



Australian Government  
Australian Transport Safety Bureau

# Loss of separation between VH-TFK and VH-PDP

6 km N of Cairns, Queensland | 23 November 2011



Investigation

**ATSB Transport Safety Report**  
Aviation Occurrence Investigation  
AO-2011-147  
Final





**Australian Government**  
**Australian Transport Safety Bureau**

**ATSB TRANSPORT SAFETY REPORT**

Aviation Occurrence Investigation  
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## **SAFETY SUMMARY**

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### **What happened**

On 23 November 2011, a loss of separation occurred 6 km north of Cairns, Queensland, between a Cessna Aircraft Company 402C (C402), registered VH-TFK, and a Cessna Aircraft Company T210N (C210), registered VH-PDP.

The C402 was conducting an instrument landing system (ILS) approach for runway 15 and was 1.8 NM (3.3 km) from the airport when the pilot initiated a missed approach from a height of 1,000 ft in instrument meteorological conditions. At the time the C210 was on the same ILS approach and was 6.4 NM (11.9 km) behind the C402. About 1 minute after the pilot of the C402 turned left to establish the aircraft on the missed approach track, the distance between the two aircraft reduced below the required air traffic control separation (ATC) standard.

### **What the ATSB found**

The Australian Transport Safety Bureau identified that a local ATC procedure, published in part to assist ATC in separation management during a missed approach event, was not clear and subject to varying interpretation. This resulted in the spacing between the two aircraft being closer than intended at the point when the pilot of the C402 commenced the missed approach.

The local ATC procedure did not fully consider all operational aspects that may lead a pilot to initiate a missed approach in instrument meteorological conditions above the procedure-defined minimum cloud base height.

### **What has been done as a result**

In response to this occurrence, Airservices has initiated a number of safety actions including amending the local procedure to assist with the clarity and intent, changing the Cairns local instructions to enforce minimum flow (distance) spacing and updating controller missed approach procedures refresher training. This updated training will increase controller awareness of separation assurance issues relating to consecutive approaches and ensure that due consideration is given by controllers to the broad mix of aircraft types using straight-in approaches.

### **Safety message**

This occurrence reinforces the need for all local procedures, in particular those that assist controllers in separation management, to be unambiguous and to encompass all possible operational circumstances. The importance of effective radar navigation guidance when positioning an aircraft for an approach is also highlighted.

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# THE AUSTRALIAN TRANSPORT SAFETY BUREAU

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The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau 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* (Cwlth) 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 safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

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 appropriate, or to raise general awareness of important safety information in the industry. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

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## TERMINOLOGY USED IN THIS REPORT

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**Occurrence:** accident or incident.

**Safety factor:** an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, current risk controls and organisational influences.

**Contributing safety factor:** a safety factor that, had it not occurred or existed at the time of an occurrence, then either: (a) the occurrence would probably not have occurred; or (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or (c) another contributing safety factor would probably not have occurred or existed.

**Other safety factor:** a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report in the interests of improved transport safety.

**Other key finding:** any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which ‘saved the day’ or played an important role in reducing the risk associated with an occurrence.

**Safety issue:** a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

**Risk level:** the ATSB’s assessment of the risk level associated with a safety issue is noted in the Findings section of the investigation report. It reflects the risk level as it existed at the time of the occurrence. That risk level may subsequently have been reduced as a result of safety actions taken by individuals or organisations during the course of an investigation.

Safety issues are broadly classified in terms of their level of risk as follows:

- **Critical** safety issue: associated with an intolerable level of risk and generally leading to the immediate issue of a safety recommendation unless corrective safety action has already been taken.
- **Significant** safety issue: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable. The ATSB may issue a safety recommendation or a safety advisory notice if it assesses that further safety action may be practicable.
- **Minor** safety issue: associated with a broadly acceptable level of risk, although the ATSB may sometimes issue a safety advisory notice.

**Safety action:** the steps taken or proposed to be taken by a person, organisation or agency in response to a safety issue.

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# FACTUAL INFORMATION

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## Background

At 1007:16 Eastern Standard Time<sup>1</sup> on Wednesday, 23 November 2011, a loss of separation<sup>2</sup> (LOS) occurred 6 km north of Cairns, Queensland (Qld) between a Cessna Aircraft Company 402C (C402), registered VH-TFK, and a Cessna Aircraft Company T210N (C210), registered VH-PDP.

The C402 was on a scheduled service from Mareeba, Qld to Cairns with the pilot and one passenger on board. The C210 was operating a non-scheduled service from Mareeba to Cairns with the pilot the sole occupant. Both aircraft were under radar surveillance and subject to an air traffic control (ATC) service.

## Sequence of events

After departing Mareeba at 0948, the pilot of the C402 contacted Cairns ATC (Cairns approach) and received a clearance to Cairns at 5,000 ft above mean sea level (AMSL). The approach controller advised the pilot to expect an instrument landing system (ILS)<sup>3</sup> approach to runway 15.

