Australian Government
Australian Transport Safety Bureau

Aircraft separation issue during take-off involving Lancair, VH-VKP, and De Havilland Aircraft of Canada Limited DHC-8-315, VH-TQZ

Mildura Airport, Victoria, on 29 September 2023

ATSB Transport Safety Report
Aviation Occurrence Investigation (Defined)
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Acknowledgement of Country and Traditional Owners

The Australian Transport Safety Bureau acknowledges the traditional owners of country throughout Australia, and their continuing connection to land, sea and community. We pay our respects to them and their cultures, and to elders both past and present.

Investigation summary

What happened

In the early afternoon of 29 September 2023, a QantasLink De Havilland Aircraft of Canada Limited DHC-8-315 (Dash 8) registered VH-TQZ, being operated on a scheduled air transport flight to Melbourne, Victoria, began to taxi at Mildura, Victoria for runway 09. A short time later, an amateur-built Lancair Super ES registered VH-VKP, taxied for runway 36 at Mildura for a private flight to Ballarat.

Both aircraft gave taxi, entering and backtracking calls on the local common traffic advisory frequency. Neither the pilot of the Lancair, or the crew of the Dash 8, were aware of each other. The crew of the Dash 8 gave a rolling call and had commenced their take-off on runway 09 as the pilot of the Lancair gave a rolling call on runway 36, this was received by the Dash 8 crew with an immediate response given to the Lancair to hold on the runway. Another aircraft, taxiing behind the Lancair for runway 36, advised them to hold position while the Dash 8 departed.

The Dash 8 crossed the runway 09/36 intersection while the Lancair remained on the threshold of runway 36.

What the ATSB found

The ATSB's investigation identified that the Dash 8 crew were actively engaged in organising separation with other airborne traffic. During this time, the pilot of the Lancair made a taxi call, and then an entering and backtracking call which partially over-transmitted the Dash 8 checking on other airborne traffic. The crew of the Dash 8 heard neither of the Lancair pilot's calls. This led to a situation where the crew of the Dash 8 had an incomplete comprehension of the ground-based traffic at Mildura, and had no knowledge of the Lancair until during the take-off. In addition, due to the position and distance of the Dash 8, the pilot of the Lancair had no awareness of the Dash 8 or its radio calls until another aircraft advised that the Dash 8 was rolling on runway 09.

The ATSB investigation found that the Dash 8 aircraft type had reduced ground-based radio reception and transmission strength with other airfield users located behind the aircraft, which affected radio call readability. This reduced the situational awareness for the Dash 8 crew and other traffic. Further, the Dash 8 ground-based transmissions on VHF COM 2 (which used an aerial on the aircraft underbelly) had reduced strength and clarity compared to VHF COM 1 (which used an aerial on the roof). This likely led to situations where other aircraft had difficulty in receiving and understanding radio transmissions, and the Dash 8 not receiving other traffic radio transmissions. Due to topography and buildings at Mildura Airport, aircraft are not directly visible to each other on the threshold of runways 09, 27 and 36. This, and the lack of a requirement for mandatory rolling calls, increased the risk of aircraft not being aware of each other immediately prior to take-off.

The ATSB also identified that the QantasLink radio procedure required Dash 8 crews to use the VHF COM 2 radio to broadcast and receive on local frequencies during operations at all non-controlled aerodromes. This reduced the ground-based reception and transmission strength of the Dash 8, and therefore reduced the likelihood of radio calls being received in some circumstances.

Furthermore, the aircraft manufacturer, De Havilland Aircraft of Canada Limited, did not have guidance to operators on the transmission and reception performance limitations of VHF COM 2 radios for ground-based communications in Dash 8 aircraft.

What has been done as a result

On 6 December 2024, De Havilland Aircraft of Canada Limited issued 2 flight operations service letters relating to radio communications, with one covering Dash 8 100-300 series aircraft and the other covering the Dash 8 400 series aircraft. The service letters remind operators that ground-based VHF communications are affected by line of sight and can be impacted by buildings, terrain or aircraft structures and that use of VHF COM 1 is more effective for ground-based communications with other aircraft on the ground.

In support of the De Havilland Aircraft of Canada Limited service letters, the ATSB has issued a safety advisory notice (AO-2023-050-SAN-01) in conjunction with this report to advise operators of Dash 8 aircraft of the potential for reduced ground-based communications quality of VHF COM 2 radios. The SAN advises all operators and crew of De Havilland Aircraft of Canada Limited Dash 8 aircraft to consider the use of VHF COM 1 radios for all ground-based communication while operating at non-controlled aerodromes.

QantasLink has updated its operations manual to reflect the updated minimum company requirements of a rolling call to be made at all CTAF aerodromes. This is to improve procedural consistency across the pilot group, and to reduce the likelihood of traffic conflict. QantasLink has provided guidance to its pilot group on specifics of potential radio communication degradation on the ground at Mildura Airport between runway 36 and 09 thresholds, including the conduct of rolling calls, and required the clarification of broken, suspicious or ambiguous radio calls from other aircraft prior to departure. QantasLink has also made changes to its operations into Mildura Airport, requiring crews to use VHF COM 1 for ground-based departure communications, however this does not apply to other non-controlled aerodromes.

In response to the draft ATSB report, QantasLink provided a bowtie qualitative risk assessment on the proposed adoption of modified CTAF radio panel usage, which focused on additional threats, increased complexities and controls. ATSB acknowledges that the risk assessment identified additional threats. However, QantasLink has not provided an assessment of how these threats may pose a higher risk than the existing aircraft collision risk identified in the safety issue. The ATSB notes that the risk assessment does not address aerodromes other than Mildura that may exhibit similar risk factors, namely, radio shielding, visual obstructions, and/or multiple runways. Furthermore, the risk assessment did not take into account the newly introduced advice from the aircraft manufacturer in 2 flight operations service letters. Notwithstanding, the ATSB has closed the safety issue as partially addressed as the risk has been controlled at Mildura. However, noting that the use of VHF COM 2 at other non-controlled airports for ground-based traffic communication currently remains unaddressed, the ATSB expects QantasLink will appropriately apply its safety management system to ensure any similar risk is controlled.

As a result of the potential radio interference at Mildura Airport that was investigated in an ATSB investigation (AO-2023-025) into a similar collision-risk pairing event about 3 months earlier, Mildura Airport successfully established a permanent notice to airmen for Mildura Airport operations as of 4 April 2024. This included the advice that aircraft are not directly visible to each other on the thresholds of runway 09, 27 and 36 and that mandatory rolling calls are required from all aircraft immediately prior to take-off due to the increased risk of aircraft not being aware of each other. This permanent notice to airman was subsumed into the En Route Supplement Australia publication for Mildura Airport in the 2406 amendment cycle on 13 June 2024.

Additionally, QantasLink has updated its operations manual to reflect the updated minimum company requirements of a rolling call to be made at all CTAF aerodromes. This was to improve procedural consistency across the pilot group, and to reduce the likelihood of traffic conflict.

Safety message

Communication and self-separation in non-controlled airspace is one of the ATSB's SafetyWatch priorities. Whenever you fly, into either non-towered or controlled aerodromes, maintaining a vigilant lookout at all times is important. Situational awareness and alerted see-and-avoid is an effective defence against collisions, and good airmanship dictates that all pilots should be looking out and not be solely reliant on the radio for traffic separation. Being aware of other nearby aircraft and their operational intentions is important to prevent collisions. Remember that there may be a variety of aircraft of different sizes, flight rules, and performance levels all operating at the same time, in the same airspace.

Pilots can guard against similar issues to those highlighted by this incident by:

- making the recommended broadcasts when in the vicinity of a non-controlled aerodrome
- actively monitoring the CTAF while maintaining a visual lookout for other aircraft and constructively organising separation through direct contact with other aircraft
- clarifying radio call over-transmissions to ensure that all stations in the vicinity have the best chance of updating their mental model of potentially conflicting traffic
- ensuring transponders, where fitted, are selected to transmit altitude information
- ensuring transmissions are made at non-controlled aerodromes with the radio/antenna that will provide the optimal ground-based transmission and reception strength.

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. This investigation report highlights the safety concerns around Reducing the collision risk around non-towered airports.

SafetyWatch

Contents

The occurrence

In the early afternoon of 29 September 2023, a De Havilland Aircraft of Canada Limited DHC-8-315 (Dash 8), registered VH-TQZ, with 4 crew and 50 passengers on board, being operated by QantasLink on a scheduled air transport flight to Melbourne, Victoria, began to taxi at Mildura Airport for runway 09[1] (Figure 1, blue line). A short time later, an amateur-built Lancair Super ES aircraft, registered VH-VKP, taxied for runway 36 at Mildura, for a private flight to Ballarat (Figure 1, orange line). The pilot was accompanied by 2 passengers.

Figure 1: Overview of airport showing Dash 8 (blue) and Lancair (orange) ground tracks

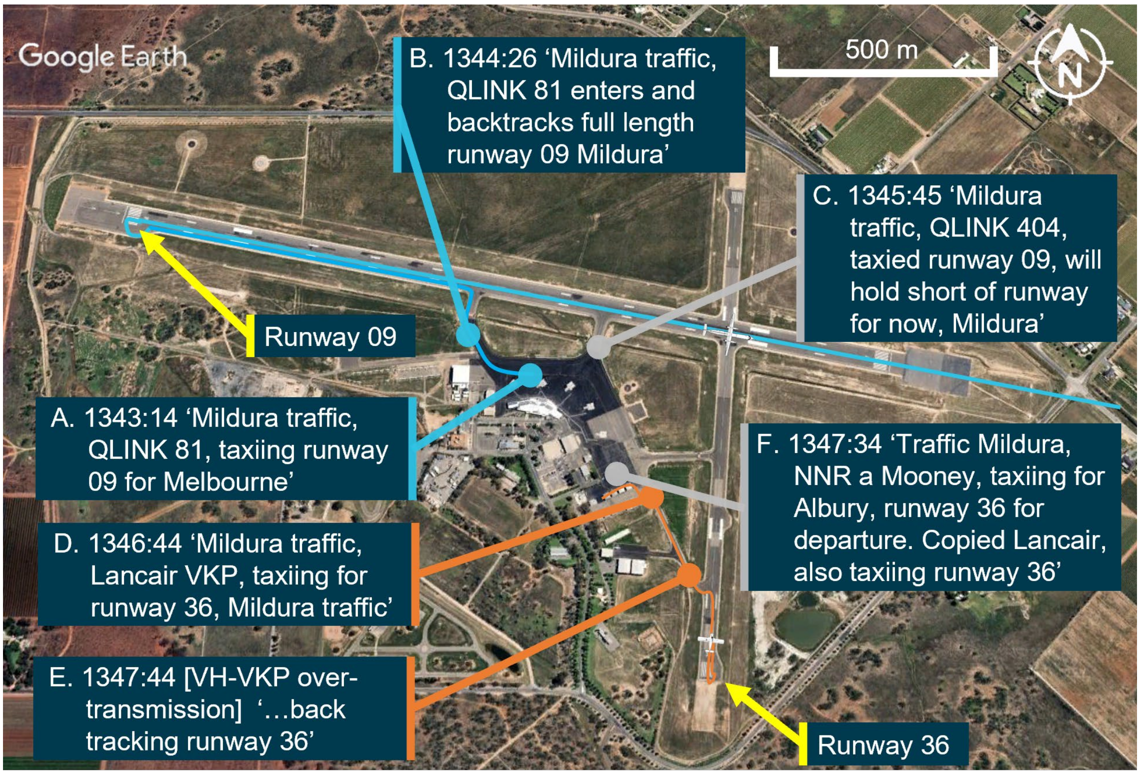
Aircraft in the overhead images are not the occurrence aircraft.
Source: Google Earth, annotated by the ATSB

Radio data collected from Mildura Airport CTAF recordings (Appendix A) are overlaid on a Google Earth image of the airfield (Figure 2). These showed that the crew of the Dash 8 (call sign QLINK81) made a taxi call for runway 09 at Mildura (A), with a further entering and backtracking call 72 seconds later (B). The crew of a second Dash 8 (QLINK 404) called taxiing for runway 09 and held short of runway 09 (C).[2]

1 Runway number: the number represents the magnetic heading of the runway. In this case, '09' represents a magnetic heading of 090 degrees.

2 See *Witnesses* for the recollections of the crew of this Dash 8 and the pilot of the Mooney, discussed below.

Figure 2: Sequence of events while the Dash 8 and Lancair taxied to their respective runways



Source: Google Earth, annotated by the ATSB

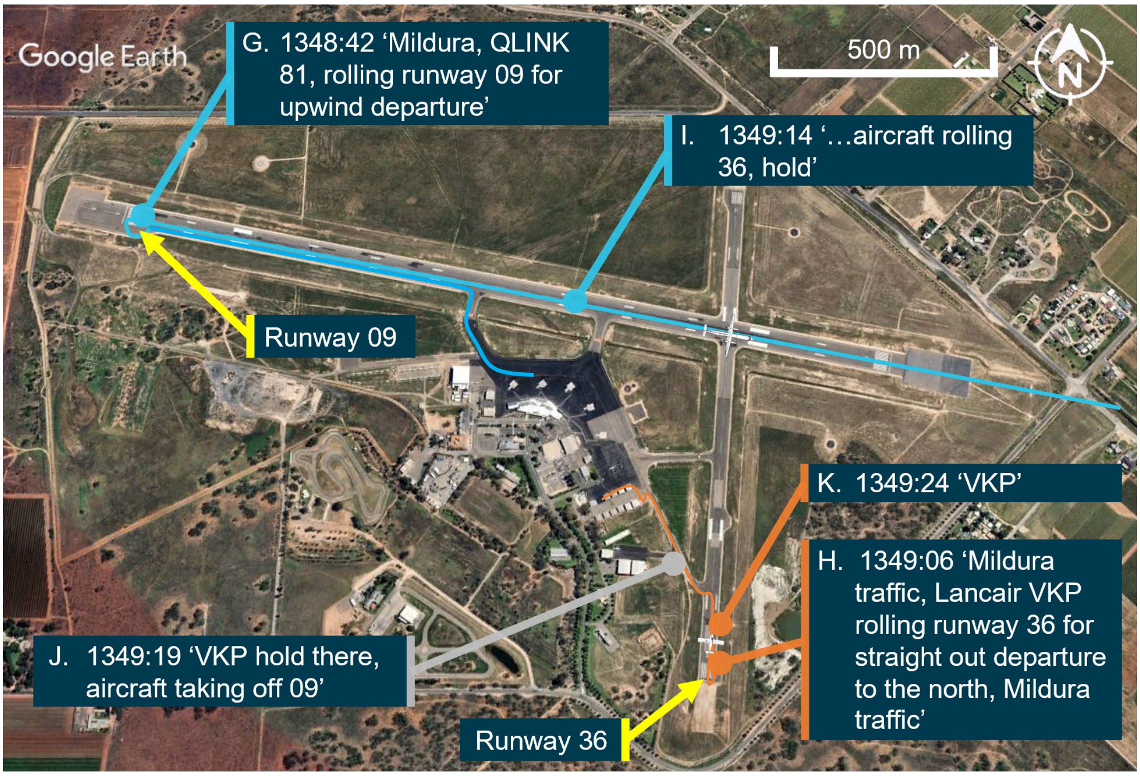
The Dash 8 flight crew were backtracking on runway 09 while making a series of calls with the pilot of a Tecnam aircraft, about 11 km north of Mildura and a Cessna joining the circuit overhead the aerodrome. The Dash 8 flight crew spent about 11 minutes communicating with the Cessna to establish deconfliction. It was during this time that the pilot of the Lancair made their taxi call on the CTAF (D).

The flight crew of the Dash 8 had just begun another call to contact the overhead traffic at the same time as the Lancair pilot transmitted an entering and backtracking call for runway 36 (E). This over-transmission made the first 10 seconds of the Lancair pilot's call unintelligible.

A Mooney aircraft, departing Mildura for Albury, also gave a call about 70 seconds after the Lancair taxi call, stating that they intended to taxi for runway 36 and that they had copied the Lancair also taxiing for runway 36 (F). According to ATSB interviews with the respective pilots, neither the pilot of the Lancair nor the flight crew of the Dash 8 backtracking on runway 09 were aware of each other at this time.

