Australian Government

Australian Transport Safety Bureau

Flight below minimum sector altitude involving Cessna 310R, VH-ZMB

14 km west-north-west of Alice Springs Airport, Northern Territory, on 1 July 2024

ATSB Transport Safety Report

Aviation Occurrence Investigation (Short)

AO-2024-039

Final – 20 March 2025

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Addendum

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Investigation summary

What happened

On 1 July 2024, a Cessna 310R, registered VH-ZMB, was returning to Alice Springs from Willowra aircraft landing area, Northern Territory (NT), with only the pilot on board.

During an instrument approach in instrument meteorological conditions, the pilot reported receiving false indications from the attitude indicator and directional gyroscope. The aircraft deviated from the published approach path and tracked perpendicular to the approach track, below minimum sector altitude (MSA).

The pilot notified air traffic control at Alice Springs tower of the situation, before obtaining a clearance to track from their present position back to the initial instrument landing system approach point, for a subsequent attempt at landing.

A second approach was then flown, followed by a successful landing at Alice Springs Airport.

What the ATSB found

The ATSB found that the pilot, whilst established on the ILS approach to Alice Springs, likely experienced spatial disorientation that led to an undesired flight path, below the MSA.

In their state of distress, the pilot did not broadcast a PAN PAN call notifying air traffic control of their situation. Further, air traffic control did not issue a safety alert, which would have alerted the pilot that they were in unsafe proximity to terrain and needed to climb immediately. This was also influenced by the pilot not broadcasting a PAN PAN, but could have been made independently.

Once the pilot was outside of the required tolerances for the instrument approach and below the MSA, the pilot did not conduct a missed approach, remaining below minimum sector altitude for an extended period.

Other factors that increased the risks identified in this investigation include post-occurrence fault finding that found the artificial horizon exhibited deviations outside the manufacturer's required tolerances. Additionally, the pilot's choice to not make use of the autopilot for the approach may have increased their workload and the subsequent risk of spatial disorientation during the instrument approach procedure.

What has been done as a result

The operator has since introduced an automation policy for the use of autopilot in instrument meteorological conditions and in high workload single-pilot operations.

Safety message

Pilots should not hesitate to report an urgent condition when encountering situations that may not be immediately perilous but significantly increase risk. Broadcasting a PAN PAN call when there is uncertainty about the safety status of the aircraft will alert ATC to the need for immediate assistance.

Air traffic control has a duty of care to provide safety alerts to pilots on becoming aware that an unsafe situation such as proximity to terrain has, or may, occur.

Once an aircraft is no longer on an established approach path and doubt exists as to its lateral position and location, a missed approach should be conducted, including an immediate climb to achieve a safe altitude, clear of terrain.

The investigation

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

The occurrence

On the morning of 1 July 2024, a Cessna 310R, registered VH-ZMB, conducted a passenger transport flight[1] to Willowra aircraft landing area, NT, and was repositioning[2] to Alice Springs, NT, with only the pilot onboard.

At approximately 1020 local time, the pilot commenced an instrument landing system (ILS) approach[3] for runway 12 at Alice Springs Airport. This approach was manually flown (not utilising the autopilot system), in instrument meteorological conditions.[4]

At 1022:05, the aircraft was established at 4,250 ft above mean sea level (AMSL) on the approach into Alice Springs Airport on the published ILS approach profile. About 25 seconds later, the pilot recalled receiving erroneous instrument indications from the artificial horizon (AH). At 1022:30, flight data showed the aircraft departing the ILS to the left, and tracking at a perpindicular direction from the approach path with unusual aircraft bank angles (AOB) (Figure 1).