The pilot of the C210 departed Mareeba 2 minutes after the C402 and contacted Cairns approach. The pilot was also cleared to Cairns at 5,000 ft with the expectation of an ILS approach to runway 15. The Cairns runway 15 ILS procedure is reproduced at Appendix A.

At 0952, the C402 was positioned on the Cairns 258 radial at 20 DME<sup>4</sup> when the approach controller issued the pilot with a radar vector<sup>5</sup> heading of 020° towards the runway 15 ILS approach path. The C210 was at about the same position at 0954 when the approach controller issued the pilot of that aircraft the same heading of 020° for the runway 15 ILS approach. At that time, both aircraft were

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<sup>1</sup> Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

<sup>2</sup> A 'loss of separation' denotes 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 is subject to an air traffic separation standard. A LOS was previously termed a 'breakdown of separation'; the terminology was changed for consistency with the usage of other organisations.

<sup>3</sup> Instrument landing system (ILS) - a standard ground aid to landing, comprising two directional radio transmitters: the localiser, 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 path provide distance information.

<sup>4</sup> 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 from the ground station. A distance of 1 DME equates to being 1 NM from the station.

<sup>5</sup> A radar vector is a heading issued by ATC as part of radar navigation guidance.

maintaining an altitude of 5,000 ft, with the C210 positioned 5.8 NM (10.7 km) behind the C402.

The approach controller continued with other air traffic duties until 0959 when the pilot of the C402 was instructed to turn right on to a heading of 120° to intercept the localiser. At this time the C402 was 14 DME to the north-west of Cairns with about 17 NM (31 km) to fly on the approach to the runway. The controller cleared the pilot to descend to 3,700 ft and issued a clearance to commence the ILS approach.

At 1002, the C402 was positioned on the ILS approach at about 9.4 DME and maintaining 3,700 ft when the approach controller transferred the aircraft to the tower controller. Although the C402 was on the ILS final approach path, the pilot had not reported to the approach controller that the aircraft was established on the localiser.<sup>6</sup>

After issuing the pilot of the C210 with vectors to establish the aircraft on the localiser, the approach controller cleared the C210 pilot to commence the ILS approach with an additional instruction to maintain best speed for as long as possible. The pilot of the C210 acknowledged the instruction and at 1004 reported that the aircraft was established on the localiser. The approach controller advised the pilot that the aircraft was 14 NM (26 km) from touchdown and transferred the aircraft to the tower controller. At that time the C210 was 8.1 NM (15 km) behind the C402.

### **Missed approach**

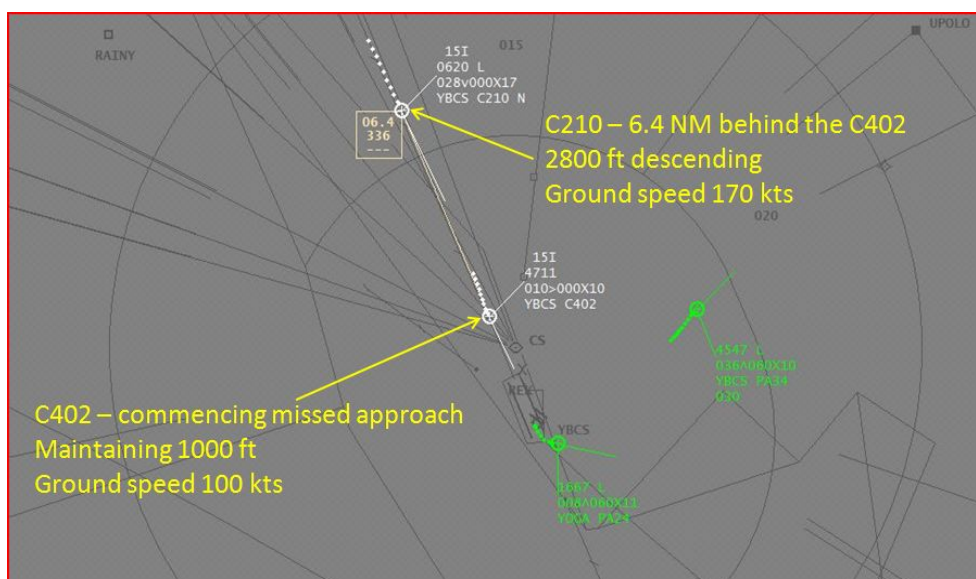
At 1006:01, the pilot of the C402 advised the tower controller that the aircraft was going around.<sup>7</sup> At that time the C402 was established on the localiser, but positioned above the glideslope. The aircraft was about 2 NM (3.7 km) from touchdown, maintaining 1,000 ft with a ground speed of 100 kts. The C210 was now 6.4 NM (11.9 km) behind the C402 and descending through 2,800 ft with a ground speed of 170 kts, which was 70 kts faster than the C402 (Figure 1).

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<sup>6</sup> 'Established' means being within half full-scale deflection of the aircraft's course deviation indicator for the ILS.

<sup>7</sup> Not proceeding with the landing and initiating a missed approach procedure.