Subsequent events are shown in Figure 3. After reaching the end of the runway, at 1348:42, the Dash 8 gave a rolling call on 09 for departure (G). After a short backtrack along runway 36, the Lancair gave a rolling call on runway 36 at 1349:06 (H). The Dash 8 first officer immediately responded with 'aircraft rolling 36, hold' (I). The Lancair pilot did not recall hearing any calls from the Dash 8.

Figure 3: Sequence of events after Dash 8 commenced take-off



Source: Google Earth, annotated by the ATSB

Believing that the Dash 8 crew's call may not have been heard by the Lancair, the Mooney pilot relayed to the Lancair that there was another aircraft rolling on runway 09 (J). The Lancair pilot acknowledged and aborted their take-off at 1349:24 (K) as they had not yet begun to roll, at which point the Lancair was stationary at the end of runway 36, about 730 m from the runway intersection. As the Dash 8 had already passed V_1,[3] the flight crew continued the take-off.

[3] V_1: the critical engine failure speed or decision speed required for take off. Engine failure below V_1 should result in a rejected take off; above this speed the take-off should be continued.

Context

Pilot information

Flight crew VH-TQZ (Dash 8)

The captain held an Air Transport Pilot Licence (ATPL) (Aeroplane), a valid class 1 aviation medical certificate and reported a total flying time of about 18,500 hours with about 420 of those being on the Dash 8 and about 60 hours as captain. The captain reported being familiar with Mildura Airport and had operated there regularly in the past and recalled operating into Mildura at least 5 times in 2023, with the last flight being the week before the occurrence.

The first officer (FO) held an ATPL (Aeroplane), a valid class 1 aviation medical certificate, and reported a total flying time of about 3,100 hours, having flown about 700 of those hours in the Dash 8. The FO was familiar with Mildura Airport having regularly operated there over 50 times and had also operated into Mildura the previous week.

Pilot VH-VKP (Lancair)

The pilot held a Private Pilot Licence (Aeroplane) and reported a total flying time of about 200 hours, with about 93 hours on VH-VKP. They held a valid class 2 aviation medical certificate and were familiar with Mildura Airport, however had only operated there 3 or 4 times previously.

Aircraft information

VH-TQZ

The De Havilland Aircraft of Canada Limited DHC-8-315 is a high-wing, pressurised, commuter aircraft powered by 2 turboprop engines. VH-TQZ was manufactured in Canada in 2000 and was first registered in Australia on 29 November 2000. It was registered with Qantas Airways Limited on 8 February 2011, and operated by Eastern Australia Airlines Pty Limited.

VHF radio antenna position and condition

The Dash 8 had 2 VHF antennas installed on the upper and lower fuselage.

- Number 1 VHF COM antenna (VHF COM 1) mounted on the roof of the aircraft forward of the wings.
- Number 2 VHF COM antenna (VHF COM 2) mounted on the belly of the aircraft (Figure 4).

Figure 4: Dash 8 antenna position

Source: ATSB

The VHF COM 2 antenna was installed onto VH-TQZ on 1 March 2018 with the last reported C-check[4] conducted on VH-TQZ on 1 August 2023. There was no reported corrosion present under the VHF COM 2 antenna and the only recent defects in the previous 6 months related to the VHF COM 2 screen and frequency knob on the head unit inside the cockpit which were subsequently returned to service.

Traffic collision avoidance system

A traffic collision avoidance system (TCAS) was fitted to the Dash 8. A TCAS interrogates the transponders of nearby aircraft and uses this information to calculate the relative range and altitude of this traffic. The system provided a visual representation of this information to the flight crew and issued alerts should a traffic conflict be identified. Other aircraft do not receive TCAS alerts if they are not fitted with TCAS.

These alerts include:

- Proximate traffic: an alert issued when another aircraft is within 6 NM range (and 1,200 ft vertically if the traffic is transmitting altitude information).
- Traffic advisory (TA): an alert issued when the detected traffic may result in a conflict.
- Resolution advisory (RA): a manoeuvre, or a manoeuvre restriction, calculated by the TCAS to avoid a collision (the closest point of separation is approximately 25 seconds away or less). This alert is inhibited (inactive) on the ground.

Due to its method of operation, a TCAS cannot detect aircraft that are not equipped with a transponder or one with a transponder that is switched off. Additionally, the system is unable to issue an alert for traffic that is not fitted with an altitude reporting transponder (mode C or S), or in circumstances where the mode C or S transponder on board the conflicting traffic is not transmitting altitude information.

[4] A detailed operator maintenance check of the aircraft and systems, which occurs about every 18 months to 2 years (depending on type of aircraft) and takes up to 3 weeks.

The crew of the Dash 8 reported that the TCAS was used regularly by the operator as an aid to identify potential conflicting traffic in the vicinity of a non-controlled aerodrome prior to take-off.

QantasLink advised that the use of TCAS was not a formalised procedure for monitoring other aircraft ground movements and that TCAS identification on the ground may be unreliable due to system limitations.

The first officer recalled conducting a check of the TCAS prior to rolling on runway 09 and the TCAS only identified airborne traffic in the vicinity of Mildura Airport.

VH-VKP

VH-VKP was a privately owned amateur-built aircraft Lancair Super ES, built in New Zealand in 1997. It was first registered in Australia on 26 November 2020 to the pilot. The Lancair is a low wing, fixed undercarriage, piston engine, 4-seat touring aircraft made from composite materials.

VHF radio antenna position

The primary VHF radio antenna on the Lancair was located underneath the rear of the aircraft empennage and was used to make the required broadcasts on the day of the occurrence. No defects or communication problems, either prior to or after the occurrence at Mildura, were reported by the owner.

Lancair transponder operation

The Lancair was equipped with a mode C transponder and the pilot recalled turning the transponder on (and selecting mode C) before entering the runway at 1347. The pilot believed that the transponder was operating and transmitting positional and altitude information during the take-off. The ATSB was unable to identify any transponder data of the Lancair during its taxi at Mildura.

In September 2024, the Lancair had 2-yearly Civil Aviation Order 100.5 instrument checks conducted and it was found that the transponder was transmitting a weak signal, was considered unserviceable and was replaced. It is unknown if this problem existed with the transponder at the time of the incident at Mildura, however recorded transponder data of the Lancair at the time of the occurrence was unavailable.

Meteorological information

At Mildura Airport around the time of the occurrence, the wind was variable at about 3 kt, with clear conditions and good visibility. Four of the pilots involved remember the wind favouring runway 36 with one stating that the wind at the time of the occurrence was from the north at about 5 kt.

Mildura Airport

Mildura Airport was a certified aerodrome. The aerodrome had an elevation of 167 ft above mean sea level and had 2 sealed runways, orientated in an east-west, north-south direction. The main east-west runway was 1,830 m long and the secondary, north-south runway was 1,139 m long.

The airport was serviced by a number of major aviation carriers and a large international flying school and accommodated aircraft as large as Boeing 737s but regularly operated with lower capacity passenger flights from numerous operators. It also accommodated general and recreational aviation flight training schools, charter operators and private flying. The aerodrome terminal building was upgraded in 1994, with further expansion constructed in 2004 due to increased utilisation and growth. Due to aerodrome expansion in recent years, numerous new buildings had been erected, including the site of an international flight training school and the southern general aviation hangar complex.

The En Route Supplement Australia (ERSA), promulgated by Airservices Australia, provides information to pilots on the operations specific to each aerodrome. The ERSA entry for Mildura Airport detailed that aircraft may not be visible to one another while on the runway. It also stated that the circuit can be busy due to it being a training airfield with multiple runways in use at any time, in conjunction with frequent high-capacity passenger air transport operations (Figure 5).

Figure 5: Mildura Airport ERSA details

LOCAL TRAFFIC REGULATIONS

1. Very limited PRKG for ACFT ABV 5,700KG MTOW. Contact AD OPR for parking.
2. Additional grassed parking with tie-down facility available for ACFT below 5,700KG adjacent to TWY A and B entrance via TWY A.
3. ACFT on RWY may not be visible to one another.
4. ACFT LDG RWY 18/36 at night - taxi via RWY 09/27 and use TWY C or D.

FLIGHT PROCEDURES

Right hand circuits RWY 27 and 36.

CTAF - AFRU 118.8

ADDITIONAL INFORMATION

1. Birds may be present on SFC and approaches to RWYs.
2. Caution: training airfield. Multiple RWY may be in use with significant TFC within circuit at any time.
3. Caution: frequent movements of high capacity RPT ACFT occur at AD.
4. Gliding OPS HJ JF and NOTAM from grass airstrip 2NM SSW of AD. Wire launching. Gliders monitor CTAF.

Source: Airservices Australia

Airspace and traffic services

Mildura Airport was located within non-controlled Class G[5] airspace and did not have an air traffic control tower. The non-controlled airspace surrounding Mildura Airport was available for use by aircraft operating under visual flight rules (VFR) and instrument flight rules (IFR). No separation service was provided to aircraft operating in this airspace, with pilots responsible for making themselves aware of nearby aircraft and maintaining mutual self-separation. The primary method of traffic separation at Mildura Airport was by visual reference and relied on pilots using ‘alerted see-and-avoid’[6] practices (see *Alerted see-and-avoid*).

Common traffic advisory frequency

The Mildura Airport CTAF was a designated very high frequency (VHF) radio frequency on which pilots must monitor and make positional broadcasts when operating within a 10 NM radius of the aerodrome. For non-controlled aerodromes, including Mildura, there were a

5 This airspace is uncontrolled. Both IFR and VFR aircraft are permitted and neither require air traffic control clearance.

6 Improved visual acquisition by pilots alerted to traffic presence (by radio, electronic conspicuity, or other means).

number of recommended VHF radio calls (Table 1) to assist traffic coordination and to enhance the situational awareness of pilots operating within the surrounding airspace.

Visual line of sight limitations

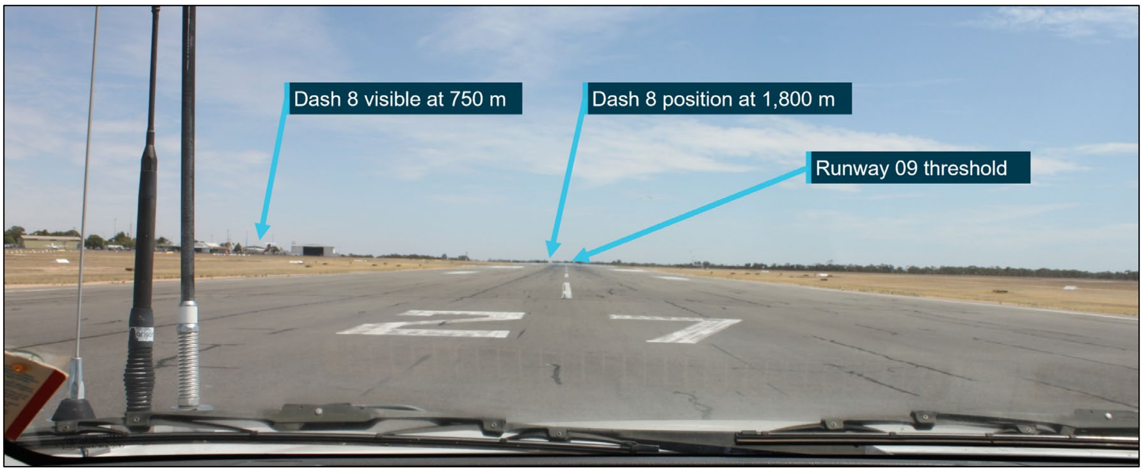
ATSB inspection of Mildura Airport established that from the threshold of runway 36, the threshold of runway 09 was visually obscured by the terminal buildings (Figure 6). The threshold of runway 36 was similarly not visible from the threshold of runway 09.

Figure 6: View from threshold runway 36

Source: Operator, annotated by the ATSB

The ATSB site inspection also identified a lack of line of sight between the thresholds of runway 09 and 27 (either end of the same physical runway about 1,800 m away) when viewed from the occupant height of a road vehicle. This was due to raised terrain along the runway between the two ends (Figure 7).

Figure 7: View from threshold of runway 27



Dash 8 not clearly visible at other end of runway.
Source: ATSB

Operations in the vicinity of non-controlled aerodromes

At and around non-controlled aerodromes, pilots are responsible for making themselves aware of nearby aircraft and maintaining separation. Safe operations at non-controlled aerodromes relies on all pilots maintaining an awareness of their surroundings and other aircraft, flying in compliance with procedures, while being observant, courteous and cooperative.

VHF radio is the primary communication tool to provide 'alerted see-and-avoid' commonly across aviation from sport and recreational flying to air transport. VHF radio allows for the communication of information (in this instance traffic information) to the pilot from other aircraft (Civil Aviation Safety Authority, 2013). Other tools to enhance 'alerted see-and-avoid' include ground radar, automatic dependent surveillance broadcast (ADS-B), and traffic collision avoidance system (TCAS).

Civil Aviation Safety Regulation 91.630 made certain radio calls (listed in the Part 91 Manual of Standards) mandatory for aircraft that are fitted with or carry a radio. Chapter 21 of the Part 91 Manual of Standards prescribed one type of mandatory broadcast that applied at all non-controlled aerodromes, namely:

> When the pilot in command considers it reasonably necessary to broadcast to avoid the risk of a collision with another aircraft.

To aid in increasing situational awareness at non-controlled aerodromes, recommended broadcasts are published by the Civil Aviation Safety Authority (CASA) for pilots to alert other traffic to their location and intentions before take-off, inbound to land at, or if intending to overfly a non-controlled aerodrome.

Table 1: Recommended radio calls

Recommended positional broadcasts in the vicinity of a non-controlled aerodrome		
Recommended calls in all circumstances		
Item	**Situation**	**Broadcast**
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.
Recommended calls dependent on traffic		
Item	**Situation**	**Broadcast**
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)
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 advisory circular 91-10 Operations in the vicinity of non-controlled aerodromes

In addition, individual aerodromes can require additional broadcasts due to unique circumstances by adding a requirement into the ERSA entry for their aerodrome. As seen in Figure 5, the ERSA entry for Mildura did not have any additional broadcast requirements.

CASA advisory circular 91-10, *Operations in the vicinity of non-controlled aerodromes*, provided further guidance on operations at non-controlled aerodromes, including that:

- In addition to making positional broadcasts, pilots should listen to other broadcasts to increase situational awareness
- Whenever pilots determine that there is a potential for traffic conflict, they should make radio broadcasts as necessary to avoid the risk of a collision or an Airprox event. Pilots should not be hesitant to call and clarify another aircraft's position and intentions if there is any uncertainty.

Alerted see-and-avoid

Issues associated with unalerted see-and-avoid have been detailed in the ATSB research report *Limitations of the See-and-Avoid Principles* (Hobbs, 1991). The report highlights that unalerted see-and-avoid relies entirely on the pilot's ability to sight other aircraft. An 'unalerted' search is one where reliance is entirely on the pilot searching for, and sighting, another aircraft without prior knowledge of its presence.

An 'alerted' search is one where the pilot is alerted to another aircraft's presence, typically through radio communications or aircraft-based alerting systems. Broadcasting on the CTAF to any other traffic in the vicinity of a non-controlled aerodrome is known as radio-alerted see-and-avoid and assists by supporting the pilot's situational awareness and visual lookout for traffic with the expectation of visually acquiring the subject in a particular direction. The ATSB research report found that an alerted search is likely to be 8 times more effective than an unalerted search, because knowing where to look greatly increases the chances of sighting traffic.

Positional broadcasts

Traditionally VHF radio broadcasts are made at non-controlled aerodromes in order to provide situational awareness, traffic separation and deconfliction to other traffic in the vicinity of the aerodrome.

However, positional broadcasts rely on the accuracy of the information being broadcast and the ability of other traffic receiving, comprehending and reacting to this information.

Civil Aviation Advisory Publication (CAAP) 166-2(1), *Pilots' responsibility for collision avoidance in the vicinity of non-controlled aerodromes using 'see and-avoid'* stated:

> 11.5 Pilots should be mindful that transmission of information by radio does not guarantee receipt and complete understanding of that information. Many of the worst aviation accidents in history have their genesis in misunderstanding of radio calls, over-transmissions, or poor language/phraseology which undermined the value of the information being transmitted.
>
> 11.6 Without understanding and confirmation of the transmitted information, the potential for alerted see-and-avoid is reduced to the less safe situation of unalerted see-and-avoid.