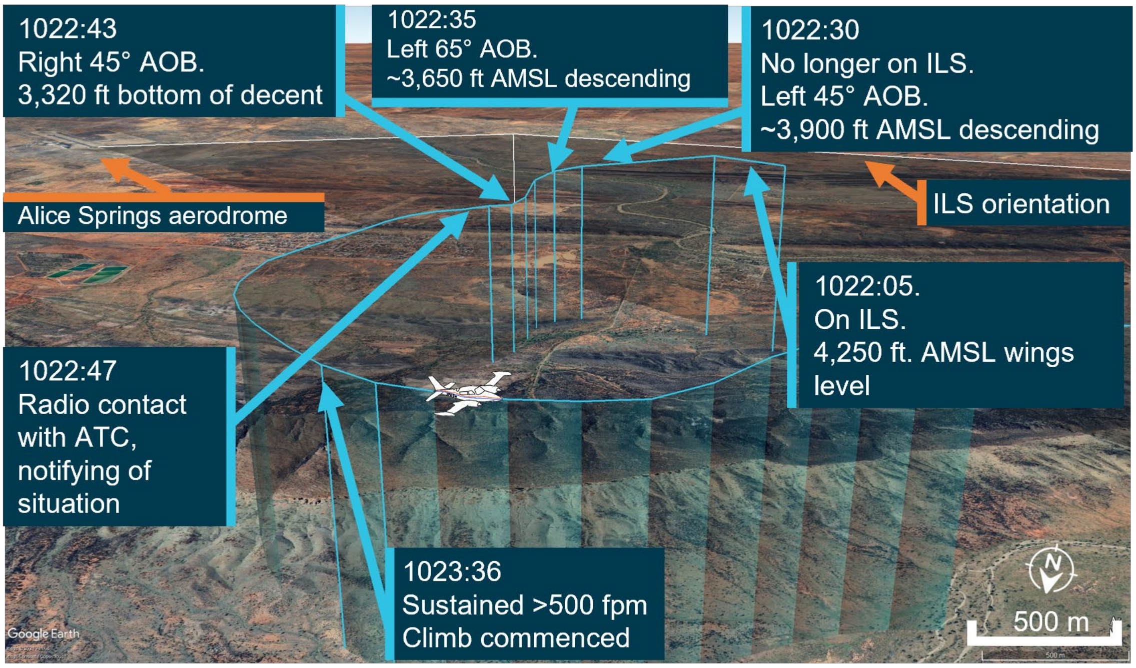
1 Flight operated under Part 135 of the Civil Aviation Safety Regulations. Part 135 of the Civil Aviation Safety Regulations (CASR) covers the air transport rules for smaller aeroplanes.

2 Flight was operated under Part 91 of Civil Aviation Safety Regulations. Part 91 of the Civil Aviation Safety Regulations (CASR) – General operating and flight rules, sets out the general operating rules for all pilots and operators. It consolidates all of the general operating and flight rules for Australian aircraft.

3 Instrument Landing System (ILS) approach is defined as a precision runway approach aid based on two radio beams which together provide pilots with both vertical and horizontal guidance during an approach to land.

4 Instrument meteorological conditions (IMC) means meteorological conditions other than visual meteorological conditions.

Figure 1: VH-ZMB flight path



Source: ATC recordings and recorded flight data, overlaid on Google Earth and annotated by the ATSB

At 1022:47, the pilot contacted air traffic control (ATC), using their callsign twice. The pilot reported an issue with the instruments and requested clearance to commence a second approach. The ATC controller observed, and ATC recordings indicate, a level of stress in the voice of the pilot at this time.

ATC subsequetly cleared the pilot to climb to 5,500 ft and to track directly to the initial approach fix for the ILS (position LISZT).

At 1023:36, nearly a minute after obtaining a clearance from air traffic control and over a minute from leaving the ILS profile, the pilot commenced a sustained climb.

Recorded flight data indicated that during this time, the aircraft was below the minimum sector altitude of 4,300 ft and tracking towards rising terrain. The aircraft came within its closest proximity to terrain as it passed the ridgeline at about 810 ft above ground level.

At 1024:30 the pilot acheived an altitude of 4,300 ft enroute to position for a second approach.

A subsequent ILS approach was then flown into Alice Springs, followed by a successful landing.