**Figure 1: C402 commencing the missed approach at 1006:01**



At 1006:11 the tower controller instructed the pilot of the C402 to make a published missed approach. Immediately after hearing that instruction, the pilot of the C402 instigated a left turn on to the missed approach track of 015°, commencing the turn about 1.2 NM (2.2 km) prior to the published missed approach point (MAPT). The tower controller advised the approach controller that the C402 was conducting a missed approach and transferred the aircraft to the approach controller.

## Loss of separation

ATC separation standards between aircraft in the Terminal Control Area (TMA)<sup>8</sup> required either 3 NM (5.5 km) horizontal distance by radar, or 1,000 ft vertically. Alternatively, a visual separation<sup>9</sup> standard could be applied when conditions allowed.

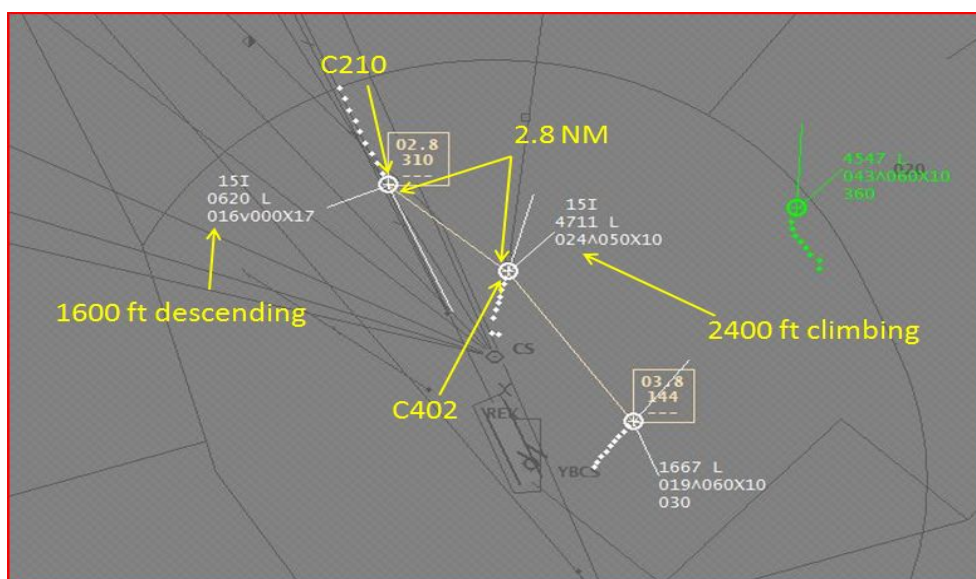
A LOS occurred at 1007:16 when the radar distance between the C402 and the C210 reduced to 2.8 NM (5.2 km) (Figure 2). Vertical separation at the time was 800 ft and visual separation was not applicable as both aircraft were operating in instrument meteorological conditions (IMC).<sup>10</sup> The vertical separation standard of 1,000 ft was re-established at 1007:29 without further controller instructions or inputs.

<sup>8</sup> TMA - a control area normally established at the confluence of ATS routes in the vicinity of one or more major aerodromes in which air traffic services are provided.

<sup>9</sup> A means of spacing aircraft through the use of visual observation by a tower controller or pilot when assigned separation responsibility.

<sup>10</sup> Instrument Meteorological Conditions (IMC) describes weather conditions that require pilots to fly primarily by reference to instruments, and therefore under the Instrument Flight Rules (IFR), rather than by outside visual references. Typically, this means flying in cloud or limited visibility.

**Figure 2: Loss of separation at 1007:16**



## **Personnel information**

### **Captain of the C402**

The captain of the C402 held an Air Transport Pilot Licence (Aeroplane) issued in April 2011 and had accumulated a total aeronautical experience of 3,190 flying hours. The captain was appropriately endorsed and held a valid Class 1 Medical Certificate.

### **Approach controller (under training)**

The approach controller was under training at the time of the occurrence after having recently transferred to Cairns approach from the Brisbane en route environment. The controller held a current Class 3 Medical Certificate and was appropriately qualified to undergo on-the-job training. The controller completed compromised separation recovery training 14 months prior to the occurrence.

### **Approach controller (training instructor)**

The on-the-job-training instructor (OJTI) was a senior controller with 20 years experience in Cairns ATC, including 7 years in the control tower and 13 years in the approach environment. The controller held a current Class 3 Medical Certificate and was appropriately qualified to be an OJTI. The controller completed compromised separation recovery training 5 months prior to the incident.

## **Air traffic control rosters**

Controller rostering was managed in accordance with the Airservices fatigue risk management system. Both controllers' previous 2-week rosters had followed a training cycle of Monday to Friday day shifts. In addition, the OJTI had conducted about 7 hours additional duty (overtime) during the previous 7-day period that included 2 rostered days off.