Positional broadcasts are a one-way communication, intended to provide a short and concise broadcast to minimise radio channel congestion. However, they do not imply receipt of information by other parties unless direct radio contact is made between stations to acknowledge the traffic, confirm intentions and if required, discuss measures to provide deconfliction.

The successful broadcast of the information is also subject to limitations of the VHF radio system.

VHF radio line of sight limitations

The VHF radio requires line of sight between both stations in order to function effectively. If an aircraft does not have a clear visual path direct to another in the vicinity, then the radio wave signal strength and clarity can be affected by obstacles. In some cases, terrain, vegetation or buildings can create areas that may shield or substantially reduce radio wave propagation and adversely affect broadcast signal strength and clarity.

At Mildura Airport, VHF radio calls on the CTAF frequency were recorded from an antenna south of the main terminal. Due to its elevated position, this antenna is within line of sight of the entire runway environment.

The Dash 8 operator's internal investigation report identified that instrument flight rules (IFR) taxi calls and entering backtracking calls were recorded well, however reduced radio strength and clarity existed with broken radio calls and aircraft unable to hear each other when on the thresholds of runway 09/36.

Transponder operation at non-controlled aerodromes

Historically, transponders have usually been switched to the standby mode on engine start-up and taxi. This was done to prevent clutter or false collision avoidance information to airborne traffic while not an immediate collision risk on the ground. If a transponder was fitted, pilots were required to select the transponder to 'on' and if mode C or S (that is, altitude information output) was available, this was to be selected to 'on' before entering the runway.

The introduction of Civil Aviation Safety Regulation 1998 (CASR) Part 91 basic operating rules commenced on 2 December 2021 and included a change to the required operation of aircraft fitted with a functioning transponder. This change required the selection of the transponder to a transmitting mode prior to the aircraft moving under its own power for the intention of take-off. This is particularly important in a non-controlled aerodrome environment where any form of enhanced situational awareness to all flight crew is paramount to avoiding the risk of collision.

Witnesses' recollections

Dash 8 crew at the holding point

The crew of the second Dash 8 (QLINK 404) that taxied to holding point Charlie believed that all radio calls appeared normal, and it was their understanding that all parties seemed to know what was going on. They reported being aware of the 2 aircraft taxiing for runway 36. The FO recalled the Lancair taxi call, and the captain recalled the entering or backtracking call and the lining up call from the Lancair. They both recalled the first Dash 8 organising traffic and their rolling call. The crew of the second Dash 8 described the radio signal strength of the Lancair as 'staticky' and 'scratchy' with a readability score of 2 out of 5.

Mooney pilot taxiing for runway 36

The pilot of the Mooney that taxied behind the Lancair, noted that they heard all the radio calls made by all aircraft and that they did not believe that their reception was blocked by airport shielding. The pilot recalled that they were holding at the taxiway Alpha holding point as the Dash 8 made their rolling call, at about the same time the Lancair had completed their enter and backtrack. Shortly after that, the Lancair called rolling on runway 09, to which the rolling Dash 8 replied to hold position. Worried that the Lancair had not heard this broadcast, the pilot of the Mooney advised the Lancair of the departing traffic.

Dash 8 operator radio procedure

The QantasLink Dash 8 standard operating procedure for departure from a non-controlled aerodrome, at the time of the occurrence, required VHF COM 1 to be set to the area frequency and VHF COM 2 to be set to the CTAF, as passenger boarding commenced.

Prior to releasing the handbrake to taxi, a call was to be made to the relevant air traffic centre on VHF COM 1 and then followed by a taxi call to the CTAF on VHF COM 2. The departing aircraft was to remain on the CTAF until after departure and clear of the CTAF, only then was the VHF COM 2 selected to 121.5 Mhz.

As a result of a related event on 6 June 2023 (see ATSB investigation report AO-2023-025), the operator provided its crew with a route manual amendment for Mildura on 8 June 2023 with a caution that:

> Crew must be extra vigilant when managing the threat of cross-strip operations at Mildura. Aircraft operating on cross runways may not be visible to each other. When operating from runway 09, the runway 36 threshold and touch down zone will not be visible.
>
> Radio wave degradation is likely to occur on the ground due to terrain and obstacle shielding. This radio shielding is most likely to occur when one aircraft is operating on runway 09 (west of Taxiway D), and other aircraft is positioned on runway 36 (south of taxiway A).
>
> Due to reduced visibility and radio wave degradation threats, flight crew are required to:
>
> - Conduct a rolling call for all departures.
> - Clarify any broken, suspicious or ambiguous radio calls from other aircraft prior to departure.

In the course of this investigation, QantasLink issued a technical advisory bulletin, effective from 17 July 2024, which changed the VHF communications procedure for Mildura departures. The aim of the change was to improve ground-to-ground CTAF VHF communication during the taxi phase. The changed procedure required use of the VHF COM 1 system, noting that this was found to have an improvement in both transmission clarity and reception.

Tests and research – radio signal strength and clarity

The ATSB conducted VHF signal strength and readability testing, undertaken on 13–14 March 2024 at Mildura Airport. The aim of the testing was to establish if signal strength degradation was occurring due to line of sight limitations and obstacles on the airport or/and if radio signal strength and clarity was aircraft related.

The testing included numerous stakeholders including expertise provided by Australian Communications and Media Authority (ACMA), Airservices Australia, QantasLink, Mildura Airport management, aerodrome reporting officers (ARO) and a local operator.

ACMA was consulted in the development of the testing schedules and assisted the ATSB during the testing with measuring equipment, by recording radio signal strength data and providing advice. All stakeholders, with the exception of the local operator, were consulted on the testing schedules prior to the conduct of the testing.

The testing comprised of signal strength, readability and clarity assessments to and from various locations on the aerodrome. The testing focused on the circumstances related to the runway incursion, concentrating on the quality of radio transmissions on the airfield and in particular between the threshold of runways 09 and 36.

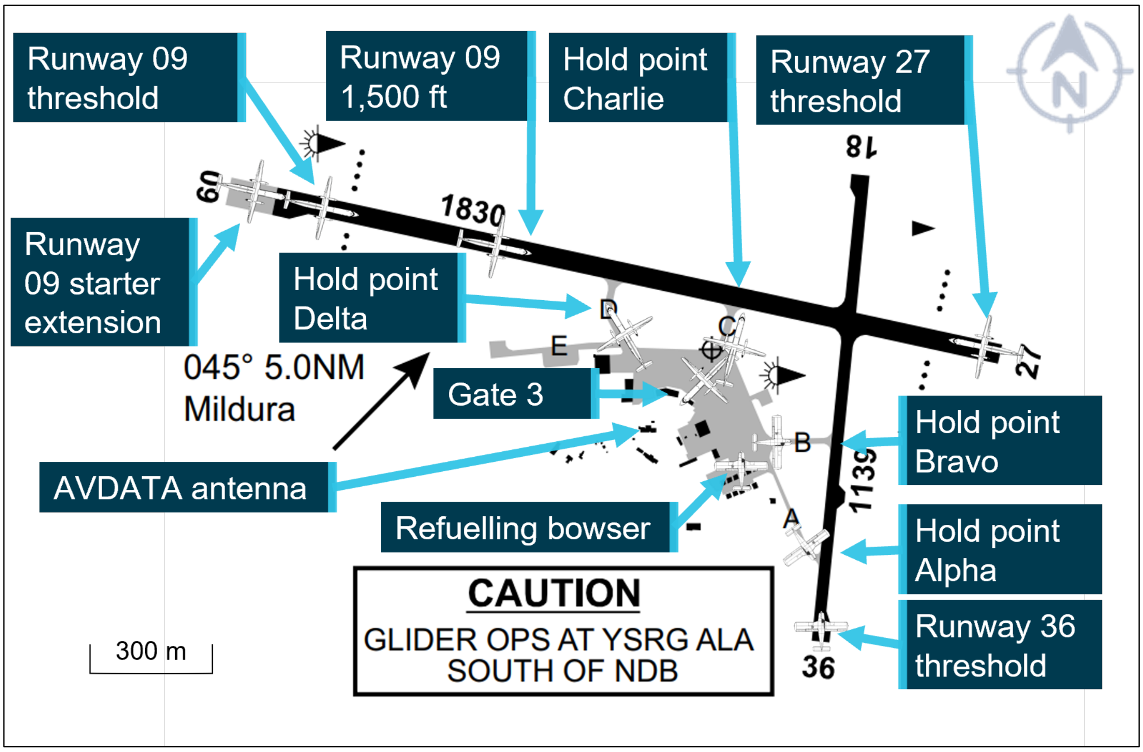
Testing specific to Dash 8 aircraft was conducted on VH-SBI, provided by the operator. This involved reception signal strength testing of aircraft transmissions.

Test schedules

The testing comprised of 4 schedules:

- Schedule 1 involved aerodrome signal reception strength and readability testing. This comprised of measuring the strength and readability of radio transmissions to and from VHF radios in ARO vehicles at relevant points on the airfield (Figure 8).
- Schedule 2 involved light aircraft signal reception strength and readability testing. This was achieved by testing transmissions to and from a light aircraft to an ARO vehicle to measure the strength and readability of radio transmissions of both stations.
- Schedule 3 included Dash 8 signal strength testing. By transmitting from relevant points on the airfield using the testing Dash 8 aircraft's VHF radios COM 1 and COM 2, and an ARO vehicle to measure the strength and readability of radio transmissions.
- Schedule 4 involved Dash 8 airframe signal strength and shielding testing. This was achieved by recording the test Dash 8 aircraft's VHF radios COM 1 and COM 2 reception strengths and readability of radio transmissions around the aircraft at about 20 m distance using an 8-point clock code.

Figure 8: Test locations at Mildura Airport



Source: En Route Supplement Australia, annotated by the ATSB

Signal strengths and readability measurements

The signal strength measurement recorded during the testing was the signal power level received from the radio transmission on the ACMA equipment at various locations remote from the aircraft or vehicle. Signal strength was measured in dBm which represents decibels relative to a milliwatt (mW). This is the power ratio in decibels (dB) of the measured power referenced to one milliwatt.[7]

A stronger and acceptable signal is one higher than −70 dBm. A weaker, unreliable signal is less than this towards a level of −100 dBm. Stronger signal strength results in more reliable and clear communications.

ATSB also recorded a radio signal readability test. For this, a qualitative 1–5 readability scale provided by ACMA (Table 2) was recorded at the receiving locations. To avoid subjectivity, these scores were recorded by ATSB, ACMA and Airservices employees and averaged to arrive at an agreed value to accurately represent the call readability.

Table 2: VHF radio readability scale

Scale	Description
5	Perfectly readable
4	Readable with practically no difficulty
3	Readable with considerable difficulty
2	Readable now and then
1	Unreadable

Aerodrome signal strength, shielding and readability testing

Schedule 1 testing was conducted on the afternoon of 13 March 2024 at about the same time of day as the occurrence. It measured the signal strength and readability during CTAF transmissions from ARO car 2 (ARO and ATSB investigator) transmitting from locations at Mildura Airport (Figure 8). Signal strength measurements and readability assessments were recorded by the ATSB and ACMA staff using ACMA measuring equipment in ARO car 3 which relocated around the aerodrome for the series of tests. Observers of the testing, including Airservices and a Mildura ARO were also in ARO car 3.

Additional signal strength readings were taken by an ACMA officer from their vehicle, designated ACMA car 1, located near the AVDATA antenna at Mildura Airport (Figure 8). ARO car 2 also conducted a readability assessment of ARO transmissions from ARO car 3 and recorded their readability testing.

The testing identified that between the radio transmission points on the aerodrome, the lesser the distance and greater the line of sight, the clearer the radio transmission was with a readability of 4 (readable with practically no difficulty) or more and signal strengths of greater than −70 dBm.

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[7] 1 mW = 0 dBm. The dBm scale is logarithmic (so a loss of −3 dBm is half of the signal strength ($10^{-0.3}$) and −10 dBm is 10 times less than 0 dBm at 0.1 mW, similarly 0.01 mW = −20 dBm. The closer the value was to 0, the stronger the signal. e.g. −56 dBm is a better signal strength than −90 dBm.

The testing also identified that the most significant reduction in recorded signal strength and readability was received when transmitting greater distances at:

- the runway 36 threshold to the threshold of runway 09, which reduced readability to 3 (readable but with considerable difficulty) and had a weaker signal strength of less than −70 dBm
- transmitting from the runway 27 threshold to the runway 09, resulting in readability of 3 (readable but with considerable difficulty) and a weaker signal strength of less than −70 dBm
- transmitting from the runway 09 threshold with slight general reduction in signal readability across all other runway thresholds and holding points to 4 (readable with practically no difficulty), but a general reduction in signal strength of less than −70 dBm across all readings.

The results of schedule 1 are shown in Appendix B.

Light aircraft signal strength and readability testing

Schedule 2 testing was conducted on the morning of 14 March 2024. However, due to the unavailability of Lancair VH-VKP due to inclement weather, the Aero Dynamic Flight Academy at Mildura provided Cessna 172, VH-ZJA and an instructor to assist with the testing.

Signal strength and readability during CTAF transmissions from VH-ZJA (Instructor and ATSB investigator) were conducted, transmitting from locations at Mildura Airport. Signal strength measurements and readability assessments were recorded by the ATSB and ACMA staff using ACMA measuring equipment in ARO car 3 which also relocated around the aerodrome for the series of tests. Observers of the testing, including Airservices and a Mildura ARO were also in ARO car 3.

The testing identified that between the aircraft radio transmission points on the aerodrome, the lesser the distance and greater the line of sight, the clearer the radio transmission was with a readability of 4 (readable with practically no difficulty) or more and signal strengths of greater than −70 dBm.

The testing also identified that the most significant reduction in recorded signal strength and readability was received when transmitting greater distances at:

- transmitting from the Mildura fuel bowser to the threshold of runway 09, which may be indicative of close proximity hangar shielding
- when receiving from the fuel bowser, a general reduction in signal strength to taxiway Charlie, Delta and the runway 09 threshold greater than −70 dBm.

However, the readability scores in this testing did not score less than 3 (readable with considerable difficulty).

The results of schedule 2 testing are shown in Appendix 2.

Dash 8 signal strength and readability testing

Schedule 3 testing was conducted on the afternoon of 14 March 2024 at around the same time as the occurrence and measured the signal strength and readability during CTAF transmissions from a QantasLink DHC-8-316, Dash 8 aircraft, VH-SBI.

The VHF radios installed in both VH-SBI (test aircraft) and VH-TQZ (occurrence aircraft) were Collins Aerospace VHF Transceiver Model: VHF-22C, Part No: 822-1113-021, with RF Power Output 20W Nominal/16W Minimum. These were installed after being released to service in 2022 in Singapore.

Dash 8 flight crew with an ATSB investigator conducted a modified schedule 1 test using both the No 1 VHF COM antenna (VHF COM 1) mounted on the roof of the aircraft forward of the wings and No 2 VHF COM antenna (VHF COM 2) mounted on the belly of the Dash 8 (Figure 4) to provide comparative ground-based signal strength and readability results. The testing focused on the recorded signal strength and reception of radio signals to and from the Dash 8 to ATSB and ACMA staff using ACMA measuring equipment in ARO car 3 which relocated around the aerodrome for the series of tests.

The purpose of this testing was to ascertain if there were any limitations of the reception and transmission of radio signals that may be affected by attenuation of the signal due to reflection, refraction or shielding from aircraft structure and what limitations this might have on both VHF COM 1 and COM 2.

This testing was conducted by the Dash 8 transmitting on VHF COM 1 first and subsequently from COM 2 from 6 locations around Mildura Airport (Figure 8). These locations were at:

- gate 3 (nose in)
- hold point taxiway C
- hold point taxiway D
- starter extension on runway 09
- runway 09 threshold
- 1,500 ft into runway 09.

The ARO vehicle (car 3) with the ACMA staff and test equipment then progressed to various locations around the airport to take transmission and readability measurements. The stationary ACMA vehicle (car 1) recorded measurements of the same VH-SBI transmissions.

