



**Australian Government**

**Australian Transport Safety Bureau**

# Separation issue involving Saab 340B, VH-ZLV and Beech Aircraft B200, VH-WXB

Brisbane West Wellcamp Airport, Queensland on 21 October 2021

## **ATSB Transport Safety Report**

Aviation Occurrence Investigation (Short)

AO-2021-044

Final – 29 September 2023

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

#### Publishing information

**Published by:** Australian Transport Safety Bureau  
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#### Addendum

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# Executive summary

## What happened

On 21 October 2021, at 0743 local time, a Beech Aircraft B200 aircraft, registered VH-WXB, departed Roma Airport on a passenger charter flight to Brisbane West Wellcamp Airport (Wellcamp), Queensland. At 0806, a Saab 340B aircraft, registered VH-ZLV, departed Brisbane Airport on a scheduled passenger service flight to Wellcamp. Both aircraft were operating under instrument flight rules, and both estimated their time of arrival at the airport to be at 0827.

Prior to each aircraft leaving controlled airspace, the Brisbane Centre air traffic controller passed traffic information to VH-WXB and VH-ZLV in 2 separate broadcasts with an updated arrival time for each aircraft. The pilots of both aircraft made a number of calls on the common traffic advisory frequency to organise separation at the non-controlled aerodrome, however, at about 0828, VH-WXB conducted a 180° left turn on the active side of the circuit, crossing in front of VH-ZLV. This resulted in the separation between the aircraft reducing to 300 ft vertically and 1,000 m horizontally. As VH-WXB commenced the left turn, VH-ZLV's traffic alert and collision avoidance system (TCAS) announced a traffic advisory (TA), shortly followed by a resolution advisory (RA). The pilot flying immediately disconnected the autopilot and followed the RA instructions and climbed the aircraft until they were clear of conflict. At about the same time, the pilot of VH-WXB received a TCAS TA and commenced a visual lookout.

The flight crew of VH-ZLV advised VH-WXB they had received a TCAS RA. Further communication occurred between the pilots of the 2 aircraft to confirm and visually identify each other's position in the circuit and ensure separation. Both aircraft landed safely at Wellcamp Airport.

## What the ATSB found

The ATSB found that the pilots of both aircraft had an incorrect mental model of the positions of the other aircraft and neither had positively sighted the other aircraft before the conflict. The flight crew of VH-ZLV broadcast an incorrect position of their aircraft when approaching the circuit, which probably resulted in the pilot of VH-WXB misidentifying VH-ZLV for another aircraft on their TCAS.

This misunderstanding affected the pilot of VH-WXB's decision to fly opposite the downwind circuit direction while in a descent. The pilot then conducted a 180° left turn in front of VH-ZLV, as they thought that aircraft was further ahead on the downwind leg. Further, the flight crew of VH-ZLV also did not effectively monitor the radio, resulting in them having an incorrect mental model of VH-WXB's position, and not identifying it as a threat. As neither the crew in VH-ZLV and the pilot in VH-WXB had positively sighted the other aircraft, alerted see-and-avoid was limited and the last line of defence was the TCAS, which prevented a potential collision.

## What has been done as a result

As a result of this occurrence the operators advised the ATSB of the following actions:

- The operator of VH-WXB:
  - will ensure there is an increased buffer between a regular public transport (RPT) flight and their aircraft by orbiting at a waypoint further out, to ensure that the RPT flight is on final approach when they join the circuit
  - have briefed their pilots of the event and communicated the need to adhere to the procedures written in CAAP 166 - Operations at Non-Towered Aerodromes. Further, they advised their pilots that when traffic congestion is anticipated, actions such as conducting orbits to allow greater spacing in traffic sequencing should be considered

- have discussed the traffic congestion issue with the flight training school based at Wellcamp and have agreed that during the scheduled arrival times of RPT aircraft, the training school will limit the number of their aircraft flying within the area.
- The operator of VH-ZLV:
  - has included operations at, and in the vicinity of, non-towered aerodromes as a focus item in the periodic aircrew check cycle
  - will use this occurrence internally as a human factors case study for operations around common traffic advisory frequency airports.

## Safety message

The ATSB's *SafetyWatch* highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported by industry. One of the priorities is [safety around non-controlled aerodromes](#). Insufficient communication between pilots is the most common cause of safety incidents near non-controlled aerodromes. Pilots should ensure that the location and intention of surrounding traffic is well understood and their intentions are clearly communicated while maintaining a visual lookout.

Safe operation at any aerodrome requires pilots to use sound judgement and to follow standard procedures and CASA guidance. Using standard procedures at non-towered aerodromes, unless otherwise stated in the En Route Supplement Australia (ERSA), assists pilots in maintaining situational awareness and separation from other aircraft.

Developing and maintaining situational awareness is essential for the conduct of safe flight, particularly at non-towered aerodromes. In addition to radio communication, systems such as ADS-B and TCAS are valuable sources of information to assist pilot's situation awareness and decision making.

# The investigation

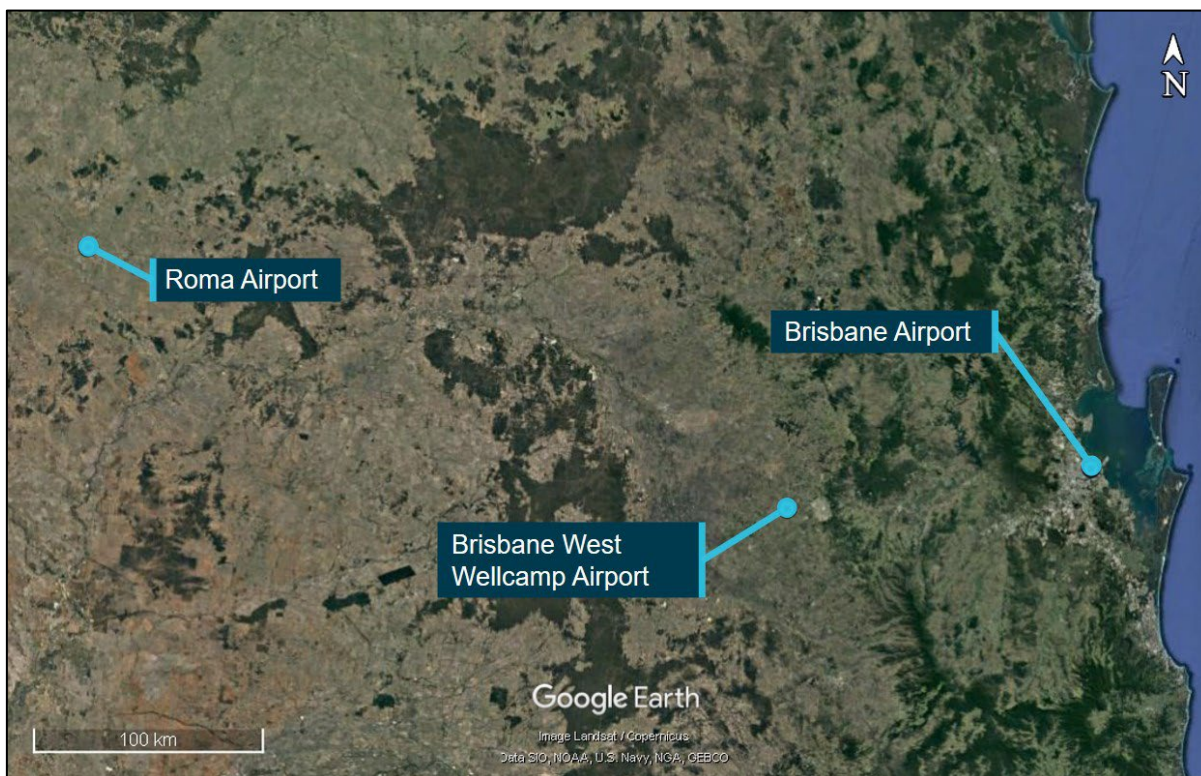
Decisions regarding the scope of an investigation are based on many factors, including the level of safety benefit likely to be obtained from an investigation and the associated resources required. For this occurrence, a limited-scope investigation was conducted in order to produce a short investigation report, and allow for greater industry awareness of findings that affect safety and potential learning opportunities.

