Australian Government
Australian Transport Safety Bureau

Near collision involving Piper PA-28-161, VH-ENL, and Bombardier DHC-8-315, VH-TQH

Mildura Airport, Victoria, on 6 June 2023

ATSB Transport Safety Report
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Addendum

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Executive summary

What happened

In the early afternoon of 6 June 2023, a Piper PA-28-161, registered VH-ENL, taxied for runway 36 at Mildura, Victoria for a private flight to Broken Hill, New South Wales. At about the same time, a QantasLink Bombardier DHC-8-315 (Dash 8), registered VH-TQH, being operated on a scheduled passenger transport flight to Sydney, began to taxi at Mildura for runway 09.

Both aircraft gave taxi, and entering and backtracking calls on the local common traffic advisory frequency (CTAF). The pilot of the PA-28 was aware of the Dash 8 backtracking on runway 09. The crew of the Dash 8 were not aware of the PA-28 preparing for take-off from the cross runway. The crew of the Dash 8 had commenced their take-off on runway 09 as the pilot of the PA-28 gave a rolling call on runway 36 at the commencement of their take-off. The Dash 8 crossed ahead of the PA-28 at the runway intersection of 09/36 by about 600 m.

What the ATSB found

The ATSB's investigation identified that the pilot of the PA-28 incorrectly identified the runway direction at Mildura Airport during their taxiing, and entering and backtracking radio calls (saying 'runway 35' instead of 'runway 36'). This, combined with the Dash 8 crew's focus on obtaining their pre-departure information from air traffic control, with the volume for the radio tuned to the CTAF frequency turned down, and only receiving certain elements of the PA-28 pilot's radio calls due to an over transmission from air traffic control, likely led to an incomplete comprehension of traffic at Mildura by the Dash 8 crew (who believed that the PA-28 was not at Mildura). However, they did not seek further information of the source of the radio calls to positively identify the traffic location.

While the pilot of the PA-28 was aware of the Dash 8, they assumed that the Dash 8 was still backtracking on runway 09, were unable to visually sight the location of the Dash 8 (due to airport buildings) and did not directly contact the Dash 8 to positively organise separation.

The ATSB also found that even though it wasn't a requirement, the Dash 8 crew did not give a rolling call on runway 09, based on their mental model of the local traffic at Mildura.

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.

After the incident, the Dash 8 crew monitored the flightpath of VH-ENL to ensure their safety and provide assistance if required.

What has been done as a result

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. Additionally, QantasLink have also provided further guidance to their pilot group on specifics of potential radio wave degradation on the ground at Mildura between runway 36 and 09 thresholds, including the conduct of rolling calls and clarification of broken, suspicious or ambiguous radio calls from other aircraft prior to departure.

Review of potential radio interference at Mildura Airport is being further investigated in an ATSB investigation (AO-2023-050) into a similar event at Mildura Airport about 3 months later, involving a similar collision-risk pairing. ATSB is continuing to work with Qantas Safety, Mildura Airport, the Australian Communications and Media Authority, CASA and Airservices Australia to identify any potential radio communication interference and shielding.

Safety message

Communication and self-separation in non-controlled airspace is one of the ATSB's SafetyWatch priorities. Wherever 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. 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
- ensuring transponders, where fitted, are selected to transmit altitude information.

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.