The testing identified that between the Dash 8 and the radio reception points on the aerodrome, the lesser the distance and greater the line of sight, the clearer the radio transmission was with a readability of 4 (readable with practically no difficulty) or more and signal strengths stronger than −70 dBm.

The testing also identified that the most significant reduction in recorded signal strength and readability was received when transmitting greater distances at:

- receiving and transmitting from the runway 09 starter extension to the runway 36 threshold on VHF COM 2 scored a readability assessment of 2 (readable now and then), and signal strength weaker than the −70 dBm acceptable signal strength limit
- receiving and transmitting from the runway 09 threshold to the runway 36 threshold on VHF COM 2 with a readability of 1 (unreadable), and −85 dBm signal strength, 15 dBm weaker than the acceptable signal strength of −70 dBm
- receiving transmissions from the 09 threshold or starter extension to taxiway Alpha on VHF COM 2 with a readability of 1 (unreadable), and −85 dBm signal strength, 15 dBm weaker than the acceptable signal strength of −70 dBm

It was identified that transmission and reception from the Dash 8 were considered 1 (unreadable) from the runway 09 threshold to the runway 36 threshold on VHF COM 2, while these were 5 (perfectly readable) to 4 (readable with practically no difficulty) on VHF COM 1.

Testing also identified a significant reduction in recorded signal strength and readability was recorded when the Dash 8 was:

- parked at gate 3 (nose in) transmitting and receiving to the threshold of runway 27 on VHF COM 2
- transmitting and receiving from holding points Delta and Charlie to the runway 36 threshold and holding point Alpha on VHF COM 2.

General trends identified from schedule 3 testing were that:

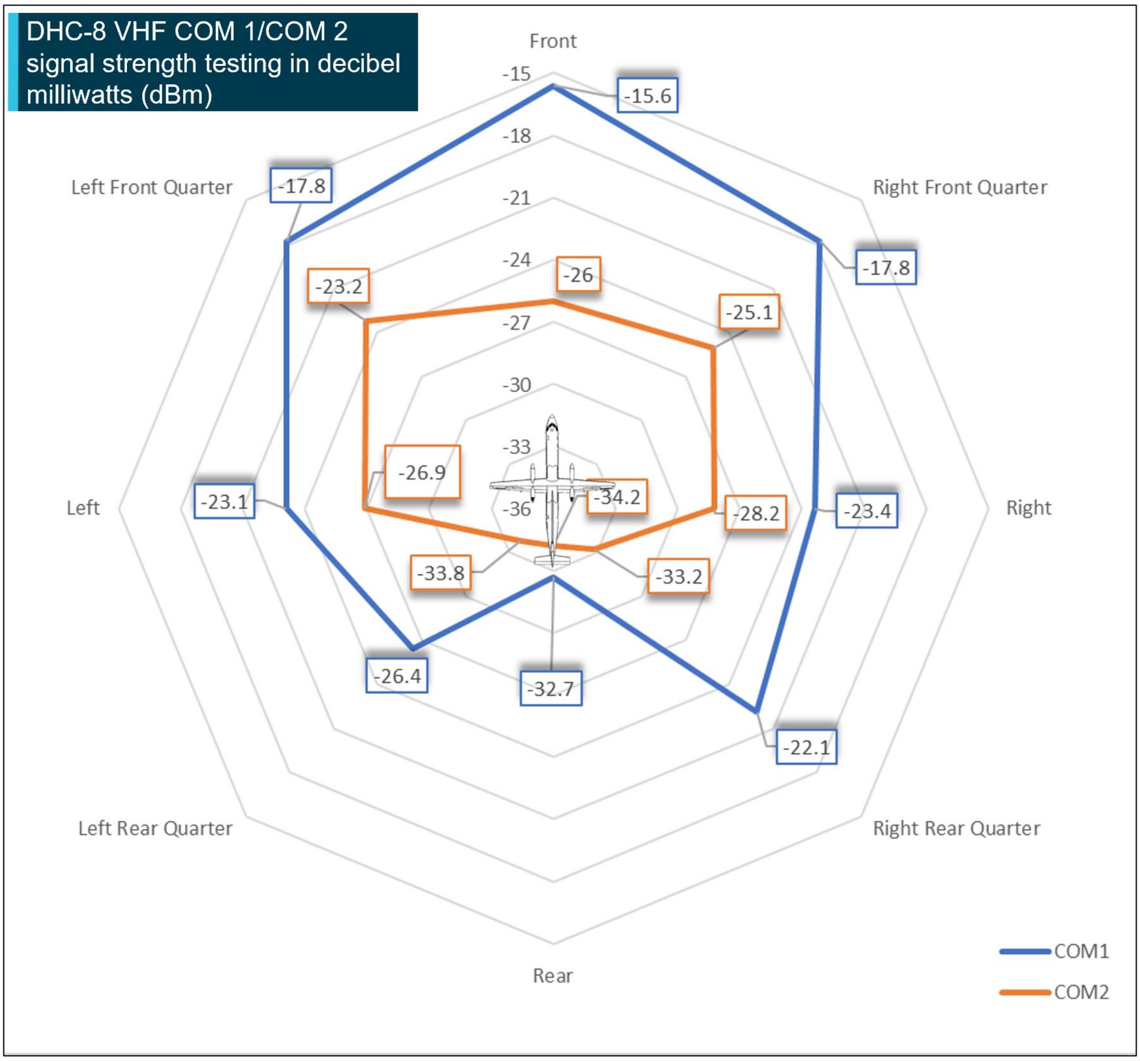
- Dash 8 VHF radio readability was most adversely affected by stations transmitting from directly behind the Dash 8 on both VHF COM 1 and 2 with slightly reduced readability and increasing signal weakness with increasing distance.
- VHF radio readability was adversely affected by increased distance between the ground-based stations, this was more evident on VHF COM 2, leading to unreadable radio signal readability and weaker signal strength.
- VHF readability was somewhat adversely affected from the runway 27 threshold to the runway 09 threshold using VHF COM 2, however Dash 8 reception from the runway 09 threshold reduced further to become only 2 (readable now and then).

Dash 8 airframe signal strength and shielding testing

The purpose of schedule 4 testing was to ascertain if there were any limitations of the reception and transmission of radio signals that may be affected by attenuation of the signal due to reflection, refraction or shielding from aircraft structure and what limitations this might have on both VHF COM 1 and COM 2.

The testing was conducted on the Mildura apron, adjacent to parking bay 3, with VH-SBI facing towards the terminal (nose in), simulating the startup position with engines running. An ATSB investigator was also present on the flight deck with operator's crew. ATSB and ACMA staff conducted a ground-based signal strength and readability test from the tarmac at about 20 m distance from the aircraft at 8 cardinal points around the aircraft (Figure 9). The testing was restricted to close proximity testing and possible results from a greater distance may vary. However, the magnitude of variation even at close distance was considered significant.

Figure 9: Dash 8 airframe signal strength and shielding testing



It should be noted that when considering these schematics the higher dBm figures (less negative and located on the outside of the antennae radiation pattern) are of a stronger signal strength level with a greater readability.
Source: ACMA test data, annotated by the ATSB

Testing identified that:

- the signal strength was strongest towards the front of the aircraft and weakest to the rear using VHF COM 1
- the signal strength of VHF COM 2 was consistently less (greater than half strength) at all locations with the VHF COM 2 maximum loss (−10 dBm) at the front and right rear quarter most notable.
- at the direct rear of the aircraft, the lowest VHF COM 1 strength (−32.7 dBm) was recorded and was consistent with similar levels to VHF COM 2
- transmissions on VHF COM 2 on the ground had significantly reduced strength compared to VHF COM 1 and that radio reception and transmission strength to the rear of the aircraft was reduced on both VHF COM1 and VHF COM 2.

The results of schedule 4 testing are shown at Table 3.

Table 3: 8-point testing VH-SBI

8-point clock code reception readings	DHC-8 VH-SBI Signal Strength (dBm)		
Location	VHF COM1	VHF COM2	Difference COM1 vs COM2
Front	-15.6	-26	-10.4
Right Front Quarter	-17.8	-25.1	-7.3
Right	-23.4	-28.2	-4.8
Right Rear Quarter	-22.1	-33.2	-11.1
Rear	-32.7	-34.2	-1.5
Left Rear Quarter	-26.4	-33.8	-7.4
Left	-23.1	-26.9	-3.8
Left Front Quarter	-17.8	-23.2	-5.4

Aircraft antenna installation and condition

The operator identified the VHF COM 2 antenna on the test aircraft, VH-SBI, was installed on 23 March 2020.

The operator's approved maintenance program included a company derived task to remove the VHF COM antennas at each 7,000 hr 'C Check' and to inspect both the fuselage mounting surface, perforated foil gasket and antenna for corrosion and condition.

No defects were identified relating to the antenna or base plate mount, either prior to the testing or after.

No corrosion or foreign object damage to the antenna or mount was identified and the operator was not aware of any directives or advisory information from the manufacturer regarding elevated risk of corrosion in this location.

Dash 8 aircraft communications

VHF radio certification – ground-based testing

The Dash 8 manufacturer, De Havilland Aircraft of Canada Limited, advised that initial ground-based VHF radio testing for original certification was conducted during original certification for the Dash 8 on 29 March 1984, in Downsview, Ontario, Canada and that this involved measuring the field strength intensity of the reception of radio signal of VHF COM 2 in ground-to-ground communications of a single aircraft. The manufacturer confirmed that at the time, there was no requirement for certification to consider the aircraft's transmission field strength intensity. The testing was recorded by an EMC-25 field intensity meter, connected to the aircraft's VHF COM 2 antenna on the ground with the aircraft conducting a tight turn while receiving radio transmissions from a ground source located at no less than 2,000 ft (610 m).

At the time of original certification in 1984, De Havilland Aircraft of Canada Limited identified that the Dash 8 aircraft radio installation was a Collins Aerospace Proline II VHF transceiver Model: VHF-22C. The radio had been certified to the required technical standing orders (TSO)-C37b and C38b standards and complied with the US Federal Communications Commission (FCC) Rules and Regulations, Parts 15 and 87 during certification testing.

Ground-based communication limitations

The ATSB supplied the above test results to De Havilland Aircraft of Canada Limited for review and comment. It identified that Dash 8 aircraft have a relatively uniform antenna polar pattern of reception on both VHF COM 1 and 2 whilst airborne and that in the air, radio range was near horizon limits. De Havilland Aircraft of Canada Limited identified that the original certification testing of the VHF COM 2 was performed at close transmitter/transceiver antenna distances and that the 1984 certification testing indicated a satisfactory result.

The De Havilland Aircraft of Canada Limited review of the ATSB Mildura test results identified that the signal strength and readability results appeared consistent with the effects of VHF line of site limitations such as physical obstructions, and intervening airport ground and localised aircraft structures, such as fuselage, wings and the tail.

De Havilland Aircraft of Canada Limited further reported that, due to the physical location of the VHF COM 1 antenna, this would inherently have better line of sight and more reliable performance in ground-based communication with other ground stations when compared to the installation location of the VHF COM 2 antenna

In response to ATSB questions about what guidance has been provided to Dash 8 operators for the use of the 2 communication channels, De Havilland Aircraft of Canada Limited reported that there was no guidance published by them on best practices for VHF radio communication usage. It was De Havilland Aircraft of Canada Limited's understanding that this was done at the airline, or national level.

In terms of the communications issues apparent in this incident, and an earlier incident at Mildura also involving a Dash 8 (see ATSB investigation AO-2023-025), De Havilland Aircraft of Canada Limited reported that it considered the root cause of both events to be operational and not aircraft related.

De Havilland Aircraft of Canada Limited further identified that due to the lower mounted aerial position of VHF COM 2, that base plate corrosion due to moisture wicking, if not drained correctly, could degrade signal strength. Additionally, antenna damage from foreign objects may also have the same effect.

Related occurrences

Occurrence history

The ATSB reviewed 30 years of recorded occurrences involving Dash 8 aircraft communication difficulties, both in the vicinity of non-controlled aerodromes and during ground-based communications at non-controlled aerodromes from 1995–2024. There were 57 communication occurrences and 51 runway-related occurrences.

Further review identified that of the above radio communication occurrences between a Dash 8 and another station, there were 25 during approach to land and 27 on the ground where the reason for the radio communication issue remained undetermined. At the time of this occurrence, these undetermined ground-based occurrences were identified across 15 different aerodromes in Australia (see Appendix C). Of these aerodromes, 10 involved a secondary runway and at the time, 4 of which also had dedicated CTAF broadcast procedures due to line of sight limitations during ground-based operations.

Ground-based air traffic services (ATS) were also identified at 9 of those aerodromes, which provides a local ground-based radio frequency and one circuit-based frequency to facilitate communication with air traffic control.

Due to the historic nature of these reported occurrences, it is not possible to provide further analysis of the exact contributing factors of the undetermined events; this could be due to numerous factors not related to limitations to line of sight, Dash 8 VHF COM 2 transmissions or reception. However, all led to a breakdown of alerted see-and-avoid during operation within the vicinity of a non-controlled aerodrome.

ATSB investigation (AO-2023-025)

On 6 June 2023, a Piper PA-28-161, registered VH-ENL, taxied for runway 36 at Mildura, Victoria. At about the same time, a QantasLink De Havilland Aircraft of Canada Limited DHC-8-315 (Dash 8), registered VH-TQH, began to taxi for runway 09. Both aircraft broadcast their intentions on the local common traffic advisory frequency. The pilot of the PA-28 was aware of the Dash 8, but the crew of the Dash 8 were not aware of the PA-28. Both aircraft commenced their take-off at about the same time and the Dash 8 crossed ahead of the PA-28 at the runway intersection of 09/36 by about 600 m.

The pilot of the PA-28 was unable to visually sight the location of the Dash 8 due to airport buildings and assumed that the Dash 8 was still backtracking on runway 09. They did not directly contact the Dash 8 to positively organise separation. They also incorrectly referred to the runway direction at Mildura Airport as 'runway 35' instead of 'runway 36'.

The Dash 8 crew was focused on obtaining their pre-departure information from air traffic control and had the volume for the radio tuned to the common traffic advisory frequency turned down. An over-transmission from air traffic control meant that the Dash 8 crew only received certain elements of the PA-28 pilot's radio calls. This likely led to an incomplete comprehension of traffic by the Dash 8 crew who believed that the PA-28 was not at Mildura (due to the incorrect reference to runway 35). However, they did not seek further information of the source of the radio calls to positively identify the traffic location.

The investigation found that, due to the topography and buildings at Mildura Airport, aircraft are not directly visible to each other on the threshold of runways 09, 27 and 36. The Dash 8 crew did not give a rolling call on runway 09, nor were they required to. The lack of a requirement for mandatory rolling calls increased the risk of aircraft not being aware of each other immediately prior to take-off.

ATSB investigation (AO-2024-009)

On 19 March 2024, a Fairchild SA226-TC Metroliner, registered VH-KGX and operated by CASAIR, taxied at Geraldton, Western Australia for runway 03. About one minute later, a Beechcraft A36 Bonanza, registered VH-CKX and operated by Shine Aviation, taxied for runway 14. After reaching their respective runway thresholds, both pilots attempted to contact the other, however, they did not hear each other, nor could they see each other. A third aircraft assisted by relaying information. Based on the information received, the Bonanza and Metroliner pilots commenced their take-off within 3 seconds of each other. The Metroliner crossed runway 14 about 400 m in front of the Bonanza, with a vertical separation of about 250–300 ft.

The investigation found that, when aircraft were positioned at the thresholds of runway 03 and 14 (and 08), they will unlikely be visible to each other due to the position of the airport buildings. Further, they may not be contactable on VHF radio due to potential shielding effects. This resulted in the pilots being unable to verify each other's position and intentions prior to commencing their take-off.

While the pilot of the third aircraft was attempting to assist, the details provided were inaccurate and incomplete. This inadvertently resulted in misinterpretation by the Bonanza and Metroliner pilots and influenced their decision to take off.

ATSB investigation (AO-2024-041)

The ATSB is investigating a runway incursion involving a De Havilland Aircraft of Canada Limited DHC-8-402 registered VH-QOD and a Piper PA-28, registered VH-XDK, at Wagga Wagga Airport, New South Wales, on 15 July 2024.