Table 1: Sequence of events

Time: local	Description of event
1022:05	On ILS, wings level, 4,250 ft. Standard rate of descent (ROD)
1022:30	No longer on localiser (LOC), AOB 45° left, ~3,900 ft, descending
1022:35	Tracking greater the 90° off LOC, AOB 65° left, ~3,650 ft descending
1022:43	Tracking greater than 90°of LOC, AOB 45° right, bottom of descent ~3,320 ft
1022:47 ZMB – Tower broadcast	**VH-ZMB**: 'ZMB, ZMB we've got incorrect AH [artificial horizon] information we have lost glidepath request tracking direct to LISZT…Currently at 3,700…' **ATC:** 'Climb to 5,500 track direct to LISZT'
1023:16	Closest point of approach to the terrain was approximately 810 ft recorded
1023:36-38	Sustained climb begun with >500 fpm climb. Sustained 15° AOB left (controlled), ~3,800 ft
1024:30	10 NM minimum sector altitude (MSA) achieved 4,300 ft

Source: ATC recordings and recorded positional data tabulated by the ATSB

Context

Pilot qualifications and experience

The pilot held a commercial pilot licence (aeroplane) and a valid class 1 aviation medical certificate. The pilot reported a total flying time of 386 hours with about 66 of those being on the Cessna 310. The pilot obtained a multi-engine aeroplane instrument rating in February 2024. The pilot reported accruing 27.3 total hours of instrument flight time with 5.7 hours being accrued in the last 90 days. The pilot had been employed with the operator since April 2024 and had completed their Operator Proficiency Check – IFR [5], on 17 May 2024.

Aircraft

The Cessna 310R is a twin-engine, low-wing, 6-seat, unpressurised aircraft equipped with retractable landing gear. The aircraft was manufactured in 1976 and had greater than 16,600 hours recorded on the maintenance release. VH-ZMB was fitted with Garmin 430W avionics, coupled with a traditional avionics suite (Figure 2).

Figure 2: Photo of cockpit instruments from perspective of left (pilot) seat

Source: Operator annotated by the ATSB

The pilot reported that placement of the standby artificial horizon on the far right-hand side of the instrument panel (Figure 2) precludes the pilot from observing angles of bank (especially to the left). However, the pilot also reported utilising the standby AH as the primary means of spatial orientation, both during the occurrence and post-occurrence to fly the second approach and identified that recovery to a safe altitude was ultimately slowed by the significant workload of stabilising the aircraft on a limited instrument panel.

5 Instrument proficiency check means an assessment, against the standards mentioned in the Part 61 Manual of Standards, of a pilot's competency to pilot an aircraft under the IFR

Weather conditions

Weather conditions in the Alice Springs terminal area at the time of the occurrence were identified as a moderate south-easterly wind of 10 kt, with greater than 10 km of visibility. The cloud was reported as scattered (between 3–4 oktas[6]) at 900 ft, broken (between 5–7 oktas) at 1,300 ft and overcast (8 oktas) at 2,400 ft above ground level. The pilot reported the approach was conducted in instrument meteorological conditions and recalled being in stratiform cloud [7] from 7,000 ft to 2,500 ft AMSL.

Instrument landing system approach

The Alice Springs ILS runway 12 initial approach fix is a waypoint designated as LISZT which is about 15 NM (27.8 km) from the end of runway 12. The approach descent commences at 11.5 NM (21.2 km) from the runway 12 threshold, on a standard 3° descent profile. The missed approach procedure is to track 116° magnetic and climb to 5,500 ft AMSL.

Minimum sector altitude

Minimum sector altitude (MSA) is the lowest altitude which will provide a minimum clearance of 1,000 ft above all objects located within a specified area. This specified area is contained within a circle, or a sector of a circle of 25 NM (46.3 km) or 10 NM (18.5 km) radius centred on a significant point.

In the case for Alice Springs, the significant point being used as the datum reference point is the Alice Springs VHF Omni Directional Range (VOR) station[8].

The 10 NM MSA in the area around Alice Springs Airport is 4,300 ft AMSL.

Missed approach procedures

The missed approach procedure plays a pivotal role in instrument approach safety. It provides a standardised procedure for managing an aborted approach and landing attempt, ensuring appropriate terrain clearance to safely conduct flight operations in diverse environmental conditions.

Section 15.11 of the Part 91[9] Manual of Standards contains specific circumstances where a missed approach must be conducted.