Contents

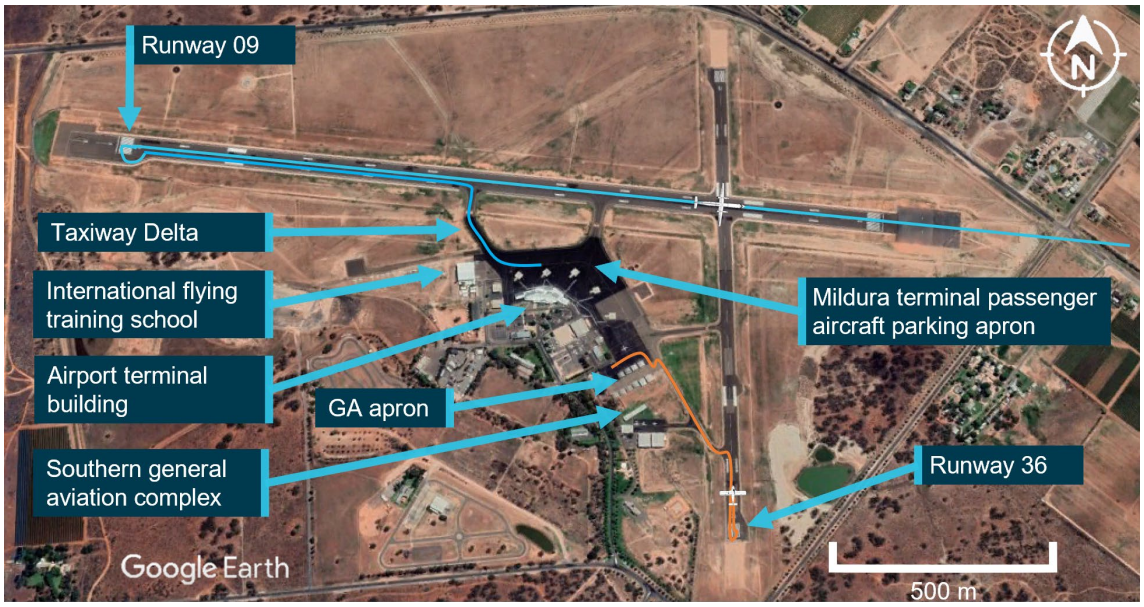
The occurrence

In the early afternoon of 6 June 2023, a Piper PA-28-161 (PA-28), registered VH-ENL taxied for runway 36[1] at Mildura, New South Wales, for a private flight to Broken Hill (Figure 1 orange line). The pilot was the sole occupant. At about the same time, a QantasLink Bombardier DHC-8-315 (Dash 8), registered VH-TQH, with 3 crew and 33 passengers on board, being operated on a scheduled passenger transport flight to Sydney, began to taxi at Mildura for runway 09 (Figure 1 blue line).

Both aircraft gave taxi, runway entering and runway backtracking calls on the local common traffic advisory frequency (CTAF) (see *Radio calls*). The pilot of the PA-28 was aware of the Dash 8 backtracking on runway 09, however the crew of the Dash 8 were not aware of the PA-28 preparing for take-off on the cross runway.

The Dash 8 had started its take off roll on runway 09 as the PA-28 gave a rolling call on runway 36 and commenced take-off. As the Dash 8 crossed the runway intersection of 09/36 at about 200 ft vertically, the PA-28 was rolling towards the intersection and about 600 m from the Dash 8 (Figure 1 aircraft positions).

Figure 1: VH-TQH (Dash 8) and VH-ENL (PA-28) ground tracks



Source: Google Earth, annotated by the ATSB

[1] Runway number: the number represents the magnetic heading of the runway. In this case, '36' represents a magnetic heading of 360 degrees.

Context

Aircraft information

VH-TQH

The Bombardier Incorporated, DHC-8-315, is a high-wing, pressurised aircraft powered by 2 turboprop engines. VH-TQH was manufactured in Canada in 2003 and was first registered in Australia on 15 August 2003. It was registered with Qantas Airways Limited on 7 February 2011, and operated by Eastern Australia Airlines Pty Limited.

VH-ENL

VH-ENL was a privately owned Piper Aircraft Corporation, PA-28-161 Cherokee Warrior II, manufactured in the US in 1980. The Cherokee was a popular training and private owner aircraft, featuring a fixed-tricycle undercarriage configuration, 4 seats and a low wing design.

Pilot Information

Flight crew VH-TQH (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 2,375 hours with about 2,130 of those being on the Dash 8. 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 2,230 hours, having flown about 1,900 of those hours in the Dash 8. The FO was familiar with Mildura Airport having regularly operated there over 40 times and had also operated into Mildura the previous week.

Pilot VH-ENL (PA-28)

The pilot held a Private Pilot Licence (Aeroplane) and reported a total flying time of about 1,250 hours, with about 260 hours on the PA-28, and about 60 hours on VH-ENL. They held a valid Class 2 aviation medical certificate and had last conducted a single-engine flight review on 5 October 2022.

The pilot was familiar with Mildura Airport after conducting their initial training there in 1995 and reported operating into Mildura at least 3 times in 2023.

Meteorological conditions

Weather conditions at Mildura Airport around the time of the occurrence were identified as a moderate north-north easterly wind at 10 kt, with greater than 10 km visibility. The cloud reported was broken (between 5-7 oktas[2]) at 1,000 ft above ground level.

Mildura Airport

Mildura Airport was a certified aerodrome situated about 5 NM south-west from the city of Mildura. The airport 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.