The De Havilland Aircraft of Canada Limited DHC-8 entered active runway 05 as the Piper PA-28 began its take-off roll. The crew of the DHC-8 was made aware of the PA-28 by another aircraft and stopped, reversing the aircraft clear of the runway.

Both crews report making the appropriate radio calls, however, no radio calls were heard from either aircraft reportedly due to known radio shielding.

The investigation is continuing.

Safety analysis

Introduction

On 29 September 2023, a Lancair, registered VH-VKP (Lancair) lined up for take-off on runway 36 at Mildura, however, a QantasLink De Havilland Aircraft of Canada Limited DHC-8-315 registered VH-TQZ (Dash 8), was just becoming airborne on runway 09 at Mildura. The Lancair stopped on the runway after being alerted to the conflicting traffic by the Dash 8 and another aircraft, the Dash 8 crossed ahead of the Lancair at the runway intersection.

This analysis will explore the operational considerations pertaining to radio calls and communication at Mildura Airport, the flight crew and pilot's mental models, and factors pertaining to the breakdown of communication.

Communication and local traffic mental models

Succinct and timely radio communication is important to ensure high levels of situational awareness and aids in providing enhanced alerted see-and-avoid safety outcomes. As such, the accuracy of the information broadcast by pilots is also critical in ensuring minimum misunderstanding.

The ATSB investigation considered a range of human factors that could have influenced the decisions and actions of the pilots involved. While both the Dash 8 and the Lancair crews made radio calls in accordance with the applicable regulation and guidance, not being aware of each other meant that they were unable to anticipate the risk of collision and take appropriate action.

Alerted see-and-avoid relies on crew/pilot awareness of all traffic in the vicinity that may be considered a hazard to their operations. Enhanced situational awareness requires the crew/pilot mental model of the location and intentions of nearby traffic being updated in order to form an evolving understanding of the nearby traffic.

Without this information, the likelihood of effective situational awareness is degraded, and the mental model and shared understanding of hazards is compromised.

During one of the busiest parts of passenger transport operations from a non-controlled aerodrome, the crew of the Dash 8 were managing the co-ordination and deconfliction of a number of other airborne aircraft in the vicinity of Mildura Airport. This added complexity within the busy phase of pre-departure for the Dash 8 crew and likely led to attentional focus on the identified airborne traffic. Reduced Dash 8 ground-based signal reception associated with distance between the stations, aircraft and geographical shielding, likely reduced the clarity of calls on the CTAF. Although the Lancair pilot's taxi call was not over-transmitted and was likely received by the Dash 8's radio, its reduced clarity meant it would have required more of the crew's attention to notice and interpret.

A significant amount of radio use was recorded by the Mildura CTAF prior to the occurrence (Appendix A). Substantial use can introduce difficulty in identifying relevant parties, especially during multiple runway operations. The Dash 8 crew had focussed their concern on the identified overhead aircraft as an increased threat to their operation and, while in the protracted process of organising this separation, was not aware of the Lancair. The phenomenon of inattentional blindness, where an unexpected stimulus is not perceived even though it can be physically seen (Mack & Rock, 1998), also applies to auditory stimulus. Known as inattentional deafness, being focused on something else in the auditory environment reduces the chance of hearing an unexpected but salient auditory event (Dehais and others, 2012). The more a person's attention is required for other tasks, the higher the chance of missing something unexpected, such as the Dash 8 crew missing the Lancair taxi call while focused on overhead aircraft. At an extreme end of this spectrum is cognitive tunnelling where the person is too focused on the task at hand at the expense of what is happening in the present environment (Mack & Rock, 1998).

Such focus can reduce the chance of hearing and therefore appreciating the relevance of other radio broadcasts. The culmination of the Dash 8 crew's focus likely led to the Dash 8 crew not being aware that the Lancair was taxiing for a conflicting runway.

Contributing factor

The Dash 8 crew were actively engaged in multiple communications with airborne traffic to ensure separation for departure, and were not aware of the Lancair taxiing for runway 36.

While the Dash 8 was organising separation with another airborne aircraft, the pilot of the Lancair also broadcast their 'entering and back tracking' call at the same time, resulting in an over-transmission and only partial receipt of the Lancair call to the CTAF. The over-transmission was not queried by any of the other local traffic.

This was a missed opportunity that could have allowed the Dash 8 crew to update their mental model as they still had no expectation of another aircraft on the ground that had the potential to become a conflict. The Dash 8 crew continued to focus their attention on airborne traffic.

Should over-transmission occur, a request for one or both stations to repeat their last transmission is vital to ensuring position and intentions are well known to all other operators in the vicinity.

Contributing factor

The Lancair pilot's entering and backtracking radio call for runway 36 was partially over-transmitted. This did not afford an opportunity to alert other aircraft as to their location or intentions.

The pilot of the Lancair did not hear the calls from the Dash 8, and visual identification of the location of the Dash 8 backtracking on runway 09 was not possible from the threshold of runway 36. This likely reduced the effectiveness of the alerted see-and-avoid principle and prevented the Lancair pilot from seeing the other traffic on runway 09.

Analysis of the radio calls made on the CTAF frequency and the traffic at Mildura, identified that both airborne and taxiing traffic did not witness any direct communication, between either the departing Dash 8 crew or the taxiing Lancair. It is highly likely that both the Dash 8 crew and the Lancair pilot did not either receive or recognise each other's positional broadcasts and therefore were not able to update their mental model of other aircraft in the vicinity of Mildura Airport at the time.

Contributing factor

Neither the Dash 8 nor the Lancair crews heard each other's previous radio calls prior to the Dash 8 taking off on runway 09, and the Lancair giving a rolling call on runway 36.

The Lancair pilot was aware of other airborne traffic and traffic taxiing behind them as they entered and backtracked runway 36.However, during all the time from start up, taxi and entry to runway 36, they were not aware of the Dash 8 backtracking and holding on the threshold of 09, likely a result of weaker signal strength transmission from the VHF COM 2 of the Dash 8 at the threshold of runway 36, there being no visual line of sight between the thresholds of runway 36 and 09, and localised radio transmission effects between these two locations.

The crew of the Dash 8 were not aware of the presence of the Lancair as a threat to their operation. Although visibility was greater than 10 km with no cloud in the area, start-up, taxi direction and entering the runway orientation of the Dash 8, meant that visibility of the GA apron was limited to the Dash 8 crew with it being behind them. Visual searches prior to take-off on runway 09 for other conflicting traffic were likely obscured by obstacles such as trees, hangars and buildings between the threshold of runway 09 and runway 36.

Furthermore, the Dash 8 crew also checked electronic surveillance equipment prior to departure and did not identify any conflicting traffic.

In addition to neither crew hearing radio calls from the other aircraft, the above resulted in both crew of the Dash 8 and the pilot of the Lancair having incorrect mental models of the local traffic at Mildura during their take-off. While each of the pilots made assumptions as to local traffic location and intentions, neither were directly aware of each other to positively ascertain traffic separation, resulting in a missed opportunity to utilise the mitigation of alerted see-and-avoid effectively.

Contributing factor

Both the Dash 8 and Lancair crews had no awareness of each other at any stage until after the Dash 8 was taking off, and the Lancair pilot gave a rolling call.

The Mooney pilot taxiing behind the Lancair, became situationally aware of the departing Dash 8 on runway 36 and identified the potential collision risk as the Lancair gave a rolling call on runway 09. At this time, the Dash 8 requested the Lancair stop their take-off, however fearing that the Lancair may not have understood the import of the call, the pilot of the Mooney advised the Lancair to hold their position, due to the departing traffic. This third-party intervention likely prevented a near miss or collision at the runway 09/36 intersection.

Other finding

Third party intervention by the Mooney pilot prevented the Lancair from rolling on runway 36. The Lancair pilot held on the runway until the Dash 8 departed.

Dash 8 radio reception and transmission

The VHF radio strength and readability testing conducted at Mildura on 14 March 2024 by the ATSB in conjunction with the Australian Communications and Media Authority (ACMA), identified that Dash 8 signal strength reception could be adversely affected by the Dash 8's orientation relative to the other aircraft or antenna locations. Significant recorded signal reduction on both VHF COM 1 and VHF COM 2 radios was observed when the tail of the aircraft was pointed towards the receiver.

Schedule 3 testing with no geographical or man-made obstructions between stations identified that the Dash 8 with the nose in at the terminal gate and tail pointed to the end of runway 27, recorded a significant drop in readability on VHF COM 2 to the threshold of runway 27 to a readability of 3 (readable with considerable difficulty). Signal strength weakening, over one of the shortest distances tested was also observed. Conversely, testing on VHF COM 2 at the taxiway Charlie holding point to the threshold of runway 27 with almost the same physical distance, but different aircraft orientation at about right angles to the runway 27 threshold, resulted in perfectly readable transmissions and adequate signal strength.

This had the effect of reducing the likelihood that other ground-based airfield users located behind the Dash 8 would either receive the transmission or that the Dash 8 would receive transmissions made by those aft ground-based stations.

This meant that a Dash 8 taxiing from the bay, or at holding points Charlie or Delta, would be orientated with their tail towards the GA parking, refuelling area, taxiway Alpha and the threshold of runway 36. This, coupled with reduced VHF COM 2 strength and readability, significantly reduced the likelihood of transmissions being received and understood by other airfield users, which adversely affected the situational awareness of all operations in the vicinity of the aerodrome.

Contributing factor

The reduced Dash 8 radio reception and transmission strength to the rear of the aircraft affected radio call readability to and from other airfield users. This reduced the situational awareness for the Dash 8 crew and other traffic.

Testing conducted by ATSB and ACMA measured the transmission power pattern of the VHF COM 2 (via the lower antenna) on the ground and identified that signal reception exhibited significant directional variation, with the average signal strength forward of the aircraft being about 8.5 dB stronger than the average signal strength behind and to the side of the aircraft. Depending on the external physical environment and other factors, this can lead to signal degradation or loss.

While geographic obstacles and structures between the stations had the likelihood of reducing signal strength and readability in general, it was identified that a significant reduction in radio signal strength and consequent readability existed when VHF COM 2 was used for ground-based communications when compared with VHF COM 1, even when no geographical or man-made structures were present between the stations. It was further identified that Dash 8, VHF COM 2, radio signal strength also declined significantly depending on the distance between ground-based transmission stations.

VHF COM 2 transmissions made from the starter extension and threshold of runway 09, to a receiver at the threshold of runway 36 or holding point Alpha, lacked the signal strength and readability required for effective communication when compared to the use of VHF COM 1, which had an acceptable level of signal strength and readability despite potential surface-based obstacles that may partially impede VHF radio line of sight.

Schedule 3 radio signal strength testing from the Dash 8 and readability testing to and from the Dash 8 (Table 4) at taxiway Delta and Charlie with its tail pointing directly towards the holding point at taxiway Alpha and the runway 36 threshold without significant man-made shielding, had reduced Dash 8 VHF COM 2 readability and this was also reflected in the Dash 8 VHF COM 2 readability from taxiway Delta to the threshold of runway 36.

Table 4: Schedule 3 testing of VHF COM strength and readability

From/to/distance (m)	Transmitter/ receiver Dash 8	Readability at Car 3 receiver	Signal strength at Car 3	Car 3 readabiity at Dash 8 receiver
Taxiway D to Taxiway A, 770 m	COM 2	3-Readable with considerable difficulty	-89.50 dBm	3-Readable with considerable difficulty
	COM 1	5-Perfectly readable	-66.10 dBm	4-Readable with practically no difficulty
Taxiway D to taxiway A, 950 m	COM 2	3-Readable with considerable difficulty	-82.30 dBm	3-Readable with considerable difficulty
Taxiway D to runwy 36 , 950m	COM 1	5-Perfectly readable	-65.70 dBm	4-Readable with practically no difficulty
Taxiway C to Taxiway A, 570 m	COM 2	4-Readable with practically no difficulty	-77.10 dBm	3-Readable with considerable difficulty
	COM 1	5-Perfectly readable	-62.00 dBm	4-Readable with practically no difficulty
Taxiway C to runwy 36, 760 m	COM 2	3.5-Readable with difficulty	-82.80 dBm	3-Readable with considerable difficulty
	COM 1	5-Perfectly readable	-61.50 dBm	4-Readable with practically no difficulty

Both these tests with COM 2 indicated recorded strength values 10 to 20 dBm lower than the acceptable level with reduced readability. Comparatively, Dash 8 VHF COM 1 reception at these locations resulted in perfectly readable transmissions with improved signal strength.

Readability at the Dash 8 from taxiway Alpha and the threshold of runway 36 was also found to be significantly reduced on VHF COM 2 with some reduction on VHF COM 1.

Further to this, testing conducted with the Dash 8 at taxiway Charlie, with its tail orientated to the terminal, with a clear line of sight to both taxiway Alpha and the threshold of runway 36, showed reduced Dash 8 VHF COM 2 transmission readability and signal strength readings lower than the acceptable level. Comparatively, the Dash 8 VHF COM 1 reception at this location resulted in perfectly readable transmissions with improved signal strengths.

The readability at the Dash 8 from taxiway Alpha and the threshold of runway 36 was also found to be reduced significantly on VHF COM 2 with some reduction on VHF COM 1 readability.

The reduction of transmission strength and readability of VHF COM 2 broadcasts, coupled with the reduced transmission reception provided to the flight crew, increased the likelihood of the Dash 8 crew and the other operators in the vicinity of a non-controlled aerodrome having communication difficulties.

Given the decades of operation of this aircraft type and related types without widespread reports of radio problems using VHF COM 2 on the ground, and the difficulty in ascertaining and obtaining the applicable standards, the ATSB did not further evaluate certification aspects of the aircraft VHF radio.

Contributing factor

Dash 8 ground-based transmissions on VHF COM 2 had reduced strength and clarity. This likely led to situations where other aircraft had difficulty in receiving and understanding radio transmissions, and Dash 8 aircraft not receiving other traffic radio transmissions.

Rolling calls at Mildura Airport

Prior to take-off, rolling calls at all non-controlled aerodromes were not required when there was no identified traffic. This determination was based on the situational awareness of flight crew and may not always be correct at aerodromes where visual identification of other traffic is limited by buildings, terrain or vegetation. At Mildura Airport, it has been established that when 2 aircraft are at the thresholds of runway 09 and 36, they are not visible to each other due to buildings and trees. Similarly, 2 aircraft at either end of runway 09/27 intending to take off toward each other, may not be visible due to central runway elevation.

While the lack of visibility may be recognised by some pilots and prompt them to make a take-off rolling call, a lack of awareness of another aircraft will not prompt the pilot to consider the possibility of another aircraft. As such, a reliance on an extra broadcast through recognition of the lack of visibility will often be ineffective, especially when there is no expectation of another aircraft.

Aerodromes can mandate additional broadcasts where there is a need, such as a rolling call to improve flight crew situational awareness of conflicting traffic when there are visibility limitations. Although Mildura Airport had recognised that aircraft may not be visible to each other on the runway prior to take-off and had this noted in the En Route Supplement Australia (ERSA), they had not mandated any additional mitigating radio calls.

The need for further radio calls is exacerbated due to topography and buildings at Mildura Airport, with aircraft not directly visible to each other on the threshold of runways 09, 27 and 36.

Contributing factor

Due to topography and buildings at Mildura Airport, aircraft are not directly visible to each other on the threshold of runways 09, 27 and 36. The lack of a requirement for mandatory rolling calls increased the risk of aircraft not being aware of each other immediately prior to take-off. (Safety issue)

Operator procedures

QantasLink procedures required the use of VHF COM 2 for ground-based communication at non-controlled aerodromes. However, the use of VHF COM 2 for ground-based communications was not required for controlled airspace, where ground-based communications were conducted by VHF COM 1.

Schedule 3 ground-based signal strength testing on Mildura Airport (Table 4) identified a significant and mostly uniform reduction in the Dash 8 VHF COM 2 radio transmission strength and readability compared to the Dash 8 VHF COM 1 system. It was also found that the use of VHF COM 2 reduced ground-based recorded signal strength and call readability to other aerodrome users in comparison with signal strength and readability results from the Dash 8 VHF COM 1 system.

It was also identified that radio call reception at the Dash 8 was significantly reduced while using VHF COM 2. This was particularly evident during transmissions made in the vicinity of the threshold of runway 09 to most of the other tested locations on the airport.