## The occurrence

On 21 October 2021, at 0743 local time, a Beech Aircraft B200 aircraft, registered VH-WXB (WXB) and operated by Air Charter Coordinators, departed Roma Airport, Queensland on a passenger transport flight to Brisbane West Wellcamp Airport (Wellcamp), Queensland. On board were the pilot and 8 passengers.

At 0806, a Regional Express Saab 340B aircraft, registered VH-ZLV (ZLV), departed Brisbane Airport, Queensland on scheduled passenger service flight ZL5662 to Wellcamp (Figure 1). On board were 2 flight crew, one cabin crew and 9 passengers. The captain was the pilot monitoring (PM), and the first officer was the pilot flying (PF).<sup>1</sup> Both aircraft were operating under the instrument flight rules.<sup>2</sup>

**Figure 1: Locations of Brisbane and Roma Airports in reference to Brisbane West Wellcamp Airport**



Source: Google Earth, annotated by ATSB.

<sup>1</sup> 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.

<sup>2</sup> Instrument flight rules (IFR): a set of regulations that permit the pilot to operate an aircraft in instrument meteorological conditions (IMC), which have much lower weather minimums than visual flight rules (VFR).

Prior to each aircraft leaving controlled airspace, the Brisbane Centre<sup>3</sup> air traffic controller passed traffic information to the pilot of WXB and the flight crew of ZLV on 2 separate broadcasts at 0811 and 0820, respectively. The controller advised the pilot of WXB that ZLV was inbound to Wellcamp from Brisbane with an estimated time of arrival of 0829, and advised the flight crew of ZLV that WXB was inbound for Wellcamp with an estimated time of arrival of 0830.

At 0821 the pilot of WXB made a broadcast on the Wellcamp common traffic advisory frequency (CTAF)<sup>4</sup> advising that they were 30 NM west of the airport, on descent, inbound for Wellcamp via waypoint LUKEY.<sup>5</sup> The stated intention was to make a left turn and to join right base for runway 12 (Figure 2), with an estimated time of arrival of 0827. About 1 minute later, the PM of ZLV made a radio call advising traffic they were 20 NM east of Wellcamp, at 8,000 ft, descending shortly to join crosswind for runway 12, with an estimated arrival time of 0827.

As WXB and ZLV approached the airport there were 5 other aircraft operating in the CTAF area. There were 2 Diamond DA 40's associated with a flight training school operating in the circuit for runway 12, VH-YNH and VH-EQV and another DA 40, VH-YTK, which was outbound from Wellcamp via Toowoomba to the north-east operating at 4,600 ft. In addition, a Beech Aircraft 58, VH-CLE, that was inbound for Toowoomba from the west and another Beech Aircraft B200, VH-WXN, that was inbound to Wellcamp, 3 minutes behind WXB.

At 0823:56, the pilot of VH-YNH broadcast on the CTAF they were entering and rolling for take-off on runway 12 to conduct circuit training. At 0824:26, the flight crew of ZLV responded to this call, advising they were 11 NM to the east leaving 8,000 ft with the intention to join downwind behind VH-YNH. About 30 seconds later, the pilot of the second DA 40 VH-EQV, which was in the circuit ahead of VH-YNH, advised the pilots of both ZLV and WXB that they were downwind in the circuit for runway 12 for a touch-and-go.<sup>6</sup>

At 0825:07, the pilot of WXB advised the pilots of both ZLV and the DA 40s, that they were 6 NM west of LUKEY, with the intention to soon make a left turn to join a wide right base circuit leg and again advised their estimated arrival time was 0827.

The pilot of VH-EQV responded and advised the pilot of WXB they would be on final when WXB and ZLV joined the circuit and would stay out of their way.

The pilot of WXB then contacted the crew of ZLV at 0825:43 (Figure 2 - positions 1), and advised them they were about to make a left turn at LUKEY and then join the circuit on the base leg for runway 12 at time 0827 and asked if ZLV would be happy if WXB went number 1<sup>7</sup> to them.

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<sup>3</sup> Brisbane Centre is one of 2 major centres – the other being in Melbourne. From Brisbane Centre, Airservices manages the airspace over the northern half of Australia, representing around 5% of the world's total airspace. Brisbane Centre's flight information region (FIR) neighbours include Indonesia, East Timor, Papua New Guinea, Fiji, New Zealand, and the USA.

<sup>4</sup> A common traffic advisory frequency (CTAF): a designated frequency on which pilots make positional broadcasts when operating in the vicinity of a non-controlled airport or within a broadcast area.