## **Meteorological information**

Aerodrome weather reports released by the Bureau of Meteorology at the time of the LOS indicated that the horizontal visibility was 5,000 m in light rain showers. Cloud amount and height above the aerodrome was reported as Few at 800 ft, Scattered at 2,500 ft and Broken at 3,500 ft.<sup>11</sup>

The Cairns Automatic Terminal Information Service (ATIS)<sup>12</sup> reported that instrument approaches were expected with a wet runway and that the high intensity approach lighting was selected 'on'. Visibility was reported greater than 10 km, reducing to 5,000 m in showers, and cloud Scattered at 500 ft and 1,500 ft.

The pilot of the C402 reported that the aircraft was operating in IMC for the duration of the ILS approach, including at the time when the missed approach was initiated. The pilot commenced the missed approach at about 1,000 ft.

All aircraft in the approach sequence, with the exception of the C402, were visual at or prior to the ILS-Decision Altitude (DA)<sup>13</sup> and completed normal landings.

## **Air traffic control information**

### **Vectors to intercept the ILS approach path**

The provision of radar vectors gives ATC the flexibility to manage the traffic sequence into an airport by providing appropriate spacing and separation. In general, radar vectors for an ILS approach aim to position an aircraft on the localiser at least 2 NM (3.7 km) prior to the point where the pilot commences the approach. Clearance to commence the approach authorises the pilot to descend once the aircraft is established on the glideslope.

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<sup>11</sup> Cloud cover is normally reported using expressions that denote the extent of the cover. The expression Few indicates that up to a quarter of the sky was covered. Scattered indicates that cloud was covering between a quarter and a half of the sky. Broken indicates that more than half to almost all of the sky was covered, while Overcast means that all the sky was covered.

<sup>12</sup> An automated pre-recorded transmission indicating the prevailing weather conditions at the aerodrome and other relevant operational information for arriving and departing aircraft.

<sup>13</sup> A specified altitude or height in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been established. Decision altitude (DA) is referenced to mean sea level and decision height (DH) is referenced to the runway threshold elevation.

For the Cairns runway 15 ILS approach, aircraft were radar vectored on to the approach path at 14 DME and 3,700 ft. This position was also included as operational note No. 4 on the ILS/LOC instrument approach chart (Appendix A).

The Manual of Air Traffic Services (MATS) stated that:<sup>14</sup>

When vectoring an aircraft for final approach...ensure that the aircraft is established on final approach track at least 2 NM before commencement of final approach.

In contrast with the requirements of operational note No. 4 to the Cairns ILS/LOC instrument approach chart, the radar vector that was issued to the pilot of the C402 positioned the aircraft on the ILS approach path at 10.4 DME. The pilot reported that from this distance, the aircraft remained above the glideslope throughout the ILS approach by a half full-scale deflection,<sup>15</sup> increasing to a full-scale deflection just prior to the outer marker. It was at that point that the pilot commenced initiated the missed approach.

A review of data on 14 other aircraft that had been radar vectored for an ILS approach during the period 15 minutes prior to and 40 minutes after the occurrence, identified that all except the C402 were positioned on the localiser at a distance greater than 12.7 DME. The C402 was the only aircraft in the sequence to conduct a pilot initiated missed approach.

### **Speed request**

The approach controller's speed request to the pilot of the C210 was due to a faster following De Havilland Canada Dash 8-103 (DHC-8) that was 15 NM (27.8 km) behind the C210. The DHC-8's ground speed was 260 kts; about 100 kts faster than the C210. The approach controller's request was to ensure sufficient distance existed between the C210 and the DHC-8 to allow the DHC-8 to complete the ILS approach and landing with the required separation in place.

After acknowledging the speed request from ATC, the pilot of the C210 maintained a ground speed of about 170 kts on the ILS approach. The C402 maintained a ground speed between 100 and 120 kts on the approach, which increased to about 130 kts when the pilot commenced the missed approach.

### **Cairns ATC missed approach separation procedures**

Due to environmental and operational constraints, the Cairns runway 15 ILS approach procedure positioned the missed approach track 46° to the east of the runway 15 instrument approach path.<sup>16</sup> This required that, in IMC, sufficient

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<sup>14</sup> MATS 11-10-310.

<sup>15</sup> A half full-scale deflection of the glideslope equates to 0.7°. In terms of the aircraft's position with reference to the glideslope, a half full-scale deflection above equates to the aircraft being about 0.7° above the glideslope.

<sup>16</sup> Includes for both the published Cairns runway 15 ILS/LOC and RNAV-Z (GNSS) approaches.



spacing was established between two aircraft on the approach path, to ensure that separation was maintained between an aircraft that might require an ILS missed approach and an aircraft that was on the final segment of a runway 15 instrument approach.

Local procedures were established at Cairns to ensure that ATC separation was appropriately managed. Under the heading 'Missed approaches' these procedures in part stated:<sup>17</sup>

The aerodrome controller [tower controller] shall advise [Cairns approach] whenever missed approaches are likely.

That included when the tower controller determined that a missed approach was likely due to cloud (amount and height) and/or visibility.