Procedurally required use of the Dash 8 VHF COM 2 radio system for ground-based communications at non-controlled aerodromes reduced the likelihood of other aircraft receiving and interpreting their calls in some circumstances. Furthermore, the reduced transmission reception also increased the likelihood of Dash 8 crews not receiving strong and readable radio calls from other aerodrome users.

The use of VHF COM 1 in preference to VHF COM 2 to broadcast and receive on local frequencies during ground-based operations at non-controlled aerodromes would increase the VHF transmission strength and readability, increasing the likelihood of other aircraft and vehicles on the ground receiving a strong and clear transmission from the Dash 8 aircraft.

Radio calls made at runway 09 and 36 thresholds with reduced line of sight and at significant distances, compounded by using VHF COM 2, are less likely to be heard by other aerodrome operators. This likely reduced the situational awareness of the Dash 8 crew and all other traffic at Mildura.

In addition, many regional non-controlled aerodromes into which QantasLink Dash 8 aircraft operate have some, if not all, of the attributes of Mildura Airport. However, regardless of cross runways, non-line of sight communication due to geographical or man-made structures, the reduced transmission strength of the Dash 8 ground-based VHF COM 2 transmissions routinely used at all non-controlled aerodromes added a potential risk to clear communications that may degrade situational awareness for all operators.

ATSB analysis of 30 years of non-controlled aerodrome occurrences involving Dash 8 aircraft communication, identified 25 unresolved radio communication issues during approach and landing and 27 occurrences of radio communication difficulties in ground-based communication at 15 different aerodromes in multiple Australian states. Some of these exhibit similar characteristics to the occurrence at Mildura.

Contributing factor

The QantasLink radio procedure required Dash 8 flight crews to use the VHF COM 2 radio to broadcast and receive on local frequencies during operations at non-controlled aerodromes. This reduced the ground-based radio transmission and reception strength, and therefore reduced the likelihood of other aircraft receiving calls in some circumstances. (Safety issue)

Manufacturer advice to operators

De Havilland Aircraft of Canada Limited identified that there is no specific guidance provided on the limitations of ground-based communications on VHF COM 2 to operators. Its understanding was that most operators used VHF COM 1 for ground-based communications and that best practice VHF communication usage was conducted at an airline or national level. However, the ATSB identified that without specific knowledge of the nature or limitations of the ground-based communications provided by the manufacturer, including reduced signal strength and clarity, operators would not be in a position to identify and mitigate the risks.

Contributing factor

De Havilland Aircraft of Canada Limited did not publish any guidance to operators of Dash 8 aircraft on the transmission and reception performance limitations of VHF COM 2 radios for ground-based communications. (Safety issue)

Safety advisory notice

The Australian Transport Safety Bureau advises all operators and crew of De Havilland Aircraft of Canada Limited DHC-8 (Dash 8) aircraft to consider the use of VHF COM 1 radios for ground-based communication while operating at non-controlled aerodromes, to improve radio transmission and reception with other stations.

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.

Safety issues are highlighted in bold to emphasise their importance. A safety issue is 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 operating environment at a specific point in time.

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 aircraft separation issue during take-off involving a Lancair, VH-VKP, and De Havilland Aircraft of Canada Limited DHC-8-315, VH-TQZ, at Mildura Airport, Victoria, on 29 September 2023.

Contributing factors

- The Dash 8 crew were actively engaged in multiple communications with airborne traffic to ensure separation for departure, and were not aware of the Lancair taxiing for runway 36.
- The Lancair pilot's entering and backtracking radio call for runway 36 was partially over-transmitted. This did not afford an opportunity to alert other aircraft as to their location or intentions.
- Neither the Dash 8 nor the Lancair crews heard each other's previous radio calls prior to the Dash 8 taking off on runway 09, and the Lancair gave a rolling call on runway 36.
- Both the Dash 8 and Lancair crews had no awareness of each other at any stage until after the Dash 8 was taking off, and the Lancair pilot gave a rolling call.
- The reduced Dash 8 radio reception and transmission strength to the rear of the aircraft affected radio call readability to and from other airfield users. This reduced the situational awareness for the Dash 8 crew and other traffic.
- Dash 8 ground-based transmissions on VHF COM 2 had reduced strength and clarity. This likely led to situations where other aircraft had difficulty in receiving and understanding radio transmissions, and Dash 8 aircraft not receiving other traffic radio transmissions.
- **Due to topography and buildings at Mildura Airport, aircraft are not directly visible to each other on the threshold of runways 09, 27 and 36. The lack of a requirement for mandatory rolling calls increased the risk of aircraft not being aware of each other immediately prior to take-off.** (Safety issue)

- **The QantasLink radio procedure required Dash 8 flight crews to use the VHF COM 2 radio to broadcast and receive on local frequencies during operations at non-controlled aerodromes. This reduced the ground-based radio transmission and reception strength, and therefore reduced the likelihood of other aircraft receiving calls in some circumstances.** (Safety issue)
- **De Havilland Aircraft of Canada Limited did not publish any guidance to operators of Dash 8 aircraft on the transmission and reception performance limitations of VHF COM 2 radios for ground-based communications.** (Safety issue)

Other finding

- Third party intervention by the Mooney pilot prevented the Lancair from rolling on runway 36. The Lancair pilot held on the runway until the Dash 8 departed.

Safety issues and actions

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues. The ATSB expects relevant organisations will address all safety issues an investigation identifies.

Depending on the level of risk of a safety issue, the extent of corrective action taken by the relevant organisation(s), or the desirability of directing a broad safety message to the aviation, industry, the ATSB may issue a formal safety recommendation or safety advisory notice as part of the final report.

All of the directly involved parties were provided with 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.

The initial public version of these safety issues and actions are provided separately on the ATSB website, to facilitate monitoring by interested parties. Where relevant, the safety issues and actions will be updated on the ATSB website as further information about safety action comes to hand.

Threshold visibility

Safety issue description

Due to topography and buildings at Mildura Airport, aircraft are not directly visible to each other on the threshold of runways 09, 27 and 36. The lack of a requirement for mandatory rolling calls increased the risk of aircraft not being aware of each other immediately prior to take-off.

Issue number:	AO-2023-050-SI-01
Issue owner:	Mildura Airport
Transport function:	Aviation: Airports
Current issue status:	Closed-Adequately addressed
Issue status justification:	Mildura Airport has advised that as of 4 April 2024, a permanent Notice to Airmen (NOTAM) has been declared for Mildura Airport requiring mandatory rolling calls by all aircraft. This will increase the situational awareness of all pilots in the vicinity of Mildura Airport and alert them to aircraft about to take off and reduce the risk of potential aircraft collision on the aerodrome.

Proactive safety action taken by Mildura Airport

Action number:	AO-2023-050-PSA-01
Action organisation:	Mildura Airport
Action status:	Closed

Mildura Airport has advised that it has been successful in establishing a permanent NOTAM for Mildura Airport operations as of 4 April 2024.

The NOTAM includes the advice that aircraft are not directly visible to each other on the thresholds of runways 09, 27 and 36 and that mandatory rolling calls are required from all aircraft immediately prior to take-off due to the increased risk of aircraft not being aware of each other. This permanent NOTAM was subsumed into the ERSA publication for Mildura Airport in the 2406 amendment cycle on 13 June 2024.

Operator radio procedure

Safety issue description

The QantasLink radio procedure required Dash 8 flight crews to use the VHF COM 2 radio to broadcast and receive on local frequencies during operations at non-controlled aerodromes. This reduced the ground-based radio transmission and reception strength, and therefore reduced the likelihood of other aircraft receiving calls in some circumstances.

Issue number:	AO-2023-050-SI-02
Issue owner:	QantasLink
Transport function:	Aviation: Air transport
Current issue status:	Closed-Partially addressed
Status justification:	The interchange the use of departure transmissions to VHF COM 1 from VHF COM 2 for Mildura Airport will reduce the risk of pilots of QantasLink and other aircraft missing radio broadcasts on the ground at Mildura. The ATSB acknowledges that QantasLink has done a risk assessment of the safety issue across all non-controlled aerodromes and that assessment identified additional threats. The ATSB notes, however, QantasLink has not provided an assessment of how these threats are considered to pose a higher risk than the existing aircraft collision risk identified in the safety issue. The ATSB believes that the risk assessment may be benefited by examining aerodromes other than Mildura that exhibit similar risk factors, namely, radio shielding, visual obstructions, and/or multiple runways. Furthermore, the risk assessment did not take into account the newly introduced advice from the aircraft manufacturer in 2 flight operations service letters.

Proactive safety action taken by QantasLink

Action number:	AO-2023-050-PSA-310
Action organisation:	QantasLink
Action status:	Closed

On 17 July 2024 QantasLink fleet safety issued a fleet-wide technical advisory bulletin (TAB-2024-44) for Mildura Airport, citing changes to the VHF communication procedure only for departures at Mildura. The effective change was to interchange the use of departure transmissions to VHF COM 1 from VHF COM 2. This was to improve ground-to-ground common traffic advisory frequency (CTAF) VHF communication quality during taxi and to mitigate the airborne collision risk due to cross runway layout and communication difficulties between runways 09 and 36.

The bulletin further identified VHF radio communication as suspected to be unreliable between runways 09 and 36. It further mentioned the ATSB/ACMA testing and identified improved ground-to-ground transmission clarity and strength, due to the VHF COM 1 antenna's location on the top of the fuselage. QantasLink also reviewed a possible new procedure to address the ATSB safety issue concerning communications on local frequencies at all non-controlled aerodromes via a bowtie analysis.[8] It stated:

> Utilising VHF 2 for communications with ATS [air traffic services][9] and reserving VHF 1 for CTAF communications may limit the ability for ATS to be reached when on the ground at some aerodromes without requiring the lower-fidelity HF radio, due to the VHF 2 antenna being located on the underside of the fuselage. Contact with ATS when on the ground is essential for crew to gain an accurate awareness of … traffic movements prior to departure.
>
> The complexity of the procedure may lead to a mismanagement of radio comms swaps and potentially not hearing important traffic information. In addition, this procedure is likely to increase crew workload and subsequent operational errors.

The QantasLink analysis concluded:

> The current procedures pose lower number of threats whereas the proposed procedure would introduce three additional threats as well as increase complexities. Whilst intention of having greater safety outcomes is understood, there would be unintended consequences of additional complexity if applied to all CTAF airports.
>
> Additionally, the proposed changes would result in a degradation of several existing controls. Adopting a new procedure which isn't widely practiced within the aviation industry, adding complexity in the event of a non-normal operation and reducing the crew mental model of traffic within CTAF environments.

On 16 April 2025, Qantas stated:

> Following the implementation of the VHF comms swap procedure in Mildura, QantasLink reviewed the opportunity to adopt this procedure at all non-towered aerodromes. Upon completing a detailed risk assessment, it was determined that this change is likely to introduce unintended consequences, such as the ability to maintain effective communication with ATS when on the ground and increased flight crew workload in an already complex CTAF environment. It was also determined that the existing procedure is effective at aerodromes where there is no significant ground radio shielding and the thresholds of active runways are not visually obscured.
>
> As a result of this assessment, it was decided to confine this special procedure to aerodromes with known ground radio shielding and where the thresholds of active runways are visually obscured. At time of writing, Mildura is the only aerodrome in the QantasLink network that has been identified with these characteristics.

ATSB comment

The introduction of TAB-2024-44 introduces proactive safety action for Mildura departures, however the ATSB notes this does not encompass Dash 8 operations at other non-controlled aerodromes where Dash 8 radio transmission strength and clarity may be reduced due to the use of ground-based communications on VHF COM 2. The Mildura procedural change demonstrates the effective mitigation of Dash 8 VHF COM 1 departure communication for ground-based communications, in which consideration to all non-controlled aerodrome operations may be beneficial.

The QantasLink bowtie qualitative risk assessment on the proposed adoption of modified CTAF radio panel usage across all non-controlled aerodromes focussed on additional threats, increased complexities and controls. ATSB acknowledges that the risk assessment identified additional threats. However, QantasLink has not provided an assessment of how

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8 Bowtie analysis is a risk analysis methodology that uses a visual representation of threats, hazards, consequences, and risk controls.

9 When on the ground, pilots often need to communicate with air traffic services that are not located at the airport.

these threats are considered to pose a higher risk than the existing aircraft collision risk identified in the safety issue. QantasLink may wish to consider for example:

- the risk of being unable to contact ATS prior to taxi (when there is no immediate hazard) in comparison with the risk of missed communications with other aircraft operating in the vicinity of the aerodrome
- the level of procedural complexity and flight crew workload, considering that the procedure would be the same as is currently done at controlled aerodromes as well as Mildura, with no additional radio frequency changes to the current procedure.

The risk assessment focus was narrowed from assessing the risk of all airports due to the aircraft shielding to those with known ground shielding and did not quantify the number of affected airports with suspected geographic radio shielding within the network, or the number of airports affected by multiple runway operations and the projected likelihood of these impacts on a procedural change.

As a result, QantasLink considered Mildura as the only affected airport, however the ATSB believes that the risk assessment may be benefited by considering aerodromes other than Mildura that exhibit similar risk factors, namely, radio shielding, visual obstructions, and/or multiple runways (such as those in Appendix C).

Furthermore, the risk assessment did not take into account the newly introduced advice from the aircraft manufacturer in flight operations service letters detailing the limitation of direct line of sight VHF communications and the effects of buildings, terrain or features of the aircraft, such as the vertical stabiliser or landing gear and use of the upper fuselage antenna to provide improved communication in both transmission and reception.

Dash 8 operator guidance

Safety issue description

De Havilland Aircraft of Canada Limited did not publish any guidance to operators of Dash 8 aircraft on the transmission and reception performance limitations of VHF COM 2 radios for ground-based communications.

Issue number:	AO-2023-050-SI-03
Issue owner:	De Havilland Aircraft of Canada Limited
Transport function:	Aviation: Air transport
Current issue status:	Closed-Adequately addressed
Issue status justification:	On 6 December 2024, De Havilland Aircraft of Canada Limited released 2 flight operations service letters to operators recognising that VHF COM 1 may provide better ground-based signals to other stations either on the ground or in the air. ATSB believes that the proactive release of the flight operations service letters to inform operators of the limitations of the aircraft radio systems is sufficient for ATSB to conclude that the safety action taken by De Havilland Aircraft of Canada Limited was appropriate and timely and considers this safety issue adequately addressed.

Proactive safety action taken by De Havilland Aircraft of Canada Limited

Action number:	AO-2023-050-PSA-02
Action organisation:	De Havilland Aircraft of Canada Limited
Action status:	Closed

De Havilland Aircraft of Canada Limited provided a response on 28 November 2024 stating that:

After reviewing the details of each event, De Havilland Aircraft of Canada Limited believes the root cause of the events to be operational and not aircraft related. However, in order to increase awareness of on ground communication De Havilland released 2 flight operations service letters (FOSLs) highlighting the antenna locations.

The FOSLs were released on 6 December 2024 for the Dash-8-100/200/300 (DH8-SL-23-008A) and Dash-8-400 (DH8-SL-23-020A). Details included a description of the limitations of VHF line of sight communications and the recommendation that VHF COM 1 may provide a better signal (receiving and transmitting) to other stations on the ground, or nearby in the air.

Both FOSLs identified the location of the VHF COM 1 and COM 2 antennas and that the nature of direct line of sight VHF communications can be affected by buildings, terrain or features of the aircraft, such as the vertical stabilizer or landing gear. They also identified that use of the upper fuselage antenna may provide a better line of sight with other aircraft or ground stations, which may result in improved communication in both transmission and reception.

The FOSLs are both located in Appendix D.

Safety advisory notice to operators and crew of De Havilland Aircraft of Canada Limited DHC-8 aircraft

SAN number	AO-2023-050-SAN-01

The Australian Transport Safety Bureau advises all operators and crew of De Havilland Aircraft of Canada Limited DHC-8 (Dash 8) aircraft to consider the use of VHF COM 1 radios for ground-based communication while operating at non-controlled aerodromes to improve radio transmission and reception with other stations.

Safety action not associated with an identified safety issue

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 QantasLink addressing CTAF operations

- The introduction of rolling calls at all CTAF aerodromes through introduction of changes to their current operations manual.
- Pilot group provided further guidance on specifics of potential radio wave degradation on the ground between runway 36 and 09 thresholds at Mildura.