A summary of these circumstances is as follows:

- during the final segment of an instrument approach, where the aircraft is not maintained within the applicable navigation tolerance for the aid in use
- when the required visual reference is not established at or before reaching the missed approach point from which the missed approach procedure commences
- when a landing cannot be made from a runway approach, unless a circling approach can be conducted in weather conditions equal to or better than those specified for circling
- when visual reference is lost while circling to land from an instrument approach.

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6 Total cloud amount measured visually by the fraction (in eighths or oktas) of the sky covered by clouds.
7 Stratus clouds tend to be featureless, low altitude clouds that cover the sky in a blanket of white or grey.
8 VHF Omni Directional Range (VOR) navigation consists of a ground-based component, called VOR stations, (as well as receivers installed in the aircraft). VOR stations are infrastructure, often located at terminal areas, to aid in navigation and approaches.
9 Part 91 of Civil Aviation Safety Regulations, General operating and flight rules.

Procedures outlined in the Aeronautical Information Publication (AIP) state that a missed approach must be conducted under certain conditions if the aircraft is below MSA. These conditions include, but are not limited to:

- issues arising with the radio aid,
- visual reference not being established, and
- a landing cannot be effected from the runway approach.

Operational procedures require that during a missed approach manoeuvre, an immediate climb is carried out to achieve an altitude that will remove the aircraft's exposure to the risks of collision with terrain.

Instrument approach procedures

An instrument approach or instrument approach procedure (IAP) is a series of predetermined manoeuvres for the orderly transfer of an aircraft operating under instrument flight rules from the beginning of the initial approach fix to a landing, or to a point from which a landing may be made visually.

An IAP enables a descent below the MSA, positioning the aircraft to safely approach and land.

Operations below MSA increase the risk of collision with terrain or obstacles which are an immediate threat. Maintaining the published instrument approach path assures the pilot of obstacle clearance below the MSA. Outside of these areas, while below the MSA and in instrument meteorological conditions (IMC), separation from terrain and obstacles cannot be guaranteed and the pilot must conduct a missed approach procedure.

Recorded data

Automatic dependant surveillance broadcast (ADS-B) Exchange and Flightradar24 data was collected by the ATSB and was supplemented with OzRunways data provided by the pilot.

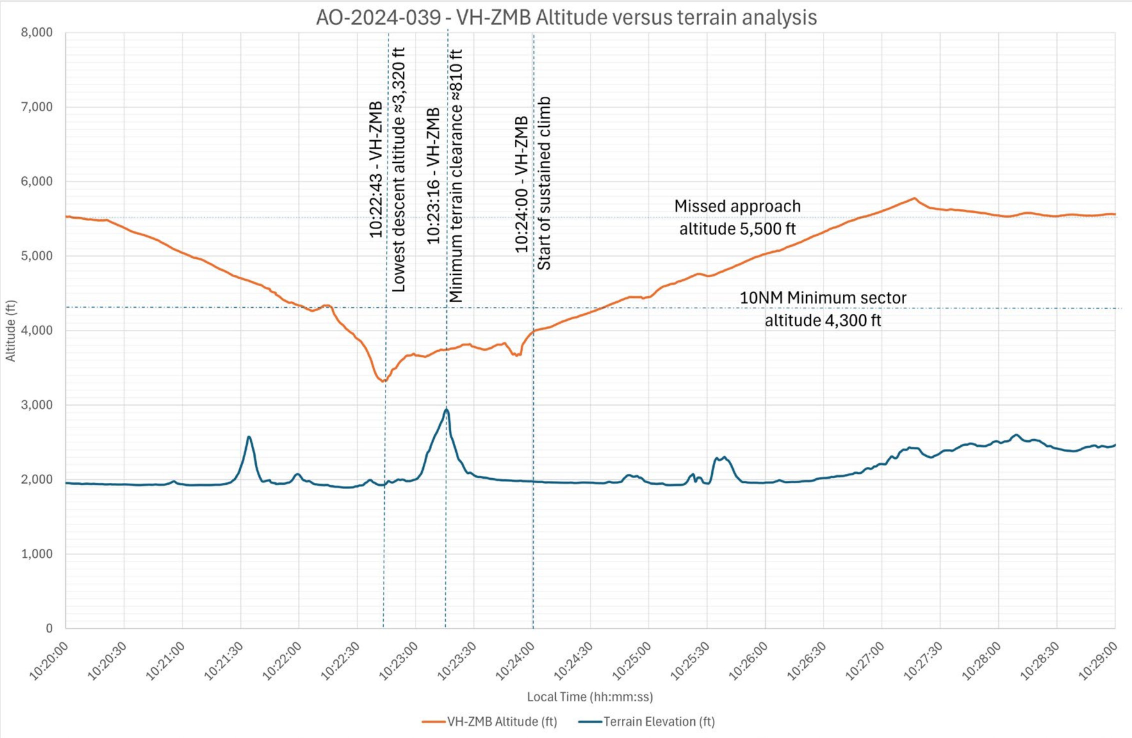
ATSB analysis combined the ADS-B flight data and the OzRunways aircraft track data to ascertain the track position and orientation of the aircraft during the occurrence.