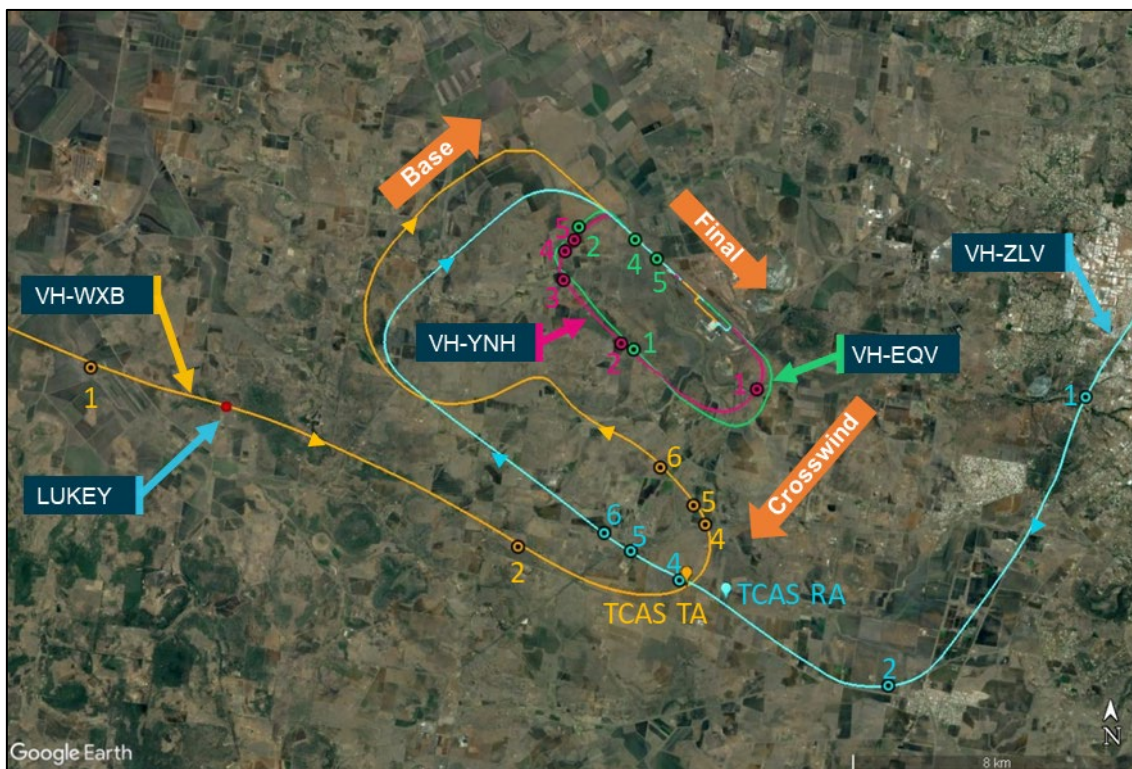
<sup>5</sup> A waypoint is a specified geographical location used to define an area navigation route or the flight path of an aircraft employing area navigation.

<sup>6</sup> Touch-and-go landing: a procedure whereby an aircraft lands and takes off without coming to a stop.

<sup>7</sup> Sequence numbers specify the landing sequence position of an aircraft with respect to any preceding traffic.



**Figure 2: Aircraft flight paths and positions during different CTAF broadcasts – WXB in yellow, ZLV in blue, EQV in green and YNH in pink, with numbering showing where each aircraft was at the time of the broadcasts**



Source: Google Earth, annotated by ATSB based on FlightRadar 24 data.

The crew of ZLV acknowledged the request and incorrectly advised that they were positioned on a very early downwind (rather than their actual crosswind position) and would reduce their airspeed and track second to WXB.

The pilot of WXB, thinking that ZLV was already established in the circuit on downwind rather than on an early crosswind, responded and advised they would track as number 2 to ZLV and join the circuit behind them on downwind. The PM of ZLV acknowledged the broadcast.

At 0826:40, the pilot of VH-YNH made a downwind broadcast on the CTAF and advised they would be making a full stop landing.

At 0827:37 (Figure 2 - positions 2), the pilot of WXB broadcast on the CTAF that they were continuing on an easterly heading, passing 3,500 ft on descent to 3,000 ft (circuit altitude), and would be shortly making a left turn to join downwind behind ZLV. The pilot then continued their descent through 3,500 ft, opposite to the circuit direction on the downwind leg.

At about 0828 (Figure 2 – TCAS RA/TA) WXB made a left turn and crossed ZLV's path from left to right, resulting in a separation of 300 ft vertically (WXB at 3,000 ft and ZLV at 3,300 ft) and 1,000 m horizontally between the 2 aircraft. As this occurred, the crew of ZLV heard their traffic alert and collision avoidance system (TCAS)<sup>8</sup> announce a traffic advisory (TA)<sup>9</sup>, shortly followed by a resolution advisory (RA).<sup>10</sup> In response, the PF immediately disconnected the autopilot and following the RA instructions, climbed the aircraft until they were clear of conflict. Around the same

<sup>8</sup> Traffic alert and collision avoidance system (TCAS): a type of airborne collision avoidance system (ACAS).

<sup>9</sup> Traffic advisory (TA): an alert issued by an airborne collision avoidance system (ACAS) when the detected traffic may result in a conflict. Pilots are expected to initiate a visual search for the traffic causing the TA.

<sup>10</sup> Resolution advisory (RA): a manoeuvre, or a manoeuvre restriction, calculated by an airborne collision avoidance system (ACAS) to avoid a collision. Pilots are expected to respond immediately to an RA unless doing so would jeopardize the safe operation of the flight.

time as ZLV's TCAS alert, the pilot of WXB received a TCAS TA while they were conducting the 180° turn onto downwind.

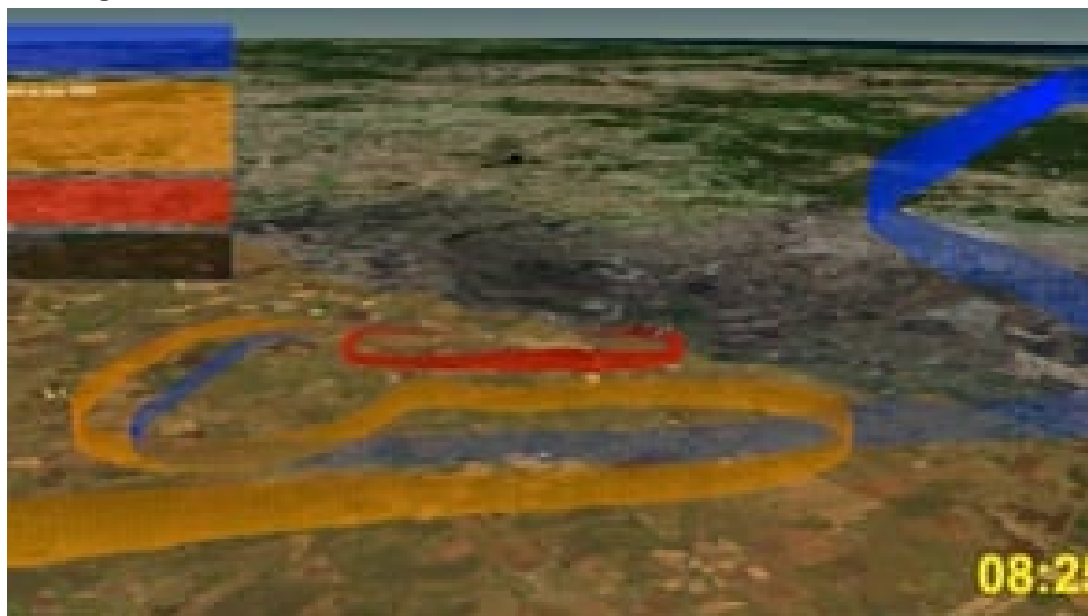
At 0828:49 (Figure 2 - position 4), the PM of ZLV made a broadcast on the CTAF to ask the aircraft to the south of the field (WXB) to identify themselves. The pilot of WXB responded and advised they were now mid-downwind and asked the pilot of ZLV to confirm their aircraft was positioned on the base leg (Figure 2 - positions 4 and 5).

At the time of this broadcast, VH-YNH was on the base leg and VH-EQV was on the final leg of the circuit. The PM of ZLV advised they were on the downwind leg of the circuit, and had received a TCAS RA. The pilot of WXB then asked the PM of ZLV to confirm their aircraft's altitude and the PM advised they were abeam (to the left) WXB. The pilot of WXB, who had not visually sighted ZLV at that stage, then advised they would widen out their circuit and come in behind ZLV. The PM again advised WXB they were to the left of them on downwind and were about to commence their descent back to circuit height.