The local procedures provided additional guidance under the heading 'Successive arriving aircraft' in terms of the minimum meteorological conditions that required the minimum spacing to be increased, including that:<sup>18</sup>

When [the] cloud base is less than 1000 FT and/or visibility is less than 2000 m [then] the distance [spacing] shall be a minimum of 5 NM [9.2 km] or 8 NM [14.8 km] when there are departures.

The intent was that in such conditions, spacing between successive arriving aircraft was increased from a minimum time spacing of 3 minutes<sup>19</sup> to a minimum distance spacing of 5 NM, or 8 NM when there were departures.

Leading up to, and at the time of this occurrence, Cairns ATC were processing arrivals and departures. Given the report of Scattered cloud at 500 ft at the time per the ATIS, and the management of departing aircraft at the time, this should have meant that a minimum spacing of 8 NM (14.8 km) was in effect.

## **Missed approach procedure note and intent**

### ***Missed approach procedure***

Operational information that is relevant to a specific procedure can be noted on the relevant procedure chart. This may include particulars on aircraft tracking, vectoring, speed requirements or any other pertinent operational information.

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<sup>17</sup> Cairns Tower and TCU – *Coordination and Standard Operating Procedures, Letter of Agreement LOA 314*, paragraph 4.12

<sup>18</sup> Cairns Tower and TCU – *Coordination and Standard Operating Procedures, Letter of Agreement LOA 314*, paragraph 4.14

<sup>19</sup> Cairns Tower and TCU – *Coordination and Standard Operating Procedures, Letter of Agreement, LOA 314*, paragraph 4.1

The Cairns runway 15 ILS or LOC instrument approach procedure chart was published with a missed approach procedure note that stated:<sup>20</sup>

MISSED APPROACH: TURN LEFT WITHOUT DELAY, TRACK 015°,  
INTERCEPT 15 DME CS ARC, CLIMB TO 3700FT OR AS DIRECTED  
BY ATC.

The Aeronautical Information Publication Australia (AIP)<sup>21</sup> outlined information on missed approach procedures stating:<sup>22</sup>

In executing a missed approach, pilots must follow the missed approach procedure specified for the instrument approach flown. In the event that a missed approach is initiated prior to arriving at the MAPT, pilots must fly the aircraft to the MAPT and then follow the missed approach procedure.

The operator of the C402 stated that the intent of the AIP reference (a turn at the MAPT) was widely understood; however, given the wording of the procedure note it was acknowledged that a pilot could misinterpret the intent and commence the left turn prior to the MAPT. The operator further advised that because of this, it was the company's standard practice that during pilot training, the intent of the Cairns ILS procedure note was discussed.

Cairns ATC staff reported that the intent of the procedure note was understood by all Cairns controllers. However, there was awareness that the note could be misinterpreted, leading to an early turn on a missed approach procedure.

### ***Intent of the pilot of the C402***

The pilot of the C402 reported that the intention was to fly straight ahead to the MAPT prior to commencing the left turn. Instead, after hearing the tower controller acknowledge the pilot's intention of a go-around by clearing the pilot to '... make a published missed approach', the pilot consciously commenced a left turn prior to the MAPT.

The pilot reported that the immediate operational preference was to manoeuvre away from the ILS approach path and that the procedure note did not influence the decision to turn prior to the MAPT. In the occurrence, the pilot commenced the missed approach about 1.2 NM (2.2 km) prior to the MAPT.

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<sup>20</sup> See Appendix A, missed approach note.

<sup>21</sup> A package of documents that provides the operational information necessary for the safe and efficient conduct of national (civil) and international air navigation throughout Australia and its Territories.

<sup>22</sup> AIP En Route (ENR) 1.5 *HOLDING, APPROACH AND DEPARTURE PROCEDURES*, paragraph 1.10.2.

## **Missed approach projections**

The Australian Transport Safety Bureau (ATSB) assessed the likelihood of a LOS between the C402 and the C210 if the pilot of the C402 had commenced the left turn at the MAPT.

It was determined that the C402 would have required a further 40 to 50 seconds to reach the published ILS MAPT. As both the C210 and the C402 speeds would have remained fairly constant during that period, there would not have been a significant change in the established 6.4 NM (11.9 km) spacing between the aircraft prior to the pilot of the C402 commencing the turn at the MAPT.

As one or both aircraft would have likely remained in IMC, it is probable that a LOS would have still occurred.

## **Aids to navigation – Cairns Airport**

Cairns Airport was equipped with a variety of ground-based navigation aids, including a category 1 (CAT 1) ILS and a VOR<sup>23</sup>/DME. Runway 15/33 was equipped with high intensity runway lighting, a CAT 1 high intensity approach lighting system and Precision Approach Path Indicators.<sup>24</sup> The Cairns VOR/DME was located about 0.9 NM (1,670 m) north of runway 15. The DME distance to run information that was provided on the ILS instrument approach procedure was derived from this point.