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[2] Total cloud amount measured visually by the fraction (in eighths or oktas) of the sky covered by clouds.

The airport was serviced by a number of major aviation carriers and a large international flying school. Mildura Airport accommodated aircraft as large as Boeing 737s but regularly operated with lower capacity passenger flights from numerous operators, while also accommodating general and recreational aviation flight training schools, charter operators and private flying. The airport terminal building was upgraded in 1994 with further expansion constructed in 2004 due to utilisation and growth. Due to airport 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 (Figure 1).

The Enroute 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 carriage operations (Figure 2).

Figure 2: 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[3] 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'[4] 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 airport. The Mildura Airport CTAF was shared with Wentworth Airport to assist traffic coordination and to enhance the situational awareness of pilots operating within the surrounding airspace. Wentworth Airport was 13 NM to the north-west of Mildura Airport and was commonly used by general and recreational aviation operators (Figure 3).

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

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

Figure 3: Mildura / Wentworth proximity

Source: Google Earth, annotated by the ATSB

Delays due to aircraft serviceability

The captain of the Dash 8 was conducting the daily aircraft checks on arrival at Mildura early in the morning and identified the unserviceability of an altitude alerter instrument on VH-TQH. After discussions and troubleshooting with Qantas technical support by phone, the aircraft was declared unserviceable for the proposed flight. This required dispatch of components by another company aircraft from Melbourne to Mildura, thereby delaying the intended flight by about 6 hours before the aircraft was repaired and declared serviceable to depart.

Recorded information

Radio calls

Recorded radio data collected from Mildura Airport CTAF and the Melbourne Centre (air traffic control) area frequency recordings (Appendix 1) indicated that the crew of the Dash 8 contacted Melbourne Centre to arrange a transponder code prior to taxing at Mildura. Due to the delayed departure of the Dash 8, the transponder code was not readily available and this resulted in a number of radio calls between the Dash 8 and Melbourne Centre, with an associated delay in receipt of the transponder code.

At the same time the Dash 8 was receiving the code on the Melbourne Centre frequency, the pilot of the PA-28 broadcast their taxi call on the Mildura CTAF (Figure 4, note A). However, the pilot of the PA-28 mis-identified runway 36 during this call, instead referring to the intended runway as '… runway 35'.

The crew of the Dash 8 confirmed the code to Melbourne Centre and about 14 seconds later made a taxi call for runway 09. About 10 seconds after that, the Dash 8 crew made an entering and backtracking call for runway 09 at Mildura.

A further 2 minutes later, the pilot of the PA-28 made an entering and backtracking call, again with the mis-identified runway number '35' and did not finalise the radio call with the required location identifier of '… traffic Mildura'.

The crew of the Dash 8, missed the first part of the transmission on the CTAF, however identified that the aircraft calling was referring to runway 35 and assumed the aircraft was in Wentworth, due to the runway direction, signal strength and clarity of the transmission.

No radio call was recorded for the Dash 8 as it began to roll on runway 09. About 20 seconds later, the pilot of the PA-28 gave a rolling call, this time with the correct runway direction and location, '… runway 36, traffic Mildura".