At 1022:30 the aircraft deviated significantly to the left of the approach path resulting in the aircraft no longer being established on the ILS approach. The aircraft was below the MSA at 3,900 ft and continued to descend to the lowest point of 3,320 ft.

About 35 seconds later the aircraft crossed a ridgeline, further reducing the vertical separation with terrain to 810 ft above ground level.

Recorded data indicated (Figure 3) that 30–40 seconds after speaking to ATC and approximately 70 seconds after leaving the ILS approach profile, the pilot commenced a sustained climb and began tracking to the initial approach fix of LISZT. During this time the aircraft was operated below the MSA.

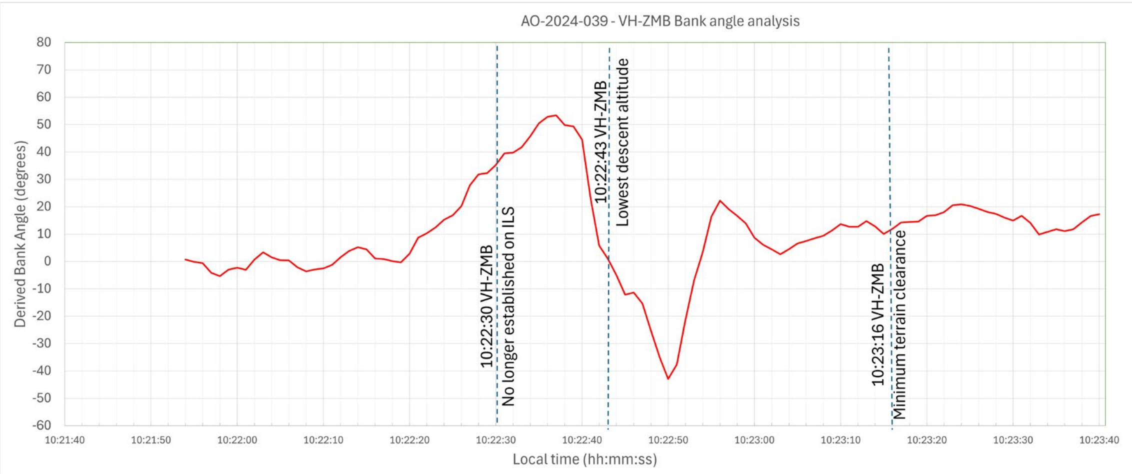
Figure 3: Aircraft vertical profile



Source: ADS-B Exchange, Flightradar24 and OzRunways data analysed and annotated by the ATSB

Recorded data identified a significant left turn, greater than 60° AOB, with a subsequent bank to the right of greater than 40° AOB and a further left correction (Figure 4). These occurred while the aircraft was still descending. The descent was arrested, at an altitude of about 3,320 ft. With minimal climb observed for about 30 seconds before approaching rising terrain, the aircraft then passed over the ridgeline at a height of approximately 810 ft (Figure 3). (Note: Graphical figures contain smoothed data profiles that may not precisely reflect the exact data point at an exact period).

Figure 4: VH-ZMB bank angles



Source: ADS-B Exchange, Flight Radar 24 and OzRunways data analysed and annotated by ATSB

Vacuum-powered gyroscopic instrumentation (artificial horizon)

The Cessna 310R is fitted with gyroscopic instruments[10] including an artificial horizon (AH), heading indicators and turn coordinators (turn and bank).