## **Additional information**

### **Subsequent loss of separation occurrence at Cairns**

On 21 January 2012, the ATSB was advised of a LOS that occurred in Cairns between a Beech Aircraft Corporation 76 (BE76) that was conducting a runway 15 ILS practice missed approach, and a Cessna Aircraft Company 208B (C208). The C208 was 5.5 NM (10.2 km) behind the BE76 when the pilot of the BE76 commenced the left turn on to the missed approach track. The horizontal distance between the aircraft reduced to 2.6 NM (4.8 km) with less than the applicable vertical separation standard.

In that occurrence the pilot of the BE76 initiated the missed approach at the MAPT at the DA of 320 ft. The LOS continued for 15 seconds prior to vertical separation being established without further controller instructions or inputs.

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<sup>23</sup> VHF 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 that aid.

<sup>24</sup> Precision Approach Path Indicator (PAPI). Is a ground based, visual approach indicating system that includes a colour discriminating system used by pilots to identify the correct glidepath to the runway.

The cloud base in Cairns was reported to have been above the DA at the time. However, visual separation could not be assured and the tower controller advised the approach controller that they were not able to visually separate the BE76 with the C208 prior to the commencement of the missed approach. In an attempt to increase the spacing between the aircraft, the approach controller requested the pilot of the C208 to reduce speed, but a LOS was not able to be prevented.

The differences between this occurrence and the subject of this investigation include that the missed approach procedure was expected by ATC and the missed approach left turn was commenced at the MAPT.

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# ANALYSIS

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## Introduction

The loss of separation (LOS) occurred following a series of operational events that culminated in the pilot of the C402 initiating a missed approach. The lead-up events do not, in isolation present a safety issue; however, are analysed to facilitate further understanding of the complete occurrence.

## Air traffic control vectoring

The final air traffic control (ATC) vector that was issued to the pilot of the C402 was not suitably managed by the approach controller to enable the aircraft to be established on the localiser at least 2 NM (3.7 km) before commencing the approach. This resulted in the pilot conducting the instrument landing system (ILS) approach on the limits of the allowable navigation tolerances. As the ILS approach continued, the tolerances were eventually exceeded, resulting in the pilot initiating the missed approach.

At no time did the pilot of the C402 communicate to ATC, nor at any time was ATC aware, that the aircraft was not appropriately established on the ILS approach path. The first communication received by ATC to indicate that the aircraft was not properly established on the ILS final approach was advice from the pilot that the aircraft was going around.

## Speed control on the approach path

The approach controller was managing the air traffic sequence by the application of speed control. While the 'best speed' request to the pilot of the C210 ensured that suitable spacing was maintained between the C210 and the DHC-8, the higher speed of the C210 was detrimental to the spacing established between it and the slower C402 ahead on the approach. This resulted in less than the required spacing needed to ensure that separation was maintained when the pilot of the C402 initiated the missed approach.

## Early turn onto the missed approach procedure

The pilot of the C402 commenced the left turn on the missed approach procedure prior to the missed approach point (MAPT). The early turn was not authorised by ATC. The missed approach procedure note that was published on the ILS instrument approach chart, while open to the interpretation that a turn should be made early, did not in this case contribute to the pilot commencing the left turn prior to the MAPT. Furthermore, had the pilot of the C402 commenced the left turn at the MAPT, it is probable that a LOS would have still occurred.

## **Local ATC procedure – missed approach**

At the time of the LOS the Cairns Automatic Terminal Information Service (ATIS) reported the cloud base (amount and height) as Scattered at 500 ft. The local ATC procedure, which required additional spacing between successive aircraft when the cloud base was below 1,000 ft and departures were being carried out, was not in place leading up to the LOS. This increased the likelihood of a LOS during a missed approach by a preceding aircraft.

### **Clarity of local procedure**

The local procedure as published was unclear in application. In one reference the tower was responsible for advising the approach controller that missed approaches were considered likely to occur; however, no criterion to prompt that action was stated. Another reference outlined the meteorological conditions that would trigger an increase in the minimum spacing, but the source of information on those conditions, or the agency that was responsible for their dissemination, was not defined.

The local procedure further outlined that spacing shall be increased to a minimum of 5 NM (9.2km) (arrivals only) when meteorological conditions were reported as a cloud base less than 1,000 ft (and/or visibility was less than 2,000 m). There was 6.4 NM (11.9 km) spacing at the time of the missed approach in this investigation, and 5.5 NM (10.2 km) in a subsequent LOS in similar circumstances, each of which exceeded the 5 NM local standard. Given the LOS in each instance, the published minimum of 5 NM would appear to be an insufficient to assure the maintenance of separation when a leading aircraft was on the missed approach track.

The local procedure also stipulated a default minimum time spacing between two aircraft to the same runway of 3 minutes. Depending on the affected aircraft's speeds, 3 minutes spacing can often provide a greater spacing than the defined minimum of 5 NM. For example, if 3 minutes time spacing is applied to an aircraft flying at 140 kts, this speed would equate to a distance of 7 NM (13 km) in spacing.

The distance/time procedures referred to two units of measurement to define the spacing requirements. The transition from a time unit of measurement (minutes) to a distance unit of measurement (NM) was not defined within the procedure, increasing the risk of its variable application by controllers.