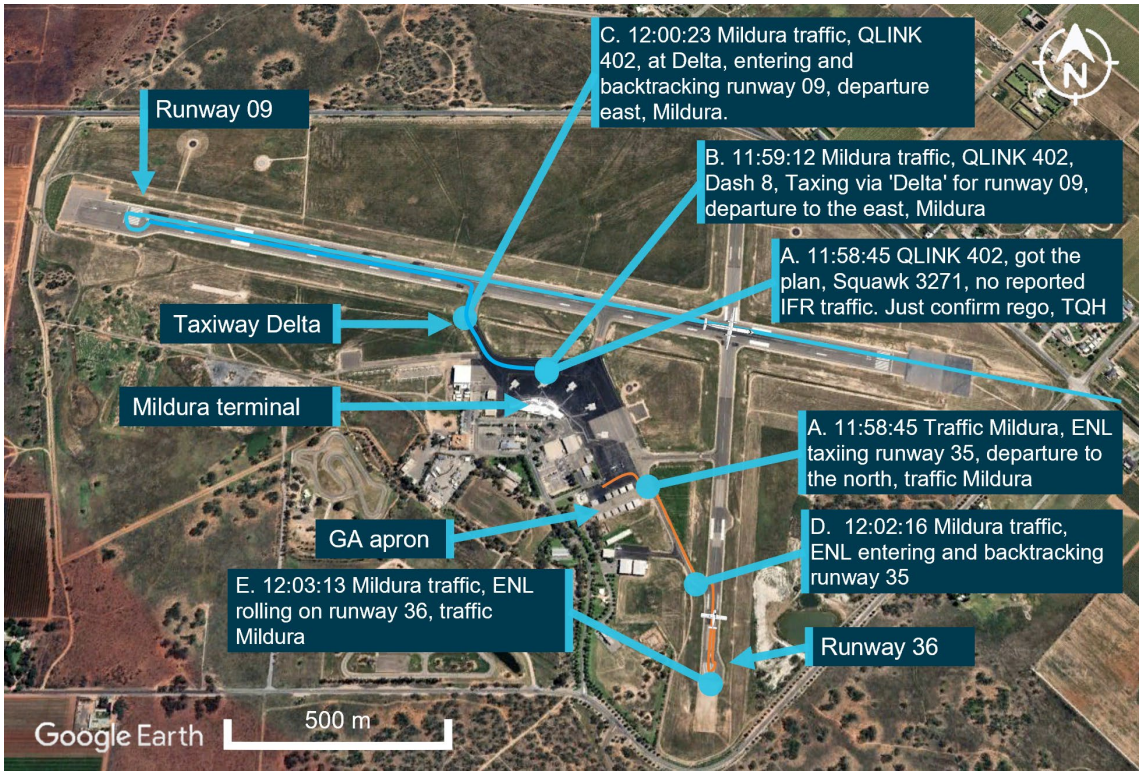
After the Dash 8 crew had departed, the FO recalled visually checking for VH-ENL to establish if they had rejected the take-off, over-run the runway or needed assistance. After observing VH-ENL on climb from runway 36 at Mildura, the FO attempted to contact the pilot of the PA-28 in order to establish the reason for the breakdown of communication and to render any airborne assistance.

Flight tracking data

Recorded ADS-B exchange data from VH-TQH on the day of the occurrence showed the Dash 8 entering and backtracking on runway 09 at 0200:37. After reaching the threshold of runway 09, the crew of VH-TQH lined up, and began their take-off roll at 0202:32.

Recorded data (Garmin watch of the pilot) on the taxi track of VH-ENL showed the PA-28 initial entry to runway 36 and backtrack occurred at 0202:18, and that initial power application occurred on the threshold of runway 36 at about 0203:22 (about 31 seconds after VH-TQH), accelerating VH-ENL along runway 36 until about abeam taxiway Bravo at 0203:38. At that time, the recorded data of VH-TQH shows the Dash 8 crossing the runway 09/36 intersection about 600 m ahead, and about 200 ft above the intersection of both runways (Figure 4).

Figure 4: Recorded data sequence



Source: Google Earth with recorded data overlay, annotated by the ATSB

The pilot of the PA-28, after identifying that the Dash 8 had departed on the crossing runway, continued their take-off roll. Recorded data further showed the PA-28 crossing the runway intersection about 18 seconds after the Dash 8, and at about 220 ft above the intersection.

Operations in the vicinity of non-controlled aerodromes

At and around non-controlled and non-towered aerodromes, pilots are responsible for making themselves aware of nearby aircraft and maintaining separation. Safe operations at non-towered aerodromes relies on all pilots maintaining awareness of their surroundings and of other aircraft, and on 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).

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 2 above, the ERSA entry for Mildura did not have any additional broadcast requirements.

CASA advisory circular 91-10, *Operations in the vicinity of non-controlled aerodrome*, provides 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 area. The ATSB research report found that an alerted search is likely to be 8 times more effective than an unalerted search, as 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, they are 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.

Mildura Airport had an aerodrome frequency response unit (AFRU) that assists in indicating the correct selection of the VHF frequency at non-towered aerodromes. The AFRU automatically responds to a radio transmission with either a pre-recorded voice message, if no transmission has been received in the last 5 minutes or an audible 'beep-back' tone, on the CTAF. This then alerts the pilot to the possibility of other traffic currently broadcasting or being in the vicinity of the CTAF.