10 Gyroscopic flight instruments are instruments which have a mechanical gyroscope incorporated into their design.

The vacuum system instruments on the Cessna 310R consist of 2 directional gyros, 2 AH gyros and the suction gauge.

The artificial horizon is the main instrument pilots use to fly through IMC. This instrument is considered a master instrument because it presents pitch and bank attitude information directly against an artificial horizon. It is a critical instrument to allow pilots to fly through non-visual and low-visibility conditions. It indicates the aircraft's orientation relative to the earth, expressed in pitch, roll, and yaw.[11]

Figure 5: Generic example of an artificial horizon

Source: Wikipedia

The gyroscopic instruments are powered by the vacuum system, consisting of a vacuum pump on each engine, pressure relief valve for each pump, a common vacuum manifold, vacuum air filter and suction gauge. Air pressure is used to rotate vanes to spin the instrument gyroscopes thus utilising gyroscopic forces as a mechanism that keeps the instrument level with respect to the

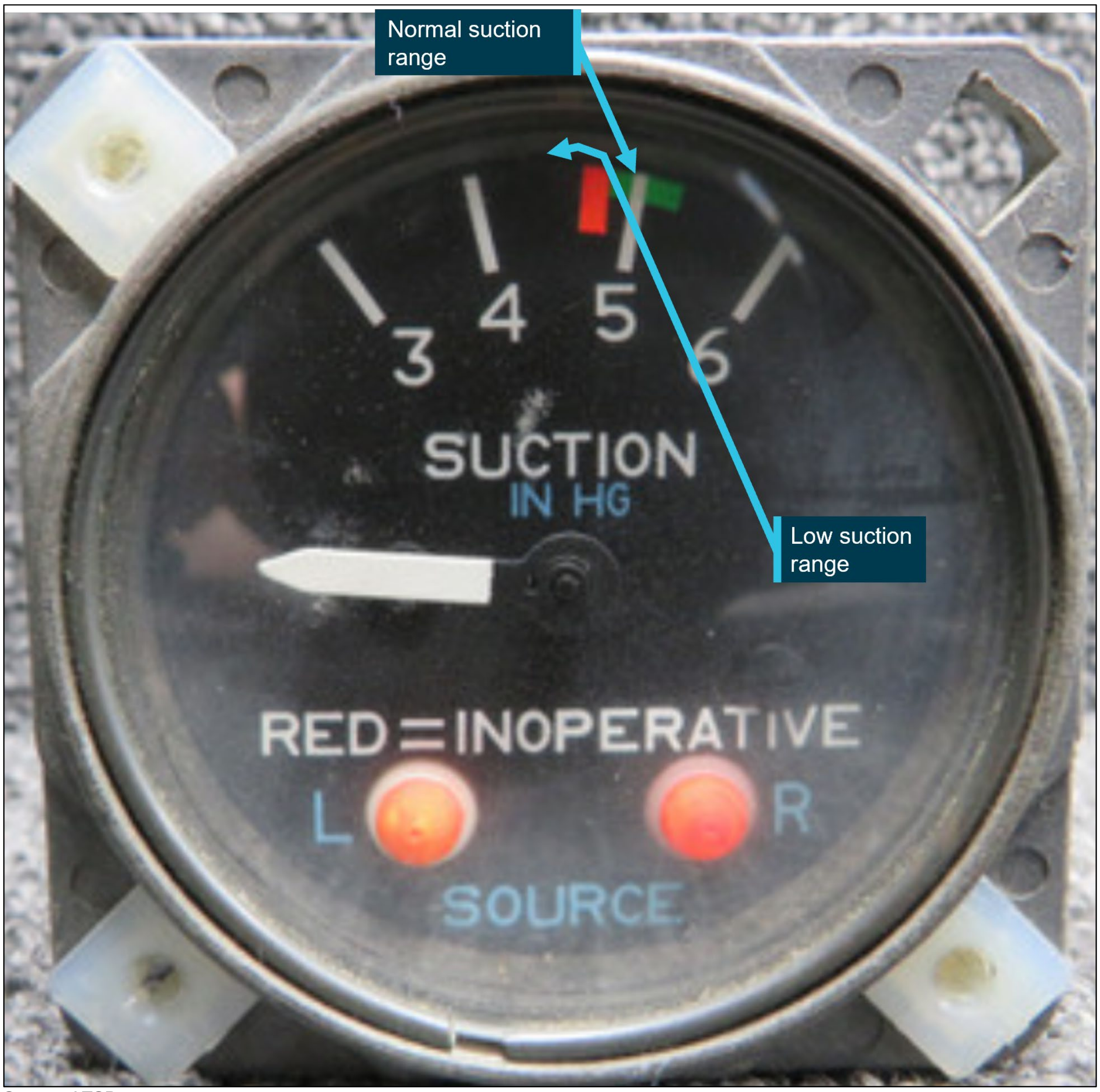
11 Rotation around the front-to-back axis is called roll. Rotation around the side-to-side axis is called pitch. Rotation around the vertical axis is called yaw.