The 1,000 ft cloud base criteria covered the vast majority of missed approach circumstances. However, it did not take into consideration that a pilot is entitled (as in this occurrence) to commence a missed approach at any height, or can climb to any height that is below the starting height of the approach, prior to commencing the turn on to the missed approach track.

Finally as instrument meteorological conditions (IMC) were prevalent at the time, instrument approaches were required to be conducted for a landing at Cairns. This meant that at any time during that period a missed approach might (and did) occur. It seems appropriate therefore that, where instrument approaches are required, the minimum spacing between successive aircraft should be increased. This would allow for all possible missed approach circumstances to be covered.

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## FINDINGS

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From the evidence available, the following findings are made with respect to the loss of separation between a Cessna Aircraft Company 402C (C402), registered VH-TFK, and a Cessna Aircraft Company T210N (C210), registered VH-PDP that occurred 6 km north of Cairns, Queensland on 23 November 2011. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

### Contributing safety factors

- The approach controller assigned the pilot of the C402 a radar vector that positioned the aircraft above the glideslope on the runway 15 instrument landing system (ILS) approach, which contributed to the navigation tolerances for the approach subsequently being exceeded, resulting in a missed approach being conducted.
- The pilot of the C210 maintained a speed on the approach path that was faster than the preceding C402, reducing the intended separation between the aircraft.
- The spacing between the C210 and the C402 when the pilot of the C402 initiated the missed approach was less than the required 8 NM as published in the Cairns air traffic control procedures when the reported cloud base was less than 1,000 ft.

### Other safety factors

- The Cairns air traffic control procedures on the management of missed approaches and the management of successive arriving aircraft were unclear in intent and function, increasing the risk of their incorrect application. [*Minor safety issue*]
- The Cairns air traffic control procedures that defined a minimum spacing of 5 NM to be established when there were no departures (when the cloud base is less than 1,000 ft and/or visibility is less than 2,000 m) were inadequate to assure separation during a missed approach event and may result in future loss of separation occurrences. [*Minor safety issue*]
- The missed approach procedure note on the Cairns runway 15 instrument landing system (ILS) or localiser (LOC) approach chart may inadvertently influence a pilot to commence a turn on the missed approach procedure prior to the published missed approach point. [*Minor safety issue*]

### Other key findings

- It is probable that a loss of separation would have still resulted had the pilot of the C402 commenced the missed approach procedure turn at the missed approach point.





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## SAFETY ACTION

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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.

### Airservices

#### Cairns local procedures

##### *Minor safety issue*

The Cairns air traffic control procedures on the management of missed approaches and the management of successive arriving aircraft were unclear in intent and function, increasing the risk of their incorrect application.

##### *Action taken by Airservices*

On 13 December 2012, Airservices advised that:

A national request for change has been raised [on the Cairns local procedure] to enforce a minimum Flow spacing to the same runway of three minutes in situations where there is no prior coordination with the tower. Any reduction in spacing (e.g. Sight and Follows) must be first agreed to by the tower. Whilst the change identifies that spacing requirements will vary depending on the specific types of aircraft, controllers are required to ensure that there is sufficient time/distance between aircraft to ensure that separation will continue to exist in the event that one or both aircraft conduct a missed approach.

[An additional] national request for change has also been raised to create ILS [instrument landing system] or localiser (LOC) Y and Z approaches to runway 15. The approach segments remain the same however the missed approach procedures segregate the low and high performance missed approach procedure tracks. This will improve separation assurance planning for both faster following and like type following scenarios. The planned implementation date for this change is 7 March 2013 to coincide with the AIRAC cycle.

The Cairns ATC missed approach procedure refresher training program has been updated to increase awareness of separation assurance issues relating to consecutive approaches. In the past, the focus of this refresher training has

been on separation assurance between departing aircraft and aircraft conducting an ILS missed approach.

## **Cairns local procedures – defined minimum distance**

### ***Minor safety issue***

The Cairns air traffic control procedures that defined a minimum spacing of 5 NM to be established when there were no departures (when the cloud base is less than 1,000 ft and/or visibility is less than 2,000 m) were inadequate to assure separation during a missed approach event and may result in future loss of separation occurrences.

### ***Action taken by Airservices***

On 13 December 2012, Airservices advised that:

Airservices has addressed the minor safety issue identified in the investigation through the implementation of a combined missed approach procedure refresher training program.