After the event, the operator's internal investigation report concluded that broken radio transmissions were present and due to radio wave degradation, which was determined by the operator's investigation to be likely caused by terrain shielding, obstacles, buildings and the local environment between runways 09 and 36.The operator concluded that non-mandated radio calls, a cross strip layout with runway visibility restrictions and low level radio shielding may have contributed to the Dash 8 not hearing a radio call from the PA-28.

Visual line of sight limitations

Threshold visibility

The Dash 8 captain recalled that from the threshold of runway 09, the threshold of runway 36 was visually obscured by the terminal buildings, and the pilot of the PA-28 also recalled the buildings prevented pilots from seeing the threshold of runway 09 from the southern end of runway 36 (Figure 5).

Figure 5: Visual line of sight from runway 36/09/27

Source: Google Earth, annotated by the ATSB

Operator's report

The operator's internal investigation report identified an obstructed visual line of sight from the threshold of runway 36 to 09 (Figure 6). The report identified that neither aircraft could visually identify each other 'due to local infrastructure and terrain that limits visibility between runway 09 and 36'.

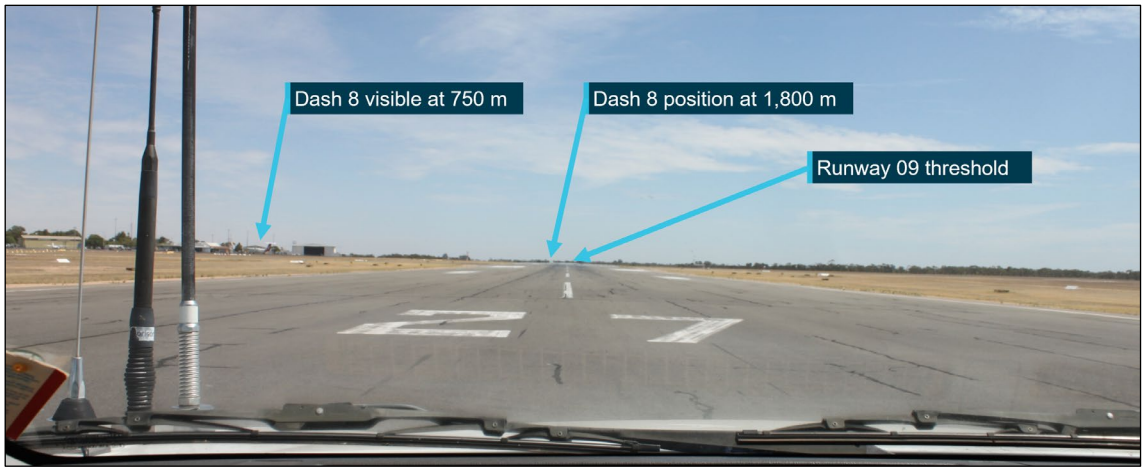
Figure 6: View from threshold runway 36

Source: Operator report, annotated by the ATSB

ATSB site examination

ATSB on-site examination of the airport confirmed the obstruction noted in the operator's report from the threshold of runway 36 to the threshold of runway 09, and in addition, from the threshold of runway 09 to the threshold of 36. In addition, the ATSB site inspection identified a lack of aircraft visibility also occurs from the thresholds of runway 09 and 27 (either end of the same physical runway). However, this was due to raised terrain along the runway between the two ends (Figure 7).

Figure 7: View from threshold of runway 27



Source: ATSB

Traffic collision avoidance system

A traffic collision avoidance system (TCAS), as fitted to the Dash 8, interrogates the transponders of nearby aircraft and uses this information to calculate the relative range and altitude of this traffic. The system provides a visual representation of this information to the flight crew as well as issuing alerts should a traffic conflict be identified.

These alerts include:

- Proximate traffic – an alert issued when an aircraft is within a range of less than 6 NM and 1,200 ft, or a range of 6 NM if the traffic is not 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).

Due to its method of operation, a TCAS cannot detect aircraft that are not equipped with a transponder (or 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.

The PA-28 was equipped with a Mode C transponder and the pilot recalled normally setting the transponder to code 1200 and then selected mode C before entering the runway, meaning the altitude of the aircraft was being transmitted during the take-off.

The crew of the Dash 8 reported that the TCAS was used as an aid to identify potential conflicting traffic in the vicinity of an aerodrome prior to take-off, however on climb the RA alert is inhibited below 1,100 ft.

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 did not identify any traffic in the vicinity of Mildura Airport, however after crossing the upwind end of runway 09, the FO recalled the TCAS identifying an aircraft consistent with the PA-28's position and altitude after take-off on runway 36.