The pilot of WXB again requested ZLV's level, to which the PM responded 3,100 ft and the pilot of WXB suggested they would track as number 1. After assessing the risk of another potential conflict between the 2 aircraft on base, the PM of ZLV requested WXB climb clear of the circuit. WXB responded and advised they now had ZLV visual and would track as number 2 to them. The pilot of WXB then made a left turn to reposition behind ZLV.

Both aircraft landed safely at 0833 and 0835 respectively.

**Animation 1: Aircraft flight paths and positions during different CTAF broadcasts - WXB in orange, ZLV in blue, and YNH in red.**



Source: ATSB based on FlightRadar 24 data

## Context

### *Pilot information*

#### **VH-WXB**

The pilot held a commercial pilot licence (aeroplane) (CPL(A)) and had a total flying time of 5,556 hours, having flown 88.6 hours in the previous 90 days. The pilot was familiar with Wellcamp and had been operating out of the airport since it opened in 2014.



### ***VH-ZLV***

The captain held an air transport pilot licence (aeroplane) and had a total flying time of 4,703 hours, and had flown 148 hours in the previous 90 days. The captain was familiar with Wellcamp and had operated there often in the previous 3 years.

The first officer held a CPL(A) and had a total flying time of 3,361 hours, with 154 hours accrued in the previous 90 days. The first officer was also familiar with Wellcamp and had operated there regularly for the previous 2 years.

### ***Pilot reports***

#### ***VH-WXB***

The pilot of WXB reported that they were aware that ZLV would be joining the circuit at the same time. The pilot also stated that they had ZLV visual most of the time and the only time ZLV was not visual to the pilot of WXB was when the left turn was conducted with the intention of positioning behind ZLV on downwind. However, they also advised that, because of the traffic congestion, they were entirely reliant on their TCAS screen to determine the location of ZLV.

The pilot of WXB reported seeing ZLV to the left of WXB's position on the TCAS screen, just before they turned to join downwind. They reported that they intended to make 2 more broadcasts to ZLV to verify their position and any other information they could collate, but they were unable to do so because the CTAF was too congested.

Once the pilot thought it was safe to do so, they turned left to join the downwind leg.

The pilot's TCAS screen was congested with numerous aircraft. For the pilot to identify the aircraft they were required to touch the aircraft symbol on the screen to obtain the callsign, level, and closing speed. It was unknown if the pilot did this.

#### ***VH-ZLV***

The flight crew both recalled the traffic information providing an estimated arrival time for WXB of 0830, prior to switching over to the CTAF.

The crew reported overflying Toowoomba at 5,600 ft to maintain 1,000 ft separation with outbound traffic, VH-YTK. As a result, the crew reported they were 600 ft higher on their normal descent profile into Wellcamp. Once they were clear of VH-YTK, about halfway between Toowoomba and Wellcamp, they commenced their descent.

They determined that the safest course of action, which was not standard procedure, was to descend while on the early crosswind and downwind legs, as they were limited on where they could conduct a descending orbit without interfering with the Toowoomba circuit traffic, or encroaching Oakey airspace to the north or the training area to the south of the field (Figure 3). They also reported that the dead side/non-active side<sup>11</sup> of the circuit was also an area they could not orbit in due to training aircraft frequently operating in there to avoid interfering with incoming and outgoing high-performance aircraft.

After organising separation with WXB and making circuit position broadcasts on the early crosswind and downwind legs, the flight crew thought separation with WXB had been effectively organised and focused their attention on circuit spacing with VH-YNH and configuring the aircraft for landing.

The flight crew did not recall hearing any broadcasts from WXB about joining downwind, and neither pilot saw WXB visually or on the TCAS until it crossed their flightpath ahead from left to right.

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<sup>11</sup> Dead side/non-active side: the area on the opposite side of the runway to where the circuit is flown.

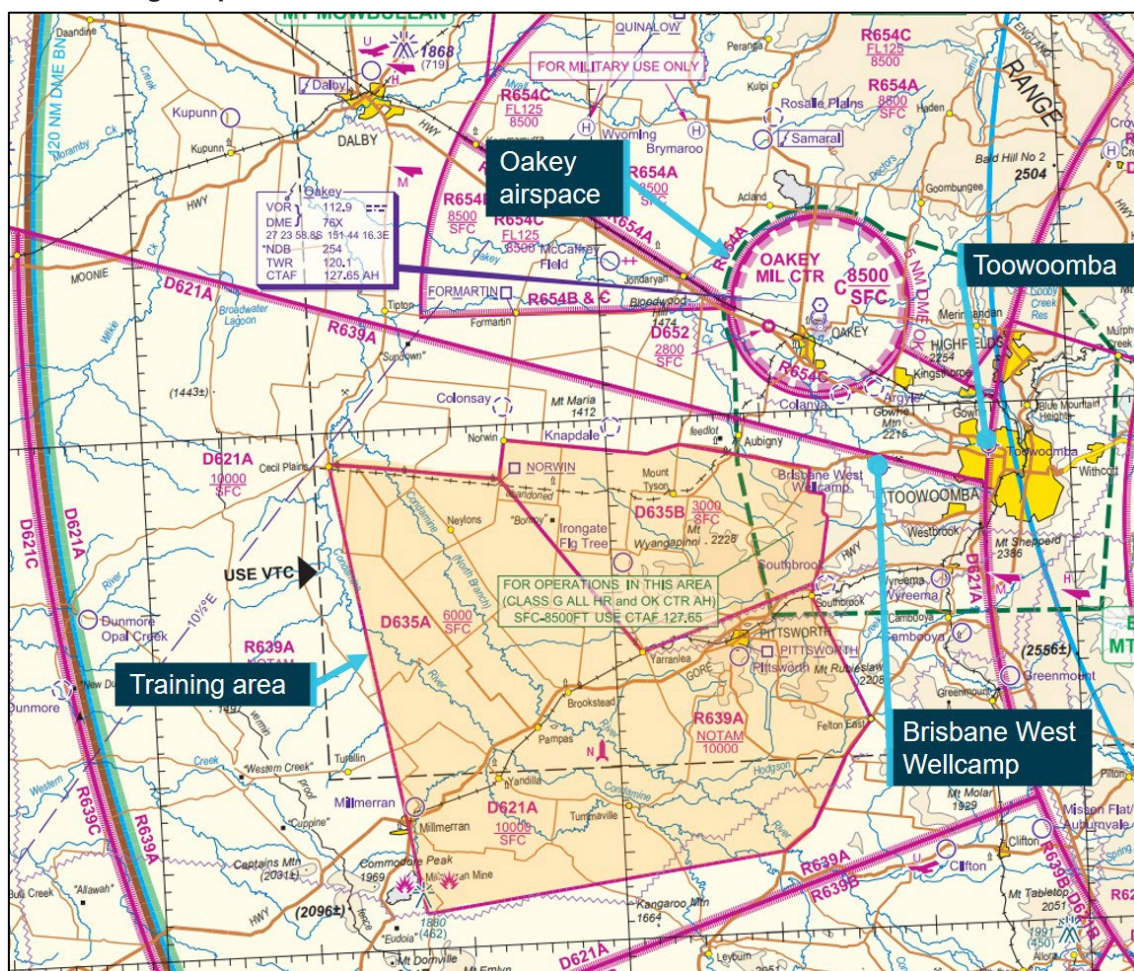
## Airspace

The airspace surrounding Wellcamp is non-controlled Class G airspace up to 8,500 ft. About 6 NM to the east of Wellcamp is Toowoomba Airport and about 9 NM to the north-north-west is Oakey Army Aviation Centre (Oakey). There are also other aircraft landing areas (ALAs) within a 10 NM radius of Wellcamp, including Wyreema, Colanya, Argyle and Southbrook (Figure 3).