direction of gravity. The AH gyro is mounted in a double gimbal, which allows the aircraft to pitch and roll as the gyro stays vertically upright.

The pilot reported that during the approach they noticed that the suction gauge was indicating 'low pressure'. A partial blockage or issue in the pilot suction line, immediately after the air filter, could affect the pilot (left-side) AH and the suction gauge, with nil effect on the copilot (right-side) gauges.

However, post-occurrence maintenance inspections and ground runs could not identify any abnormalities in the vacuum system.

Figure 6: Example of the suction gauge



Source: ATSB

Post occurrence maintenance testing of the artificial horizon identified a gradual drift in pitch, up to 7°, and up to 4° drift in the roll axis over a period of 20 minutes. The AH deviations were gradual, inconsistent and outside the manufacturer's required tolerances.

Flight automation and operator policy

Flight automation, such as an approved autopilot, utilises different control systems and technologies that reduce the requirements of human interaction.

An autopilot system can reduce the pilot's workload. This is achieved by the automation taking over routine tasks such as maintaining altitude, heading, and airspeed. Subsequently allowing the pilot mental capacity to focus on other critical aspects of the flight, such as monitoring systems, flight path, weather conditions and communicating with air traffic control. This is particularly useful in times of a high workload environment.

The operator's policy did not detail requirements on when it was appropriate or required to use the autopilot.

PAN PAN call

A 'PAN PAN' transmission is used to describe an urgent situation, but one that does not require immediate assistance. Examples of such situations include instrument malfunctions, deviation from route or entering controlled airspace without a clearance.

When an air traffic controller receives a PAN PAN call from an aircraft, the controller will declare an alert phase.[12] The Safety bulletin *What happens when I declare an emergency*, released by Airservices Australia, stated that ATC may provide a range of support services including:

- passing information appropriate to the situation, but not overloading the pilot
- allocating a priority status
- allocating a discrete frequency (where available) to reduce distractions
- notifying the Joint Rescue Coordination Centre (JRCC), appropriate aerodrome or other agency
- asking other aircraft in the vicinity to provide assistance.

An aircraft is in an urgency condition the moment that the pilot becomes doubtful about position, fuel endurance, weather, or any other condition that could adversely affect flight safety. The time for a pilot to request assistance is when an urgent situation may or has just occurred.

No 'PAN PAN call was made by the pilot during the occurrence.

Air traffic control safety alert

A safety alert issued by air traffic control is instructions prefixed by the phrase 'SAFETY ALERT'. The AIP outlines a safety alert as:

> ATC will issue a Safety Alert to aircraft, in all classes of airspace, when they become aware that an aircraft is in a situation that is considered to place it in an unsafe proximity to:
>
> a. terrain;
>
> b. obstruction;
>
> c. active restricted areas; or
>
> d. other aircraft.

A safety alert should trigger an appropriate response from the pilot to address and resolve the undesirable state.

When the pilot made contact with ATC, the controller reported observing a level of stress in the pilot's voice and noticed the pilot tracking perpendicular to the approach path for the runway 12 ILS, below the MSA, towards rising terrain.

No safety alert was made by air traffic control during the occurrence.

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[12] Alert phase: a situation where apprehension exists as to the safety of an aircraft and its occupants (this generally equates to a PAN PAN).