Crew/pilot mental models

The ATSB investigation considered a range of human factors that could have influenced the decisions and actions of the pilots involved.

Cognitive tunnelling is an inattentional blindness/deafness where an individual becomes overly -focused on some variable other than the present environment (Mack & Rock, 1998). This can reduce the likelihood of seeing/hearing something unexpected. Cognitive tunnelling may also impact an individual's decision-making processes (Bell, Facci, & Nayeem, 2005).

The flight crew recalled that before taxiing, they focused their attention on receiving the transponder code for their departure. The Dash 8 operator's internal investigation report identified that the VHF radio volume on Com 2 (tuned to the Mildura CTAF) was turned down to aid the receipt of the transponder code.

Recorded data from the area frequency (Melbourne Centre) and the CTAF (local traffic) indicated that, while receiving a radio broadcast from Melbourne Centre with the transponder code, the pilot of the PA-28 also broadcast on the CTAF local frequency at the same time.

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.

Safety analysis

Introduction

On 6 June 2023, a Piper PA-28-161, registered VH-ENL (PA-28) began its take-off roll on runway 36 at Mildura, however, a QantasLink Bombardier DHC-8-315 registered VH-TQH (Dash 8), was just becoming airborne on runway 09 at Mildura. The Dash 8 crossed ahead of the PA-28 at the runway intersection of 09/36 by about 600 m laterally, and 200 ft vertically.

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

Communication

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

The use of a standard phraseology format is an important factor to increase the effectiveness of radio communication and to prevent misunderstanding. It also increases the attentional expectation of pilots to recognise key phraseology in the cockpit to determine the significance of the information to their operations.

However, these communications can be subject to human error, even when it involves experienced pilots. In this instance, the pilot of the PA-28 unknowingly announced an incorrect runway direction designator (runway 35 instead of runway 36) on 2 separate occasions which introduced confusion and led the Dash 8 crew to incorrectly deduce that the transmission did not originate from Mildura.

During one of the busiest parts of passenger transport operations from a non-controlled aerodrome, the crew of the Dash 8 had difficulty in receiving a transponder code for their departure from Mildura. Controllers had difficulty finding the code due to the 6-hour mechanical delay from the original flight plan and their response also coincided with the taxi call from the PA-28 pilot.

This added complexity within a busy phase of pre-departure, and likely led to additional attentional focus on obtaining the departure code to the exclusion of effective situational awareness and the monitoring of other traffic on the CTAF. Such focus can reduce the chance of hearing and appreciating the relevance of other radio broadcasts.

In addition, the volume on the aircraft radio that was tuned to the Mildura CTAF was turned down (likely to facilitate the crew's focus on receiving the pre-departure transponder code). This would have further reduced the likelihood of the crew noticing the PA-28 broadcasts.

Although the operator suggested VHF radio shielding may have affected the receipt of the PA-28 radio call by the Dash 8 crew, the ATSB had no direct evidence of such radio shielding. However, even if radio shielding was possible at Mildura Airport, the above explained over transmission, focus of attention and radio volume in this occurrence likely contributed to the Dash 8 crew not fully comprehending the PA-28 broadcasts.

Local traffic mental model and runway threshold visibility

The circumstances and the restrictions imposed on the available electronic aids, particularly TCAS functionality, were impediments to effectively applying alerted see-and-avoid practices.

The crew of the Dash 8 were not aware of the presence of the PA-28 as a threat to their operation. Although visibility was greater than 10 km with no cloud in the area, 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.

In many instances the conduct of a rolling call on the runway is given by pilots to increase the situational awareness of other traffic, however if there is no identified traffic that may cause a hazard at the airport, a pilot is not required to make a rolling call.

However, other traffic may be expecting such a call, in order to update their mental model of traffic in the vicinity of the aerodrome, especially where visual identification of traffic is limited.

The pilot of the PA-28 received and understood the calls from the Dash 8, however believed that the aircraft was still backtracking on runway 09 as they had not heard, but were expecting, the Dash 8 to give a rolling call. Visual identification of the location of the Dash 8 backtracking on runway 09 was not possible from the threshold of runway 36 and therefore reduced the effectiveness of the alerted see-and-avoid principle.

This resulted in both crew of the Dash 8 and the pilot of the PA-28 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 tried to contact the other directly to positively ascertain traffic separation, resulting in a missed opportunity to utilise the mitigation of alerted see-and-avoid effectively.