General details

Occurrence details

Date and time:	29 September 2023 – 13:44 AUS Eastern Standard Time	
Occurrence class:	Incident	
Occurrence categories:	Runway incursion, Aircraft separation issues	
Location:	Mildura Airport	
	Latitude: 34.2292 º S	Longitude: 142.0856º E

Aircraft 1 details

Manufacturer and model:	DE HAVILLAND AIRCRAFT OF CANADA LIMITED DHC-8-315	
Registration:	VH-TQZ	
Operator:	QantasLink	
Serial number:	555	
Type of operation:	Part 121 Australian air transport operations - Larger aeroplanes-Standard Part 121	
Activity:	Commercial air transport-Scheduled-Domestic	
Departure:	Mildura Airport, VIC	
Destination:	Melbourne Airport, VIC	
Persons on board:	Crew – 4	Passengers – 50
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Aircraft 2 details

Manufacturer and model:	AMATEUR BUILT AIRCRAFT LANCAIR	
Registration:	VH-VKP	
Operator:	Private	
Serial number:	17	
Type of operation:	Part 91 General operating and flight rule	
Activity:	General aviation / Recreational-Sport and pleasure flying-Pleasure and personal transport	
Departure:	Mildura Airport, VIC	
Destination:	Broken Hill Airport, NSW	
Persons on board:	Crew – 1	Passengers – 2
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Glossary

ACFT	Aircraft
ATS	Air traffic services
ADS-B	Automatic dependant surveillance - broadcast
ATPL	Air transport pilot licence
ACMA	Australian Communications and Media Authority
ARO	Aerodrome reporting officer
ATSB	Australian Transport Safety Bureau
BCST	Broadcast
CAAP	Civil aviation advisory publication
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation 1998
CTAF	Common traffic advisory frequency
dBM	Decibels per milliWatt
ERSA	En Route Supplement Australia
FO	First officer
FOSL	Flight operations service letter
IFR	Instrument flight rules
NOTAM	Notice to airmen
RA	Resolution advisory
RWY	Runway
TA	Traffic advisory
TFC	Traffic
THR	Threshold
TWY	Taxiway
TCAS	Traffic collision advisory system
VFR	Visual flight rules
VHF	Very high frequency

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the pilot of VH-ENL
- the crew of VH-TQH
- the crew of QLINK 404
- The pilot of VH-NNR
- QantasLink
- De Havilland Aircraft of Canada Limited
- Civil Aviation Safety Authority
- Airservices Australia
- Mildura Airport
- AVDATA
- ADSB data

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Hobbs, A. (1991). *Limitations of the see-and-avoid principle.* Canberra: Australian Transport Safety Bureau.

Mack, A., & Rock, I. (1998). *Inattentional blindness.* Cambridge MA: MIT Press.

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:

- Civil Aviation Safety Authority

- Airservices Australia
- Mildura Airport
- QantasLink
- De Havilland Aircraft of Canada Limited
- pilot of VH-VKP
- crew of VH-TQZ
- crew of QLNK 404.

Submissions were received from:

- Civil Aviation Safety Authority
- QantasLink
- De Havilland Aircraft of Canada Limited.

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

Appendices

Appendix A – Recorded VHF radio transmissions

Table 5: Recorded VHF radio transmissions

UTC 29 Sept	Origin	Call transcript
1343:14:00	QLINK 81	Mildura traffic QLINK 81, taxi's runway 09 for Melbourne
1344:26:00	QLINK 81	Mildura traffic QLINK 81, enters and backtracks full length runway 09 Mildura
1345:00:00	QLINK404	Midura traffic, QLINK 404, taxies runway 09, will hold short of runway for now, Mildura.
1345:22:00	QLINK*81	Zulu Papa Victor, QLINK 81
1345:32:00	QLINK 81	And 1769, QLINK 81
1345:27:00	Tecnam 1769	QLINK 81, 1769 go ahead
1345:30:00	QLINK 81	We are about to line up and roll on 09, will be making a right turn for departure to Melbourne, can you confirm your current position north of the field?
1345:48:00	Tecnam 1769	Can do, 6 NM to the north of the field at the moment
1345:55:00	QLINK 81	Understood, just need you remain north of the field until we have departed?
1346:00:00	Tecnam 1769	Understood, will remain north of the field until you have departed.
1346:04:00	QLINK 81	Zulu Papa Victor, QLINK 81
1346:23:00	VH-ZPV	Traffic, Zulu Papa Victory passing 2,000 ft, descending to 1,200, going mid-downwind 27, Mildura traffic
1346:44:00	Lancair	Mildura traffic, Lancair Victor Kilo Papa, taxiing for runway 36, Mildura traffic.
1346:51:00	QLINK 81	Zulu Papa Victor, QLINK 81
1346:54:00	ZPV	Zulu Papa Victor, reading correct, going cross wind 09, Mildura traffic
1347:01:00	QLINK 81	Copied, so you're joining runway 09, is that correct?
1347:06:00	ZPV	Copied that, going crosswind 09, Mildura traffic
1347:25:00	ZPV	Mildura traffic, Zulu Papa Victor, remaining on the dead side, Mildura traffic.
1347:34:00	Mooney	Traffic Mildura CTAF, November November Romeo a Mooney, taxiing for Albury, runway 36 for departure. Copied Lancair, also taxiing runway 36.
1347:47:00	QLINK 81	Zulu Papa Victor just confirm…
1347:51:00	Lancair	(Over-transmission; QLINK 81 continuing transmission and likely part of Victor Kilo Papa call for entering and backtracking runway 36)
1347:56:00	Lancair	…back tracking runway 36
1347:58:00	ZPV	Zulu Papa Victory, tracking dead side 09, Mildura traffic
1348:24:00	ZPV	Zulu Papa Victory, maintaining dead side 09, Mildura traffic
1348:42:00	QLINK 81	Mildura, QLINK 81, rolling runway 09 for upwind departure.
1349:06:00	Lancair	Mildura traffic, Lancair Victor Kilo Papa rolling runway 36 for straight out departure to the north, Mildura traffic.
1349:14:00	QLINK 81	…aircraft rolling 36, hold.
1349:19:00	Mooney	Victor Kilo Papa hold there, aircraft taking off 09.
1349:24:00	Lancair	Victor Kilo Papa
1349:50:00	Mooney	Good to go now sir
1349:54:00	Lancair	VKP rolling runway 36, departure to the north, VKP, Mildura traffic.
1350:01:00	QLINK 81	Traffic Mildura QLINK 404, Dash 8, entering and backtracking 09 will be for departure to the East, climbing to flight levels.
1350:13:00	Mooney	VKP, your hatch is open sir, on the back of your aircraft
1350:18:00	Lancair	VKP, just caught that
1350:20:00	Mooney	Traffic Mildura, November November Romeo entering and backtracking runway 36 for departure to Albury, copied traffic taxiing runway 09.

Source: Transcribed from Airservices and AVDATA recorded data 29 September 2024

Appendix B – CTAF transmission test results

Schedule 1 test – CTAF transmission testing

Test Date/Time		Readings at ACMA Car 3			Readings at ARO Car 2		Distance & direction to transmitter		Readings at ACMA Car 1	
Date	Time	ACMA Reading Car 3 dBm)	Car 3 Readability Rating 1 - 5	Receiving location ACMA	Transmit location ARO	Car 2 Readability Rating 1 - 5	Distance (metres)	Directio n (degs)	Screen_XXX.png File	ACMA Reading Car 1 near AVDATA antenna (dBm)
13/03/2024	12:22:00 PM	-73.5	4.0	CAR 3 (ACMA) - RWY09 Threshold	CAR 2 (ARO) - Taxiway Delta	5.0	840	107	007	-60.5
	12:25:00 PM	-80.6	4.0		CAR 2 (ARO) - Taxiway Charlie	5.0	1140	106	008	-60.9
	12:27:00 PM	-85.0	4.0		CAR 2 (ARO) - Taxiway Bravo	5.0	1440	114	009 010	-73.0
	12:31:00 PM	-84.5	4.0		CAR 2 (ARO) - Taxiway Alpha	5.0	1550	123	011	-66.1
	12:34:00 PM	-83.6	4.0		CAR 2 (ARO) - RWY36 Threshold	5.0	1680	127	012	-66.3
	12:37:00 PM	-88.2	3.0		CAR 2 (ARO) - RWY27 Threshold	5.0	1800	100	013	-79.2
13/03/2024	12:43:00 PM	-75.1	4.5	CAR 3 (ACMA) - Taxiway Delta	CAR 2 (ARO) - RWY27 Threshold	5.0	970	97	014	-75.5
	12:46:00 PM	-83.6	3.0		CAR 2 (ARO) - RWY36 Threshold	5.0	950	146	015	-69.5
	12:47:00 PM	-70.7	5.0		CAR 2 (ARO) - Taxiway Alpha	5.0	770	141	016	-66.1
	12:49:00 PM	-67.9	5.0		CAR 2 (ARO) - Taxiway Bravo	5.0	610	122	017	-72.8
	12:51:00 PM	-55.3	5.0		CAR 2 (ARO) - Taxiway Charlie	5.0	300	102	018	-60.8
	12:53:00 PM	-73.9	5.0		CAR 2 (ARO) - RWY09 Threshold	5.0	850	287	019	-80.4
13/03/2024	12:55:00 PM	-79.0	4.0	CAR 3 (ACMA) - Taxiway Charlie	CAR 2 (ARO) - RWY09 Threshold	5.0	1130	285	020	-80.6
	12:57:00 PM	-54.1	5.0		CAR 2 (ARO) - Taxiway Delta	5.0	300	381	021	-70.8
	12:59:00 PM	-58.6	5.0		CAR 2 (ARO) - Taxiway Bravo	5.0	360	140	022	-76.3
	1:00:00 PM	-67.7	5.0		CAR 2 (ARO) - Taxiway Alpha	5.0	570	158	023	-65.3
	1:01:00 PM	-71.1	5.0		CAR 2 (ARO) - RWY36 Threshold	5.0	760	161	024	-71.2
	1:03:00 PM	-67.0	5.0		CAR 2 (ARO) - RWY27 Threshold	5.0	660	94	025	-74.9
13/03/2024	1:05:00 PM	-62.2	5.0	CAR 3 (ACMA) - Taxiway Bravo	CAR 2 (ARO) - RWY27 Threshold	5.0	500	63	026	-74.9
	1:07:00 PM	-61.1	5.0		CAR 2 (ARO) - RWY36 Threshold	5.0	460	177	027	-70.6
	1:08:00 PM	-52.6	5.0		CAR 2 (ARO) - Taxiway Alpha	5.0	270	181	028	-60.6
	1:09:00 PM	-57.9	5.0		CAR 2 (ARO) - Taxiway Charlie	5.0	350	321	029	-67.9
	1:11:00 PM	-70.6	5.0		CAR 2 (ARO) - Taxiway Delta	5.0	600	302	030	-70.8
	1:12:00 PM	-86.1	5.0		CAR 2 (ARO) - RWY09 Threshold	5.0	1440	294	031	-81.9

Test Date/Time		Readings at ACMA Car 3			Readings at ARO Car 2		Distance & direction to transmitter		Readings at ACMA Car 1	
Date	Time	ACMA Reading Car 3 dBm)	Car 3 Readability Rating 1 - 5	Receiving location ACMA	Transmit location ARO	Car 2 Readability Rating 1 - 5	Distance (metres)	Directio n (degs)	Screen_XXX.png File	ACMA Reading Car 1 near AVDATA antenna (dBm)
13/03/2024	1:18:00 PM	-84.3	**4.0**	CAR 3 (ACMA) - Taxiway Alpha	**CAR 2 (ARO) - RWY09 Threshold**	5.0	1530	302	032	-82.8
	1:20:00 PM	-76.1	**4.5**		**CAR 2 (ARO) - Taxiway Delta**	5.0	790	320	033	-70.8
	1:22:00 PM	-70.2	**5.0**		**CAR 2 (ARO) - Taxiway Charlie**	5.0	580	339	034	-68.0
	1:23:00 PM	-52.4	**5.0**		**CAR 2 (ARO) - Taxiway Bravo**	5.0	270	4	035	-74.2
	1:25:00 PM	-46.1	**5.0**		**CAR 2 (ARO) - RWY36 Threshold**	5.0	200	169	036	-72.0
	1:28:00 PM	-67.9	**5.0**		**CAR 2 (ARO) - RWY27 Threshold**	5.0	650	43	037	-74.2
13/03/2024	1:30:00 PM	-70.9	5.0	CAR 3 (ACMA) - RWY36 Threshold	**CAR 2 (ARO) - RWY27 Threshold**	5.0	790	31	038	-73.5
	1:32:00 PM	-46.3	5.0		**CAR 2 (ARO) - Taxiway Alpha**	5.0	200	350	039	-60.4
	1:33:00 PM	-60.1	5.0		**CAR 2 (ARO) - Taxiway Bravo**	5.0	450	357	040	-76.8
	1:35:00 PM	-70.2	5.0		**CAR 2 (ARO) - Taxiway Charlie**	5.0	760	341	041	-68.4
	1:36:00 PM	-77.3	4.0		**CAR 2 (ARO) - Taxiway Delta**	5.0	940	326	042	-71.6
	1:38:00 PM	-84.2	3.5		**CAR 2 (ARO) - RWY09 Threshold**	5.0	1690	308	043	-82.2
13/03/2024	1:44:00 PM	-86.9	3.0	CAR 3 (ACMA) - RWY27 Threshold	**CAR 2 (ARO) - RWY09 Threshold**	3.0	1800	281	044	-82.3
	1:46:00 PM	-73.7	5.0		**CAR 2 (ARO) - Taxiway Delta**	5.0	950	276	045	-72.6
	1:47:00 PM	-66.2	5.0		**CAR 2 (ARO) - Taxiway Charlie**	5.0	660	272	046	-60.4
	1:49:00 PM	-63.2	5.0		**CAR 2 (ARO) - Taxiway Bravo**	5.0	490	243	047	-74.3
	1:50:00 PM	-67.9	5.0		**CAR 2 (ARO) - Taxiway Alpha**	5.0	660	223	048	-65.8
	1:51:00 PM	-71.2	5.0		**CAR 2 (ARO) - RWY36 Threshold**	5.0	800	210	049	-71.7
13/03/2024	1:53:00 PM	-76.8	4.5	CAR 3 (ACMA) - International flying school runup bay	**CAR 2 (ARO) - RWY36 Threshold**	5.0	1040	130	050	-71.9
	1:55:00 PM	-75.4	5.0		**CAR 2 (ARO) - Taxiway Alpha**	5.0	910	122	051	-62.0
	1:56:00 PM	-80.2	5.0		**CAR 2 (ARO) - Taxiway Bravo**	5.0	820	105	052	-76.3
	1:58:00 PM	-65.7	5.0		**CAR 2 (ARO) - Taxiway Charlie**	5.0	570	85	053	-67.9
	1:59:00 PM	-54.2	5.0		**CAR 2 (ARO) - Taxiway Delta**	5.0	290	70	054	-71.6
	2:01:00 PM	-79.4	4.0		**CAR 2 (ARO) - RWY27 Threshold**	5.0	1220	90	055	-73.7