All the above-mentioned airfields and ALAs, including Oakey, operate on the same CTAF when the Oakey airspace is inactive.

Within the airspace surrounding Wellcamp there are identified Danger Areas<sup>12</sup> to the south and west, including a flight training area up to 6,000 ft.

**Figure 3: Brisbane Visual Navigation Chart depicting the airport locations and surrounding airspace**



Source: Aircservices, annotated by ATSB.

In 2019, the Office of Airspace Regulation (OAR) within the Civil Aviation Safety Authority (CASA), completed a review of the airspace within 10 NM of Wellcamp. At the time of the review, the flight training school had not established operations at Wellcamp.

<sup>12</sup> Danger area: an airspace of defined dimensions within or over which activities of potential danger to aircraft flying over the area may exist.

The 2019 airspace review found that the airspace surrounding Wellcamp was fit for purpose, however the following recommendations were made:

Recommendation 1: The OAR should monitor the traffic growth at Wellcamp over the next two years, including the integration of flight training operations based at Wellcamp. If appropriate, another review should be conducted post-implementation of flight training at Wellcamp.

Recommendation 2: The OAR should continue to liaise with other business areas of CASA regarding the commencement of flight training at Wellcamp to ensure that the airspace remains fit for purpose.

A further review of Wellcamp was scheduled to commence in February 2023. However, this review was delayed due to unscheduled changes to priorities. The OAR expects that a review of Wellcamp will be included in a Brisbane basin aeronautical study and is scheduled to commence late 2023.

### ***Brisbane West Wellcamp Airport***

Brisbane West Wellcamp Airport is a certified aerodrome located 8 NM west of Toowoomba CBD. It was opened in 2014 and consists of one runway orientated 12/30. The airport services a variety of operations including regular public transport, charter, freight, flight training and aero-medical aviation services.

The En Route Supplement Australia (ERSA)<sup>13</sup> details local traffic regulations and procedures for the airport. These included stipulating the use of published departure procedures whenever practicable to avoid Oakey military Restricted Airspace. Additionally, due to high terrain to the north-east of the airport, left circuits are to be flown to runway 30 and right circuits to runway 12.

### ***Operations at non-controlled aerodromes***

Guidance provided by CASA<sup>14</sup> (2019) defined that an aircraft was in the vicinity of a non-controlled aerodrome if it was:

- within airspace other than controlled airspace
- within a horizontal distance of 10 NM from the aerodrome (reference point), and
- at a height above the aerodrome (reference point) that could result in conflict with operations at the aerodrome.

### ***Radio Broadcasts***

When operating in the vicinity of non-controlled aerodromes on the shared CTAF, as per Regulation 166C of Civil Aviation Regulations (1988), pilots were required to make a broadcast whenever it was reasonably necessary to do so to avoid a collision, or the risk of collision, with another aircraft.

Further guidance from CASA Advisory Circular 91-10 V1.1 to pilots on the recommended positional broadcasts in the vicinity of non-controlled aerodrome for inbound aircraft is provided at Table 1. It does advise pilots may use their discretion in the number and type of broadcasts they make.

<sup>13</sup> En Route Supplement Australia (ERSA): a directory for Australian aerodromes that includes details of an aerodrome and details of available air traffic and ground services, navigation aids and public facilities and any special procedures.

<sup>14</sup> CASA Civil Aviation Advisory Publication (CAAP) 166-01 v4.2 Operations in the vicinity of non-controlled aerodromes. February 2019. CAAP 166-01 was replaced [by CASA Advisory Circular \(AC\) 91-10 v1.0 in 2021 to align with the new regulations](#).

**Table 1: Recommended positional broadcasts in the vicinity of a non-controlled aerodrome**

<b>Recommended calls in all circumstances</b>		
<b>Item</b>	<b>Situation</b>	<b>Broadcast</b>
1	The pilot intends to take-off	Immediately before, or during taxiing
2	The pilot is inbound to an aerodrome	10 NM from the aerodrome, or earlier, commensurate with aeroplane performance and pilot workload, with an estimated time of arrival (ETA) for the aerodrome
3	The pilot intends to fly through the vicinity of, but not land at, a non-controlled aerodrome	10 NM from the aerodrome, or earlier, commensurate with aeroplane performance and pilot workload, with an estimated time of arrival (ETA) for the aerodrome
<b>Recommended calls dependent on traffic</b>		
<b>Item</b>	<b>Situation</b>	<b>Broadcast</b>
4	The pilot intends to enter a runway	Immediately before entering a runway
5	The pilot is ready to join the circuit	Immediately before joining the circuit
6	The pilot intends to make a straight-in approach	On final approach at not less than 3 NM from the threshold (See Note[1])
7	The pilot intends to join on base leg	Prior to joining on base
8	During an Instrument Approach when: a. departing FAF or established on final approach segment inbound b. terminating the approach, commencing the missed approach	Including details of position and intentions that are clear to all pilots (both IFR and VFR)
9	The aircraft is clear of the active runway(s)	Once established outside the runway strip

Source: CASA 91-10 (2021)

[1] NOTE: Some distances above refer to the runway threshold and others refer to the aerodrome reference point. Pilots should be aware that a global positioning system (GPS) indication of 3 NM from an aerodrome may not be 3 NM from the runway threshold.

### **Circuit and arrival procedures**

A circuit pattern is a conventional standard path for coordinating air traffic that are taking off or landing on a runway. A circuit pattern consists of 5 legs – upwind, crosswind, downwind, base and final (Figure 4).

The Civil Aviation Safety Authority (CASA) Visual Flight Rules Guide states the following regarding standard circuit procedures at non-controlled airports, such as Wellcamp:

The standard aerodrome traffic circuit pattern facilitates an orderly flow of traffic and is normally a circuit pattern made with all turns to the left. When arriving at an aerodrome to land, a pilot will normally join the circuit upwind, crosswind (mid-field), or downwind (before mid-downwind). Landings and take-offs should be made on the active runway or the runway most closely aligned into wind. Aerodromes that have right-hand circuits are listed in ERSA. Circuit information may also be published or provided by aerodrome operators in other sources of aeronautical information.