Rolling calls at Mildura Airport

While take-off rolling calls are not required when there is no identified traffic, this is based on the situational awareness of flight crew and may not always be correct at airports where visual identification of other traffic is limited by buildings, terrain or vegetation. At Mildura Airport, it has been established that when two aircraft are at the thresholds of runway 09 and 36, they are not visible to each other due to buildings and trees. Similarly, two aircraft at either end of runway 09/27 intending to take-off will not be visible to each other 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 think about 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.

Airports 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. However, although Mildura Airport had recognised that aircraft may not be visible to each other on the runway and had this noted in the Enroute Supplement Australia (ERSA), they had not mandated additional radio calls.

Airmanship

After take-off the crew of VH-TQH made contact with the pilot of VH-ENL, partly to establish the communication breakdown, but also to check on the welfare of the other pilot after the incident and if required render any additional airborne support to the pilot after the occurrence.

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 near collision involving a Piper PA-28-161, VH-ENL, and Bombardier DHC-8-315, VH-TQH, at Mildura Airport, Victoria, on 6 June 2023.

Contributing factors

- Both aircraft crews had incorrect mental models of local traffic at Mildura and neither crew spoke directly to the other to ascertain position and intentions before take-off.
- Both Dash 8 crew were focussed on receiving the final information from air traffic control when the CTAF broadcast from the other aircraft occurred, and the volume for the radio tuned to the CTAF frequency had been turned down. Their focus and reduced radio volume, and an over transmission, likely led to an incomplete comprehension of traffic at Mildura during the time compressed phase of pre-departure.
- **Due to topography and buildings at Mildura Airport, aircraft are not directly visible to each other on the threshold of runway 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.**
- The Dash 8 crew assumed there was no traffic at Mildura and elected to not make a rolling call on runway 09 before take-off. The PA 28 pilot was aware that the Dash 8 was backtracking, but was not aware it had begun its take-off roll.
- The PA-28 pilot broadcasted an incorrect runway direction for Mildura Airport in both the 'taxiing' and 'entering and backtracking' radio calls.

Other findings

- The crew of the Dash 8 monitored the other aircraft after the occurrence to ensure their safety and render assistance if required.

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 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 or are planning to carry out in relation to each safety issue relevant to their organisation.

The initial public version of these safety issues and actions will be provided separately on the ATSB website on release of the final investigation report, to facilitate monitoring by interested parties. Where relevant, the safety issues and actions will be updated on the ATSB website after the release of the final report 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 runway 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-2023-025-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 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 airport.

Proactive safety action taken by Mildura Airport

Action number:	AO-2023-025-PSA-259
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 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 NOTAM is to be subsumed into the ERSA publication for Mildura Airport in the 2406 amendment cycle on 13 June 2024.

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.

Safety action by ATSB

Review of potential radio interference at Mildura Airport is being further investigated in an ATSB investigation (AO-2023-050) into a similar event at Mildura Airport about 3 months later, involving a similar collision-risk pairing. ATSB is continuing to work with QantasLink Safety, Mildura Airport, the Australian Communications and Media Authority, CASA and Airservices Australia to identify any potential radio communication interference and shielding.

General details

Occurrence details

Date and time:	6 June 2023 – 1203 AUS Eastern Standard Time	
Occurrence class:	Serious Incident	
Occurrence categories:	Near Collision, runway incursion	
Location:	Mildura Airport	
	Latitude: 34.2292 ° S	Longitude: 142.0856° E

Aircraft 1 details

Manufacturer and model:	PIPER AIRCRAFT CORP PA-28-161	
Registration:	VH-ENL	
Operator:	GALAXY AVIATION AUSTRALIA PTY LTD	
Serial number:	28-8116063	
Type of operation:	Part 91 General operating and flight rule	
Activity:	General aviation / Recreational-Own business travel	
Departure:	Mildura Airport	
Destination:	Broken Hill Aerodrome	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Aircraft 2 details

Manufacturer and model:	BOMBARDIER INC DHC-8-315	
Registration:	VH-TQH	
Operator:	EASTERN AUSTRALIA AIRLINES PTY LTD	
Serial number:	597	
Type of operation:	Part 121 Australian air transport operations - Larger aeroplanes-Standard Part 121	
Activity:	Commercial air transport-Scheduled-Domestic	
Departure:	Mildura Airport	
Destination:	Sydney Airport	
Persons on board:	Crew – 3	Passengers – 33
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Glossary