## **ILS/LOC missed approach procedure note**

### ***Minor safety issue***

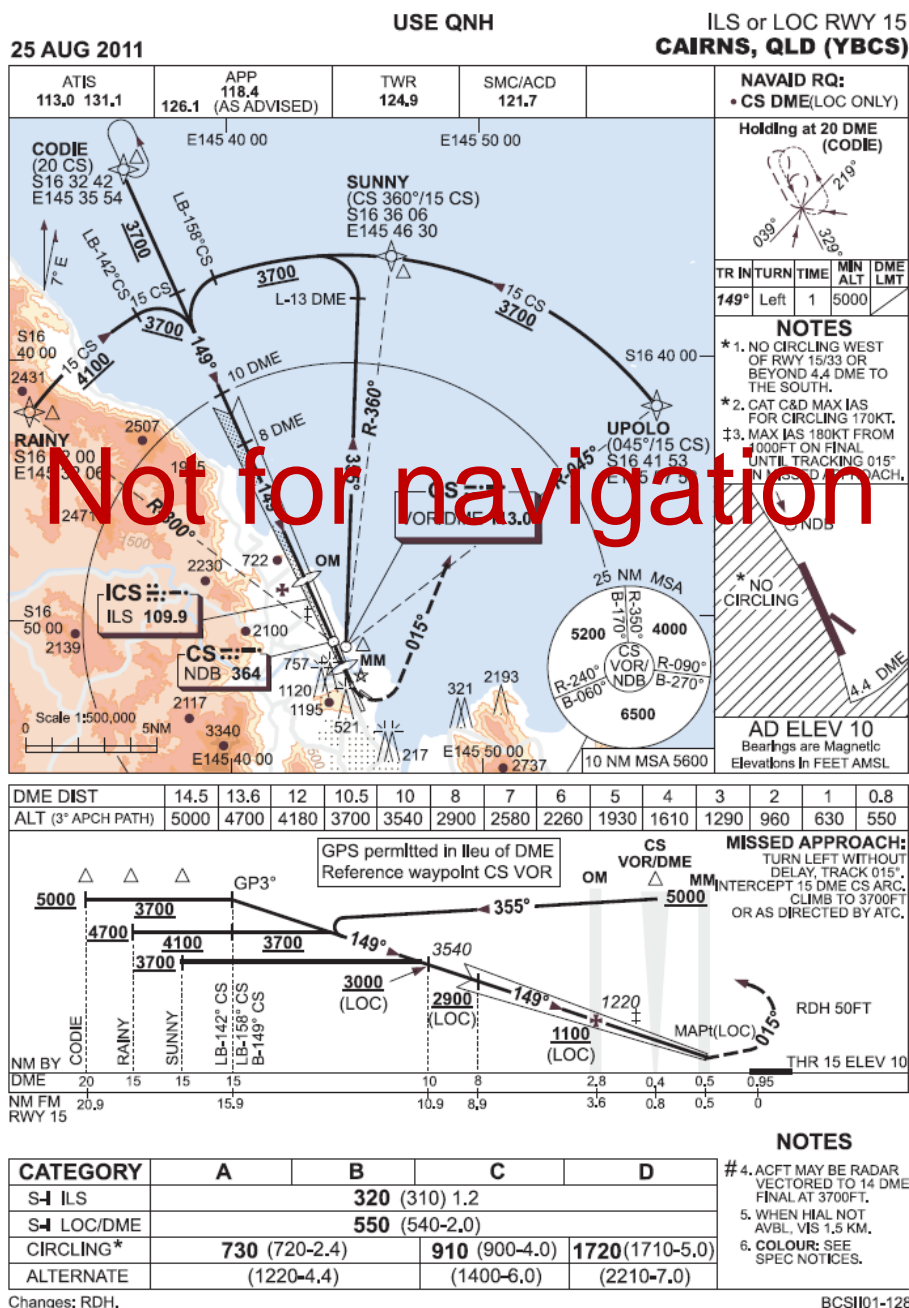
The missed approach procedure note on the Cairns runway 15 instrument landing system (ILS) or localiser (LOC) approach chart may inadvertently influence a pilot to commence a turn on the missed approach procedure prior to the published missed approach point.

### ***Action taken by Airservices***

On 13 December 2012, Airservices advised that:

A national request for change has been raised to create ILS or LOC Y and Z approaches to runway 15. The 'TURN LEFT WITHOUT DELAY' note is being removed from these procedures. The planned implementation date for this change is 7 March 2013 to coincide with the AIRAC cycle.

# APPENDIX A: ILS or LOC RWY 15, CAIRNS (25 Aug 11)



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## APPENDIX B: SOURCES AND SUBMISSIONS

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### Sources of information

The sources of information during the investigation included the:

- aircraft operator
- Airservices
- air traffic controller (ATC)
- Bureau of Meteorology
- pilot of the C402.

### References

Hopkin V.D, 1995, *Human Factors in Air Traffic Control*, Taylor and Francis London, pp. 153-168

Civil Air Navigation Services Organisation (CANSO), 2011, *Unstable Approaches ATC Considerations*

### 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 ATC, Airservices, the Civil Aviation Safety Authority (CASA), the operator of the C402 and the pilots of both aircraft.

Submissions were received Airservices and CASA and, where considered appropriate, the report was amended accordingly.

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**Investigation**

**ATSB Transport Safety Report**

Aviation Occurrence Investigation

Loss of separation between VH-TFK and VH-PD  
6 km N of Cairns, Queensland, 23 November 2011

AO-2011-147

Final