The CASA (2019) guidance provided the following caution on arrival into non-controlled aerodromes:

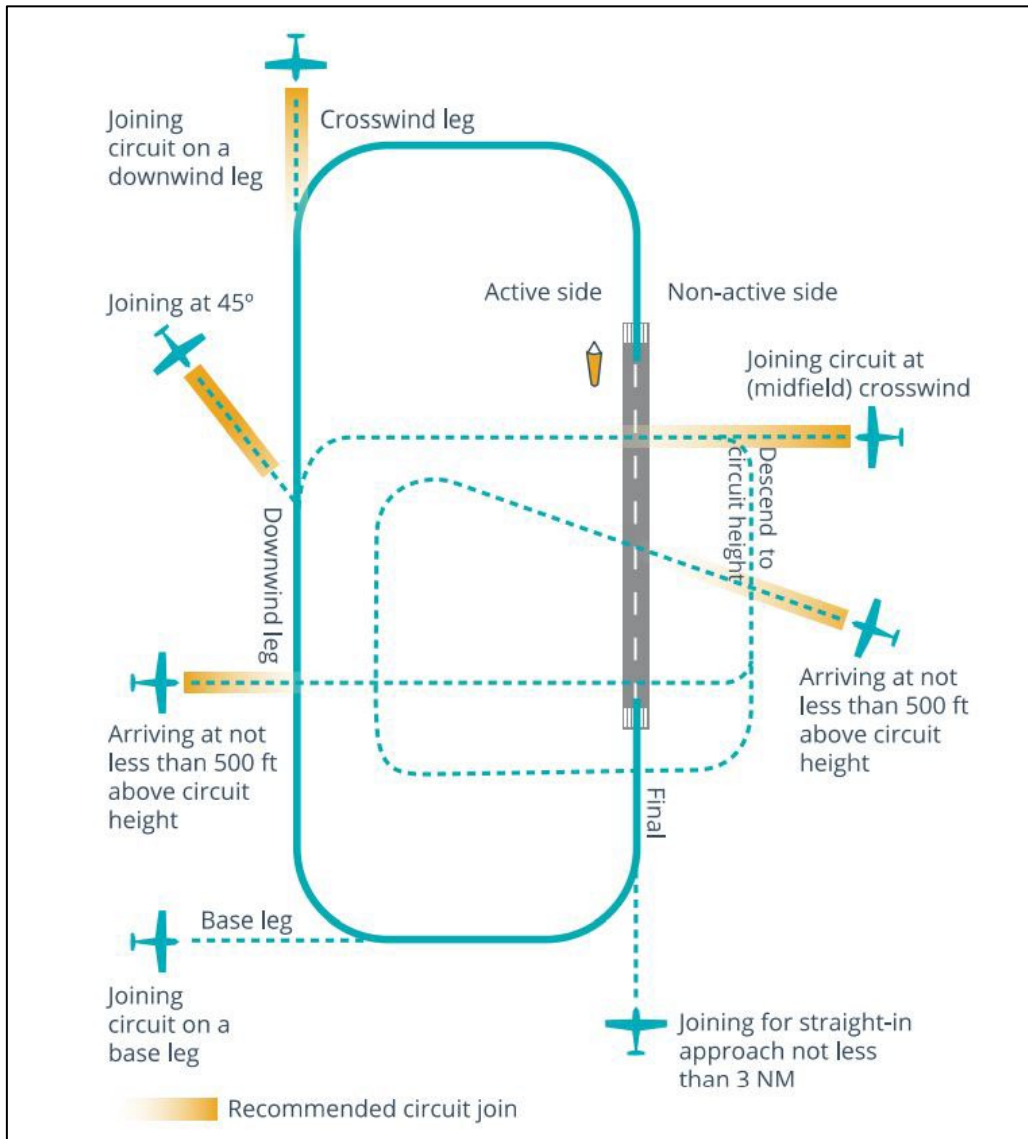
Pilots should not descend into the active side of the traffic circuit from above because of the difficulty of seeing – and being seen by – aircraft directly below the aircraft's flight path.

The guidance noted that pilots joining the circuit on the downwind leg at a midfield position should enter the circuit at approximately 45° to the downwind leg and give way to aircraft already established in the circuit.

The guidance further noted that joining the circuit on base is not a standard procedure and increases the risk of traffic conflict and/or landing on a closed runway. It is recommended that pilots join the circuit on either crosswind or downwind.

ZLV joined the circuit on the early crosswind leg and WXB joined the downwind leg after conducting a 180° turn on the active side of the circuit.

**Figure 4: Arrival procedure for a non-controlled airport (left direction circuit). The circuit direction was right at Wellcamp**



Source: CASA Visual Flight Rules Guide.



### ***CTAF congestion at Wellcamp***

All pilots involved in the incident reported the CTAF can often be quite congested with many calls being over-transmitted. The flight crew of ZLV reported the CTAF congestion on the day of the incident was manageable and was not a factor in the incident. However, the pilot of WXB reported the CTAF was highly congested. At the time of the incident there were 5 aircraft operating on the CTAF.

In the 3 minutes and 6 seconds from when WXB and ZLV started communicating with each other on the CTAF to just after the incident occurred, 16 broadcasts were made on the CTAF. These had an average length of time of 8 seconds and an average gap of 4 seconds between each broadcast.

### ***Traffic alert and collision avoidance system***

Both aircraft in this incident were equipped with a TCAS. In addition to traffic alerts, the TCAS also provides pilots with visual traffic information on a screen. The screen displays other aircraft that are operating in their proximity, and as a result, pilots are able to make decisions based on the displayed information, reducing the risk of collision. The TCAS in WXB only issued traffic advisories and not resolution advisories.

### ***See-and-avoid***

When operating in non-controlled airspace, there is no separation service provided by ATC and pilots must rely on their own separation through radio communication with see-and-avoid as the last defence.

There are 2 characteristics of see-and-avoid, unalerted and alerted. Unalerted see-and-avoid relies entirely on the pilot sighting another aircraft with no other assistance, while alerted see-and-avoid exists when a pilot has been alerted to the existence and approximate location of other traffic. The primary tool of alerted see-and-avoid is radio communication between aircraft and traffic information provided by the air traffic controller. Other tools include ADS-B IN and electronic flight bags that receive traffic information through mobile network or ground-based receivers and TCAS, which provides its own traffic surveillance function.

In the absence of a traffic alert, the probability of a pilot sighting a threat aircraft before impact is low, whereas alerted see-and-avoid can be 8 times more effective.

For further information on the limitations of see-and-avoid, please refer to the 1991 ATSB report [\*Limitations of the See-and-Avoid Principle\*](#).

### ***Reported incidents at Brisbane West Wellcamp and Toowoomba Airports***

Since 2016, the ATSB has received 17 airspace occurrence reports that occurred within a 30 NM radius of Wellcamp and Toowoomba Airports (Refer to Appendix A – Separation and TCAS events within the circuit area at Wellcamp and Toowoomba for further details).

Fourteen of the occurrences involved separation issues with the involved aircraft either receiving or not receiving a TCAS alert. Eight of these occurrences occurred at or near Wellcamp, including 6 within the circuit area. Only one of these occurrences involved an aircraft turning inside another aircraft already established in the circuit, during circuit operations. The other 6 were at or near Toowoomba, with 3 occurring within the circuit area.

