation Safety Authority.

Submissions were received from the aircraft captain, first officer, Cobham and the Civil Aviation Safety Authority. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (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 fare-paying passenger operations.

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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ATSB Transport Safety Report Aviation Occurrence Investigation

Weather-related operational event involving Boeing 717, VH-NXO Perth Airport, Western Australia, 1 June 2012

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