Schedule 2 test – CTAF transmission testing from Cessna 172 VH-ZJA

Test Date/Time		Readings at ACMA Car 3			Readings at VH-ZJA		Distance & direction to transmitter		Readings at ACMA Car 1	
Date	Time	ACMA Reading Car 3 (dBm)	Readability Rating 1 - 5 at Car 3	Receiving location ACMA	Transmit location	Readability Rating 1 - 5 at VH-ZJA	Distance (metres)	Direction (degs)	Screen_XXX.png file	ACMA Reading Car 1 near AVDATA antenna (dBm)
14/03/2024	9:47:00 AM	**-79.50**	3	CAR 3 (ACMA) - RWY09 Threshold	**VH-ZJA - Fuel Bowser**	5	1290	298°	056	**-42.8**
	9:48:00 AM	**-64.90**	5	CAR 3 (ACMA) - 1,500 ft into RWY 09		4	890	307°		**-42.6**
	9:50:00 AM	**-56.90**	5	CAR 3 (ACMA) - Taxiway Delta		4	510	319°		**-43.0**
	9:52:00 AM	**-53.80**	5	CAR 3 (ACMA) - Taxiway Charlie		4	320	354°		**-42.6**
	9:54:00 AM	**-45.90**	5	CAR 3 (ACMA) - Taxiway Alpha		5	280	148°		**-42.8**
	9:50:00 AM	**-50.40**	5	CAR 3 (ACMA) - RWY36 Threshold		5	480	154°		**-42.0**
	10:01:00 AM	**-59.90**	5	CAR 3 (ACMA) - RWY27 Threshold		5	640	067°	064	**-36.3**
14/03/2024	10:06:00 AM	**-62.10**	5	CAR 3 (ACMA) - RWY27 Threshold	**VH-ZJA - Taxiway Alpha**	5	1550	302°	065	**-57.0**
	10:09:00 AM	**-39.70**	5	CAR 3 (ACMA) - RWY36 Threshold		5	200	168°		**-57.4**
	10:11:00 AM	**-59.10**	5	CAR 3 (ACMA) - Taxiway Charlie		5	580	338°		**-57.0**
	10:13:00 AM	**-64.30**	5	CAR 3 (ACMA) - Taxiway Delta		5	790	320°		**-57.0**
	10:14:00 AM	**-71.00**	5	CAR 3 (ACMA) - 1,500 ft into RWY 09		5	1140	310°		**-57.4**
	10:16:00 AM	**-71.10**	5	CAR 3 (ACMA) - RWY09 Threshold		4	1540	303°	071	**-56.7**
14/03/2024	10:18:00 AM	**-78.70**	5	CAR 3 (ACMA) - RWY09 Threshold	**VH-ZJA - RWY36 Threshold**	5	1700	127°	072	**-64.8**
	10:20:00 AM	**-76.20**	5	CAR 3 (ACMA) - 1,500 ft into RWY 09		5	1310	316°		**-61.4**
	10:22:00 AM	**-72.10**	5	CAR 3 (ACMA) - Taxiway Delta		5	790	320°		**-63.5**
	10:31:00 AM	**-65.40**	5	CAR 3 (ACMA) - Taxiway Charlie		4	770	242°		**-61.7**
	10:33:00 AM	**-39.20**	5	CAR 3 (ACMA) - Taxiway Alpha		5	180	351°		**-61.5**
	10:40:00 AM	**-65.40**	5	CAR 3 (ACMA) - RWY27 Threshold		5	800	031°		**-60.7**

Schedule 3 test – CTAF transmission testing from Bombardier De Havilland Aircraft of Canada Limited DHC-8-315Q VH-SBI

Test Date/Time		Readings at ACMA Car 3						Readings at VH-SBI			Distance & direction to transmitter		Readings at ACMA Car 1				
Date	Time	ACMA Reading at Car 3 (dBm) COM1	ACMA Reading at Car 3 (dBm) COM2	ACMA Reading Car 3 (dBm) Delta-COM1 Vs COM2	Readability Rating 1-5 at Car 3 COM1	Readability Rating 1-5 at Car 3 COM2	Receiving location ACMA Car 3	Transmit location VH-SBI	Readability Rating 1-5 at VH-SBI COM1	Readability Rating 1-5 at VH-SBI COM2	Distance	Direction	Screen_XXX Comm1	Screen_XXX Comm2	ACMA Reading at Car 1 (dBm) COM1	ACMA Reading at Car 1 (dBm) COM2	ACMA Reading Car 1 (dBm) Delta-COM1 Vs COM2
14/03/2024	12:57:00 PM	-67.0	-73.4	-6.40	5.0	5.0	CAR 3 (ACMA) - RWY09 Threshold	DASH 8 - Gate 3 (Nose In)	4.0	4.0	1150	290	093	094	-48.9	-56.2	-7.3
	12:59:00 PM	-57.6	-68.1	-10.50	5.0	4.0	CAR 3 (ACMA) - 1,500 ft into RWY09		4.0	4.0	710	296			-48.7	-56.3	-7.6
	1:00:00 PM	-41.5	-60.1	-18.60	5.0	5.0	CAR 3 (ACMA) - Taxiway Delta		4.0	4.0	310	299			-48.6	-55.7	-7.1
	1:02:00 PM	-62.0	-63.8	-1.80	5.0	5.0	CAR 3 (ACMA) - Taxiway Alpha		4.0	4.0	500	150			-48.8	-56.0	-7.2
	1:04:00 PM	-56.4	-69.1	-12.70	5.0	4.0	CAR 3 (ACMA) - RWY36 Threshold		4.0	4.0	700	157			-48.5	-56.7	-8.2
	1:06:00 PM	-58.3	-71.3	-13.00	5.0	3.0	CAR 3 (ACMA) - RWY27 Threshold		4.0	3.0	680	85		095	-48.7	-56.8	-8.1
14/03/2024	12:23:00 PM	-55.5	-66.5	-11.00	5.0	5.0	CAR 3 (ACMA) - RWY27 Threshold	DASH 8 - Taxiway Charlie	5.0	5.0	660	94	080	081	-56.5	-75.3	-18.8
	12:28:00 PM	-61.5	-82.8	-21.30	5.0	3.5	CAR 3 (ACMA) - RWY36 Threshold		4.0	3.0	760	161		082	-55.8	-77.7	-21.9
	12:29:00 PM	-62.0	-77.1	-15.10	5.0	4.0	CAR 3 (ACMA) - Taxiway Alpha		4.0	3.0	570	158			-55.7	-77.4	-21.7
	12:32:00 PM	-46.5	-56.3	-9.80	5.0	5.0	CAR 3 (ACMA) - Taxiway Delta		5.0	4.0	300	381			-55.6	-77.0	-21.4
	12:33:00 PM	-53.7	-67.8	-14.10	5.0	5.0	CAR 3 (ACMA) - 1,500 ft into RWY09		4.0	4.0	700	288		085	-55.5	-76.0	-20.5
	12:35:00 PM	-68.2	-80.6	-12.40	5.0	4.0	CAR 3 (ACMA) - RWY09 Threshold		4.0	4.0	1130	285			-55.5	-76.8	-21.3
14/03/2024	12:39:00 PM	-59.7	-74.1	-14.4	5.0	5.0	CAR 3 (ACMA) - RWY09 Threshold	DASH 8 - Taxiway Delta	5.0	4.0	850	287	087	088	-61.6	-87.2	-25.6
	12:41:00 PM	-48.7	-62.5	-13.8	5.0	5.0	CAR 3 (ACMA) - 1,500 ft into RWY09		5.0	3.0	410	292		089	-61.8	-86.0	-24.2
	12:42:00 PM	-47.7	-55.8	-8.1	5.0	5.0	CAR 3 (ACMA) - Taxiway Charlie		5.0	4.0	770	141		090	-62.0	-86.8	-24.8
	12:44:00 PM	-65.1	-89.5	-24.4	5.0	3.0	CAR 3 (ACMA) - Taxiway Alpha		4.0	3.0	770	141		092	-61.4	-86.3	-24.9
	12:45:00 PM	-65.7	-82.3	-16.6	5.0	3.0	CAR 3 (ACMA) - RWY36 Threshold		4.0	3.0	950	146			-61.7	-85.5	-23.8
	12:47:00 PM	-66.8	-74.1	-7.3	5.0	3.5	CAR 3 (ACMA) - RWY27 Threshold		4.0	4.0	970	97			-61.5	-85.2	-23.7
14/03/2024	1:11:00 PM	-72.1	-90.8	-18.70	5.0	2.0	CAR 3 (ACMA) - RWY36 Threshold	DASH 8 - On Starter Extension to RWY09	4.0	2.0	1830	125	096	097	-76.5	-94.5	-18.0
	1:13:00 PM	-69.5	-84.7	-15.20	5.0	3.0	CAR 3 (ACMA) - Taxiway Alpha		4.0	2.0	1690	121	098	099	-76.5	-95.0	-18.5
14/03/2024	1:15:00 PM	-72.6	-96.2	-23.60	5.0	3.0	CAR 3 (ACMA) - Taxiway Alpha	DASH 8 - RWY09 Threshold	4.0	2.0	1550	123	100	101	-66.6	-85.6	-19.0
	1:16:00 PM	-72.2	-95.4	-23.20	5.0	1.0	CAR 3 (ACMA) - RWY36 Threshold		4.0	1.0	1680	127		102	-66.5	-86.6	-20.1
	1:18:00 PM	-64.2	-81.3	-17.10	5.0	3.0	CAR 3 (ACMA) - Taxiway Charlie		4.0	2.0	1140	106			-66.5	-86.7	-20.2
	1:20:00 PM	-60.0	-76.5	-16.50	5.0	4.0	CAR 3 (ACMA) - Taxiway Delta		4.0	3.0	840	107			-66.5	-85.8	-19.3
	1:22:00 PM	-72.4	-88.8	-16.40	5.0	3.0	CAR 3 (ACMA) - RWY27 Threshold		4.0	2.0	1800	100			-66.5	-85.9	-19.4
14/03/2024	1:25:00 PM	-68.8	-88.8	-20.00	5.0	5.0	CAR 3 (ACMA) - RWY36 Threshold	DASH 8 - 1,500 ft into RWY09	4.0	2.0	1310	136	104	105	-74.9	-76.8	-1.9

Appendix C - Aerodromes with historical undetermined Dash 8 communication occurrences

Aerodrome	Number of occurrences	Secondary runway	Line of sight limitations procedures	Details/comments
Armidale, NSW	1	Yes	No	Ground based ATS frequency
Bundaberg, Qld	1	Yes	No	Ground based ATS frequency
Gladstone, Qld	3	No	Yes	Limited to ATS contact on ground due to shielding
Horn Island, Qld	3	Yes	Yes	Due to terrain, Take-off runway 14 and land runway 32 not available Ground based ATS frequency
Mackay, Qld	1	No	No	No details relating to line of sight limitations or ground based ATS frequency
Mildura, Vic	4	Yes	No	Ground based ATS frequency Procedures implemented from April 2024
Moranbah, Qld	1	No	No	No details relating to line of sight limitations or ground based ATS frequency
Moree, NSW	1	Yes	No	Ground based ATS frequency
Port Lincoln, SA	1	Yes	No	Ground based ATS frequency
Port Macquarie, NSW	1	No	No	Ground based ATS frequency
Roma, Qld	2	Yes	No	Ground based ATS frequency
Toowoomba, Qld	1	Yes	Yes	Due to single lane and obstructed visibility, all TFC using TWY and/or taxilane B or C to check for oncoming ACFT and BCST intentions
Wagga Wagga, NSW	3	Yes	Yes	Light ACFT at THR of RWY 23 not visible to other ACFT on the ground using RWY 05. Radio black spots may result under some conditions Further procedures implemented from March 2024 Ground based ATS frequency
Williamtown, NSW	2	No	No	No details relating to line of sight limitations or ground based ATS frequency
Whyalla, SA	2	Yes	No	ATS available in the circuit but not on the ground

Appendix D – Flight Operations Service Letters

DE HAVILLAND AIRCRAFT OF CANADA LIMITED

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SERVICE LETTER

In-Service Engineering and Technical Support

Flight Operations Service Letter

DH8-SL-23-008A

ATA: 2321

DATE: December 6, 2024

SUBJECT: VHF Communications on the Ground

MODEL: DHC 8 Series 100/200/300

APPLICABILITY: ALL

PURPOSE:

The purpose of this FOSL is to remind Operators of the characteristics of VHF communications when operating on the ground

DISCUSSION:

A

Recently an Operator has had difficulty communicating on ground with other aircraft at an unstaffed aerodrome using VHF Comm # 2. Operators are reminded that each VHF transceiver provides amplitude modulation (AM) voice communication in the 118.000 to 135.975 MHz range in 8.33 or 25 Khz increments. As such, VHF communications are direct line of sight and while on the ground can be impacted by such things as buildings, terrain, or features of the aircraft such as the vertical stabilizer or landing gear, etc.

The No. 1 VHF antenna is located on the forward **upper** fuselage surface and No. 2 VHF antenna is located on the forward **lower** fuselage surface. In some circumstances, the upper fuselage antenna may provide a better line of sight with other aircraft or ground stations possibly resulting in improved communications for both transmission and reception.

DE HAVILLAND AIRCRAFT OF CANADA LIMITED ACTION: N/A

DH8-SL-23-008A Page 1 of 2

DT4021 -D

DE HAVILLAND AIRCRAFT OF CANADA LIMITED

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OPERATOR ACTION:

VHF Comm # 2 is typically used in the air (utilizing the # 2 antenna). When operating on the ground, VHF Comm #1 (utilizing the #1 antenna) may provide a better signal (receiving and transmitting) to other stations on the ground, or nearby in the air.

Please direct responses and inquiries regarding the content of this Service Letter to your DE HAVILLAND AIRCRAFT OF CANADA LIMITED Field Service Representative or the Technical Help Desk in Toronto at telephone +1 647 277 5820 or Toll-Free North America +1 855 310 1013 or e-mail: thd@dehavilland.com.

Electronic signature on file
Manny Almeida
Engineering Specialist - Systems
In-Service Engineering &
Technical Support

Electronic signature on file
Harlan Simkins
General Manager– Flight Operations

Rev A

Added 8.33 or 25 Khz increments

DE HAVILLAND AIRCRAFT OF CANADA LIMITED

De Havilland Aircraft of Canada Limited
[illegible]
Calgary, Alberta, Canada [illegible]
TEL [illegible]
North America: [illegible]
[illegible]
[illegible]

SERVICE LETTER

In-Service Engineering and Technical Support

Flight Operations Service Letter

DH8-400-SL-23-020A

ATA: 2321

DATE: December 6, 2024

SUBJECT: VHF Communications on the Ground

MODEL: DHC 8 Series 400

APPLICABILITY: ALL

PURPOSE:

The purpose of this FOSL is to remind Operators of the characteristics of VHF communications when operating on the ground.

DISCUSSION:

(A) Recently an Operator has had difficulty communicating on ground with other aircraft at an unstaffed aerodrome using VHF Comm # 2. Operators are reminded that each VHF transceiver provides amplitude modulation (AM) voice communication in the 118.000 to 135.975 MHz range in 25 or 8.33 Khz increments. As such, VHF communications are direct line of sight and while on the ground can be impacted by such things as buildings, terrain, or features of the aircraft such as the vertical stabilizer or landing gear, etc.

The No. 1 VHF antenna is located on the forward **upper** fuselage surface and No. 2 VHF antenna is located on the forward **lower** fuselage surface. In some circumstances, the upper fuselage antenna may provide a better line of sight with other aircraft or ground stations possibly resulting in improved communications for both transmission and reception.

DE HAVILLAND AIRCRAFT OF CANADA LIMITED ACTION: N/A

OPERATOR ACTION:

VHF Comm # 2 is typically used in the air (utilizing the # 2 antenna). When operating on the ground, VHF Comm #1 (utilizing the #1 antenna) may provide a better signal (receiving and transmitting) to other stations on the ground, or nearby in the air.

DH8-SL-23-020A Page 1 of 2

DT4034 -D

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Please direct responses and inquiries regarding the content of this Flight Operations Steering Letter to your DE HAVILLAND AIRCRAFT OF CANADA LIMITED Field Service Representative or the Technical Help Desk in Toronto at telephone +1 647 277 5820 or Toll-Free North America +1 855 310 1013 or e-mail: thd@dehavilland.com.

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Manny Almeida
Engineering Specialist - Systems
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Technical Support

Electronic signature on file
Harlan Simpkins
General Manager– Flight Operations

Rev A

Added 25 or 8.33Khz spacing increments

About the ATSB

The **Australian Transport Safety Bureau** is the national transport safety investigator. Established by the *Transport Safety Investigation Act 2003* (TSI Act), the ATSB is an independent statutory agency of the Australian Government and is governed by a Commission. The ATSB is entirely separate from transport regulators, policy makers and service providers.

The ATSB's function is to improve transport safety in aviation, rail and shipping through:

- the independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis, and research
- influencing safety action.

The ATSB 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.

About ATSB reports

ATSB investigation final reports are organised with regard to international standards or instruments, as applicable, and with ATSB procedures and guidelines.

Reports 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

An explanation of ATSB terminology used in this report is available on the ATSB website.