Two of the occurrences were classified as near collisions. In one, the crew of a Beechcraft B300 observed a glider cross their flightpath near Wellcamp. In the other a Bell 412 was on approach for Toowoomba when a Piper PA-38 crossed their track.

A loss of separation was also reported between a Cessna 182 and a de Havilland DHC-8 25 NM (46 km) east of Toowoomba, where the Cessna182 climbed above its assigned altitude.

## Safety analysis

### ***Incorrect mental models***

Mental models are a form of cognitive structure that enables an individual to effectively interact with their environment by organising knowledge into meaningful patterns (Reynolds & Blickensdefer, 2009). An individual, when performing a task will develop a mental model of what they think will occur during the task being completed. Their mental model is based upon the information available to them at the time.

#### ***VH-WXB***

The flight crew of ZLV advised the pilot of WXB that they were on early downwind (Figure 2 - position 1), when they were actually on early crosswind for runway 12. At the time of this broadcast, there were 2 other aircraft in the circuit: VH-EQV on mid-downwind and VH-YNH on mid-crosswind.

The pilot of WXB recalled seeing ZLV to the left of their position on their TCAS screen at about the same time as when they broadcast that they were continuing on an easterly heading (Figure 2 - position 2). However, a review of recorded flight data identified that ZLV was not to the left of WXB until after the 2 aircraft had crossed paths and it was VH-YNH to the left of WXB at this time. The pilot of WXB also stated that they had ZLV visual most of the time and the only period that ZLV was not visual to them was when the pilot was conducting the left turn to position behind ZLV on downwind.

After WXB crossed ZLV's track and was in communication with the flight crew of ZLV, the pilot asked the crew to confirm ZLV was on base. At the time of this broadcast, VH-YNH was on base (Figure 2 - position 5) and ZLV was to the left of WXB on downwind.

The pilot of WXB's description of when they first became aware of ZLV on their TCAS screen and their common traffic advisory frequency (CTAF) broadcasts after crossing ZLV's flight path, suggested the pilot of WXB had sighted VH-YNH and not ZLV visually or on the TCAS screen. The advice from the crew of ZLV that their aircraft was on early downwind when they were on crosswind, would have likely also confirmed the pilot's assumption that VH-YNH was ZLV and the pilot possibly assumed VH-EQV was VH-YNH.

The decision by the pilot of WXB to fly opposite to the traffic direction on downwind while descending to circuit height, before turning left, across ZLV's flight path indicates that it is likely that the pilot had not identified ZLV either visually or on the TCAS.

#### ***VH-ZLV***

Both flight crew members of ZLV recalled WXB's field estimate was 0830, which was initially given to them by the air traffic controller. However, after they transferred over to the CTAF, the pilot of WXB broadcast their new arrival time of 0827 on 2 separate occasions, including a broadcast directly to ZLV. This was the same estimated arrival time as ZLV. It is evident that the flight crew of ZLV were aware of the potential arrival time conflict as a discussion occurred between the pilot monitoring and the pilot of WXB, for the flight crew to slow down ZLV to go in number 2 to WXB.

Due to the earlier incorrect positioning call from the flight crew of ZLV, leading the pilot of WXB to believe that ZLV was already established in the circuit on downwind, the pilot of WXB advised the flight crew that they would track number 2 to ZLV and join the circuit behind them on downwind. The pilot monitoring of ZLV acknowledged the broadcast.

The pilot monitoring did not recall hearing anymore broadcasts from the pilot of WXB, after they had organised that WXB would track behind them, until after the TCAS resolution advisory was received. The pilot of WXB had made one other broadcast prior to this, just before they conducted the 180° turn onto downwind, that included intentions to descend and to shortly join the circuit via a left turn (Figure 2 - positions 2). If the flight crew of ZLV had of been effectively monitoring the CTAF, this transmission should have been a trigger for them to look for WXB and respond to

confirm their mental model. At this time, ZLV was 1,300 ft higher than WXB (4,800 ft vs 3,500 ft) and in the process of conducting a right turn onto early downwind, making sighting of a lower aircraft more difficult.

It is possible that after organising separation with WXB and agreeing that WXB would go number 2 behind them, the crew thought that WXB was aware of their position and therefore discounted WXB as a threat. Believing adequate separation had been organised, focus switched to VH-YNH and configuring the aircraft for landing.

The flight crew's ineffective monitoring of WXB's broadcasts and their incorrect mental model meant that they were now dependent on either visually acquiring WXB or the TCAS detecting them.

### ***Neither crew had positively sighted the other aircraft***

The pilot of WXB recalled having ZLV in sight both visually and on the TCAS screen prior to the left turn to join the circuit. If the pilot of WXB had accurately identified ZLV's location, it is very unlikely that they would have assessed that it was safe to turn left in front of ZLV and cross their flight path. Therefore, the pilot of WXB probably did not identify ZLV visually or on the TCAS until the completion of the left turn when both aircraft were on downwind.

The flight crew of ZLV, reported that while they were on early downwind, they did not hear any broadcasts from WXB about joining the circuit. The first indicator they had that WXB was in the vicinity of their aircraft was when they received a TCAS traffic alert followed shortly after by an RA. They recalled, during their initial communications with WXB, being unsure where WXB was planning to join the circuit, which was why they were initially happy for WXB to go first. After organising separation with WXB, they reported being under the impression that WXB would slow down and join the circuit behind them either on downwind or base. They did not recall seeing WXB on the TCAS prior to the RA. The pilot flying recalled seeing WXB visually for the first time when the aircraft crossed their flight track from left to right.

Separation in a CTAF is dependent on pilots organising their own separation through radio communication, as well as conducting standard circuit procedures. Neither crew positively identified the other aircraft's location while in, and prior to joining, the circuit, so the potential conflict was not recognised.

Conducting standard circuit procedures provides the best opportunity and risk control for aircraft to maintain separation. Finally, if available, it is also important to follow TCAS RA information. In this instance, it prevented a potential collision.

## Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include 'contributing factors' and 'other factors that increased risk' (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition 'other findings' may be included to provide important information about topics other than safety factors.

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

From the evidence available, the following findings are made with respect to the separation issue involving a Saab 340B, registered VH-ZLV, and a Beech Aircraft B200, registered VH-WXB that occurred at Brisbane West Wellcamp, Queensland on 21 October 2021.

### ***Contributing factors***

- The flight crew of VH-ZLV broadcast an incorrect position of their aircraft when approaching the circuit. This probably resulted in the pilot of VH-WXB misidentifying it for another aircraft in the circuit and influenced their decision to conduct a non-standard circuit entry contrary to the traffic flow.
- The flight crew of VH-ZLV did not effectively monitor the radio, resulting in them having an incorrect mental model of VH-WXB's position and thus not perceiving VH-WXB as a threat.
- The pilot of VH-WXB manoeuvred their aircraft opposite to circuit traffic direction while descending into the active side of the circuit in the vicinity of the airport resulting in a conflict with VH-ZLV.
- Neither flight crew identified the other aircraft visually or on their TCAS, leading to VH-WXB turning in front of VH-ZLV and resulting in the crew of VH-ZLV receiving a TCAS RA.