ADS-B	Automatic Dependant Surveillance - Broadcast
AFRU	Aerodrome frequency response unit
ATPL	Air transport pilot licence
ATSB	Australian Transport Safety Bureau
CAAP	Civil aviation advisory publication
CASA	Civil Aviation Safety Authority
CTAF	Common traffic advisory frequency
ERSA	En route supplement Australia
ETA	Estimated time of arrival
FO	First officer
IFR	Instrument flight rules
Qantas	Queensland and Northern Territory Air Service
RA	Resolution advisory
TA	Traffic advisory
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
- QantasLink
- the Civil Aviation Safety Authority
- Airservices Australia
- Mildura Airport
- AVDATA
- ADSB and Garmin watch data

References

Bell, M., Facci, E., & Nayeem, R. (2005). Cognitive Tunnelling, Aircraft-Pilot Coupling Design Issues and Scenario Interpretation Under Stress in Recent Airline Accidents. *2005 International Symposium on Aviation Psychology*, (pp. 45-49).

Civil Aviation Safety Authority. (2013, December). Pilot's responsibility for collision avoidance in the vicinity of non-controlled aerodromes using 'see-and-avoid'. Canberra, ACT, Australia.

Civil Aviation Safety Authority. (2021, November). Operations in the vicinity of non-controlled aerodromes. Canberra, ACT, Australia.

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
- pilot of VH-ENL
- crew of VH-TQH

Submissions were received from:

- Civil Aviation Safety Authority
- QantasLink
- Mildura Airport
- Airservices Australia
- Pilot of VH-ENL.

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

Appendices

Appendix – Recorded VHF radio transmissions

Combined VHF radio transmissions transcribed. Shaded transmissions indicate calls made on Melbourne Centre frequency, while unshaded transmissions were made on Mildura common traffic advisory frequency.

Table 2: Recorded VHF radio transmissions

Time	Radio call detail
11:57:57	Mel Centre, g'day QLINK 402, IFR Dash 8 taxis runway 09 for Sydney
11:58:10	QLINK 402, g'day centre, I'll need to find your plan here, is this the one from earlier this morning?
11:58:20	Affirm QLINK 402, if it does not come up, we can resend it again
11:58:24	Standby, I should be able to chase that up, just standby one
11:58:45	QLINK 402, got the plan, squawk 3271, no reported IFR traffic, I'll just confirm the aircraft rego while I have you as well, Tango, Quebec, Hotel.
11:58:45	Traffic Mildura, ENL taxiing runway 35, departure to the north, traffic Mildura
11:58:58	Thanks very much squawk 3271 and affirm that's correct, just broken plan 6, no swap, QLINK 402
11:59:07	Thanks
11:59:12	Mildura traffic, QLINK 402, Dash 8, Taxing via 'Delta' for runway 09, departure to the east, Mildura
12:00:23	Mildura traffic, QLINK 402, at Delta, entering and backtracking runway 09, departure east, Mildura
12:02:16	Mildura traffic, ENL entering and backtracking runway 35
12:03:13	Mildura traffic, ENL rolling on runway 36, traffic Mildura
12:03:35	Mildura traffic, QLINK 402airbourne runway 09’er, did not hear any of your calls
12:05:21	Aircraft on Mildura CTAF, are you there?
12:05:48	Aircraft just departed runway 36 Mildura on CTAF, you there?
12:05:57	ENL yes
12:05:59	G'day ENL, QLINK 402, just confirming you copied our taxi calls, we did not hear you on that one, we heard an aircraft at Wentworth
12:06:10	Ah, negative, I thought you were still taxiing 09, I did not hear you make a rolling call
	Copy, we did not hear a taxi call, that's OK, but you did hear us entering and backtracking?
	I did hear you entering and backtracking, did you hear my entering and backtracking?
12:06:32	Ah negative, we heard a rolling call, just as we were as well
12:06:36	My apologies
12:06:44	Copy, just confirm it was ENL
	Confirm, affirm

Source: Transcribed from Airservices and AVDATA recorded data

Australian Transport Safety Bureau

About the ATSB

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

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

- independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis and research
- fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

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

Purpose of safety investigations

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

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

It is not a function of the ATSB to apportion blame or provide a means for determining liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

Terminology

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