## Safety actions

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. All of the directly involved parties are invited to provide submissions to this draft report. As part of that process, each organisation is asked to communicate what safety actions, if any, they have carried out to reduce the risk associated with this type of occurrences in the future. The ATSB has so far been advised of the following proactive safety action in response to this occurrence.

### ***Safety action by Air Charter Coordinators***

As a result of this incident the operator of VH-WXB advised the ATSB that they:

- will ensure there is a 4-minute buffer between a regular public transport (RPT) flight's time in the circuit and theirs by holding<sup>15</sup> at LUKEY, to ensure that the RPT flight is on final approach when they join the circuit
- have briefed their pilots of the event and communicated the need to adhere to the procedures written in CAAP 166 - Operations at Non-Towered Aerodromes. This included advice that when traffic congestion is anticipated, actions such as conducting orbits to allow greater spacing in traffic sequencing should be considered
- have discussed the traffic congestion issue with the training school based at Wellcamp and have agreed that during the scheduled arrival times of RPT aircraft, the training school will limit the number of their aircraft flying within the area.

<sup>15</sup> Holding procedure: a predetermined manoeuvre which keeps an aircraft within a specified airspace whilst awaiting further clearance.

## **Safety action by Regional Express Pty Ltd**

The operator of VH-ZLV advised the ATSB of the following actions:

- operations at, and in the vicinity of, non-towered aerodromes have been included as a focus item in the periodic aircrew check cycle
- this occurrence will be used internally as a human factors case study for operations around common traffic advisory frequency airports.

## **Sources and submissions**

### **Sources of information**

The sources of information during the investigation included:

- the pilot in command of VH-ZLV
- the pilot of VH-WXB
- Regional Express Pty Ltd
- Air Charter Coordinators
- Airservices Australia
- Civil Aviation Safety Authority
- Avdata
- OzRunways

### **References**

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## **Submissions**

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section 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 following directly involved parties:

- the flight crew of VH-ZLV
- the pilot of VH-WXB
- the aircraft operators
- the Civil Aviation Safety Authority

Submissions were received from:

- the pilot in command of VH-ZLV
- the Civil Aviation Safety Authority
- Regional Express Pty Ltd

The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

# General details

## Occurrence details

Date and time:	21 October 2021 – 0828 Eastern Standard Time	
Occurrence class:	Incident	
Occurrence categories:	Issues, Airborne collision alert system warning	
Location:	Brisbane West Wellcamp Airport, Queensland	
	Latitude: 27° 33.517' S	Longitude: 151° 47.650' E

## Aircraft 1 details

Manufacturer and model:	Beech Aircraft Corp B200	
Registration:	VH-WXB	
Operator:	Brescon Pty Ltd	
Serial number:	BB-1041	
Type of operation:	Charter – Passenger – (Charter)	
Activity:	Commercial air transport – Non-scheduled – Passenger transport charters	
Departure:	Roma, Queensland	
Destination:	Brisbane West Wellcamp, Queensland	
Persons on board:	Crew – 1	Passengers - 8
Injuries:	Crew – Nil	Passengers – Nil
Aircraft damage:	None	

## Aircraft 2 details

Manufacturer and model:	SAAB Aircraft Co 340B	
Registration:	VH-ZLV	
Operator:	Regional Express Holdings Limited	
Serial number:	340B-386	
Type of operation:	Air Transport Low Capacity – Passenger – (Air Transport Low Capacity)	
Activity:	Commercial air transport – Scheduled – Domestic	
Departure:	Brisbane, Queensland	
Destination:	Brisbane West Wellcamp, Queensland	
Persons on board:	Crew – 3	Passengers - 9
Injuries:	Crew – Nil	Passengers – Nil
Aircraft damage:	None	

# Appendices

## Appendix A – Separation and TCAS events within the circuit area at Wellcamp and Toowoomba

Year	Location	Occurrence type	Aircraft 1	Aircraft 2	Overview
2014	Toowoomba	Airborne collision alert system warning   Issues	de Havilland DHC-8	Unknown helicopter	During initial climb, the de Havilland DHC-8 crew received a TCAS RA on a helicopter operating within the vicinity. The helicopter did not track as previously advised by its crew.
2014	Toowoomba	Near collision	Bell 412	Piper PA-38	Passing 400 ft on approach, the pilot of the Bell 412 observed the Piper PA-38 cross in front in close proximity. The pilot of the 412 contacted the crew of the PA-38 which subsequently conducted a missed approach.
2016	Brisbane West Wellcamp	Issues	Cessna 172	Saab 340	Passing 300 ft on climb, the Cessna 172 crew turned to maintain separation with the Saab 340 on final approach to the reciprocal runway.
2016	Brisbane West Wellcamp	Airborne collision alert system warning   Issues	Bombardier DHC-8	Beech B200	The crew of the Bombardier DHC-8 conducted a missed approach into Brisbane West Wellcamp to maintain separation with the Beech B200 on approach into Toowoomba.
2020	Toowoomba	Airborne collision alert system warning   Issues	Beechcraft B200	Diamond DA 40	During initial climb, the pilot of the Beechcraft B200 received a TCAS TA on the Diamond DA 40 and turned to increase separation. It was determined the pilot of the DA 40 was found to be on the incorrect frequency.
2020	Brisbane West Wellcamp	Airborne collision alert system warning	Saab 340	Diamond DA 40	During approach, the crew of the Saab 340 received a TCAS RA on the Diamond DA 40 in the circuit area.

Year	Location	Occurrence type	Aircraft 1	Aircraft 2	Overview
2020	Brisbane West Wellcamp	Airborne collision alert system warning   Issues	Socata TB-10	Beechcraft B300	During circuit operations, a Socata TB-10 turned inside the Beechcraft B300 that was already established on downwind. The crew of the B300 received a TCAS RA and manoeuvred to maintain separation. No radio calls were heard from the TB-10.
2021	Brisbane West Wellcamp	Issues	Airbus A350	Diamond DA 40	During approach to runway 12, the Airbus A350 closed on the slower preceding Diamond DA 40 on approach to the reciprocal runway 30. The crew of the DA 40 were concerned with the horizontal separation and amended their approach to increase separation. The instructor completed a short field landing that damaged the main landing gear tyres and vacated the runway with the A350 on short final.
2021	Brisbane West Wellcamp	Airborne collision alert system warning	Beechcraft B200	Unknown aircraft	As the Beechcraft B200 joined the circuit, the pilot received a TCAS RA on another aircraft operating in the circuit.

Source: ATSB

## Australian Transport Safety Bureau

### About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. It is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers.

The ATSB's purpose is to improve the safety of, and public confidence in, aviation, rail and marine transport through:

- 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, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

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

### Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining 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. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

### Terminology

An explanation of terminology used in ATSB investigation reports is available on the ATSB website. This includes terms such as occurrence, contributing factor, other factor that increased risk, and safety issue.