Spatial disorientation

Spatial disorientation (SD) occurs when a pilot has a false perception of the motion or orientation of the aircraft with respect to the Earth (Ledegang & Groen, 2018), subsequently incorrectly interpreting the aircraft attitude, altitude or airspeed.

The ATSB publication *Accidents involving Visual Flight Rules pilots in Instrument Meteorological Conditions* (AR-2011-050) explains the basis of SD.

> In order to correctly sense the orientation of the body relative to its environment, a pilot relies on a number of sensory systems in order to establish or maintain orientation:
> » the visual system
> » the vestibular system, which obtains its information from the balance organs in the inner ear
> » the somatic sensory system which uses the nerves in the skin and proprioceptive senses in our muscles and joints to sense gravity and other pressures on the body.
>
> The visual system is by far the most important of the three systems, providing some 80 per cent of the raw orientation information. In conditions where visual cues are poor or absent, such as in poor weather, up to 80 per cent of the normal orientation information is missing. Humans are then forced to rely on the remaining 20 per cent, which is split equally between the vestibular system and the somatic system. Both of these senses are prone to powerful illusions and misinterpretation in the absence of visual references, which can quickly become overpowering.
>
> Pilots can rapidly become spatially disoriented when they cannot see the horizon. The brain receives conflicting or ambiguous information from the sensory systems, resulting in a state of confusion that can rapidly lead to incorrect control inputs and resultant loss of aircraft control.

The ATSB research report, *An overview of spatial disorientation as a factor in aviation accidents and incidents* (B2007/0063*)*identified that spatial disorientation is a very common problem and estimates that the chance of a pilot experiencing SD during their career is in the order of 90 to 100%. This report also detailed several international studies showing that SD accounts for some 6 to 32% of major accidents, and some 15 to 26% of fatal accidents. The report also identified that the true prevalence of SD events is almost certainly underestimated.

The FAA Advisory Circular, *Pilot's spatial disorientation* (FAA AC60-4A) discussed the challenges associated with recovering from spatial disorientation. The results of a test conducted with qualified instrument pilots found that it took as much as 35 seconds to establish full control by instruments after a loss of an applicable visual reference.

Safety analysis

This analysis will explore the factors that involved aircraft directional changes, resulting in the aircraft deviating from the published ILS approach. The deviations occurred whilst the pilot was manually flying, in instrument meteorological conditions. The consequence of this deviation led to extended flight below the minimum sector altitude with increased pilot workload prior to recovering to a safe altitude.

The pilot reported being concerned with the aircraft's location in relation to terrain, however, believed the aircraft was under control, attributing the unusual attitudes indicated on the artificial horizon to an instrument error rather than the aircrafts attitude.

The pilot reported that, at the time, false indications by the vacuum instruments were incorrectly indicating a turn to the right, which the pilot believed to be a consequence of erroneous instrument indications. The pilot recalled that their initial response to correct this was a turn to the left and believed that the vacuum instruments were still incorrectly indicating a level of bank even though the aircraft was level.

ATSB analysis of the recorded data reviewed the aircraft pitch and bank angles, descent and climb profiles, and aircraft tracks and timings confirmed that the instrument indications (at this time) correlated with high levels of bank and the aircrafts track.

Furthermore, although the pilot remembered observing a low vacuum pressure indication, a post-incident system inspection indicated no identified problems with vacuum pumps or the check valves.

As such, it is almost certain that there was no instrument malfunction to the extent believed by the pilot. Rather, with no visual cues due to the IMC, the pilot likely became spatially disorientated and interpreted the real instrument indications as false as they mismatched the pilot's sensed orientation.

As is common in spatial disorientation, the pilot likely followed their sense of direction rather than the (perceived faulty) instruments, leading to directional changes of up to 90° from the approach track as well as left and right angles of bank up to 65°, whilst continuing to descend.

However, post-occurrence maintenance fault-finding of the artificial horizon did identify a gradual drift in pitch, (up to 7°) and roll, (up to 4°) over a period of 20 minutes. While this may have indicated a degree of unserviceability of the instrument, this was not consistent with the reported sudden and absolute failure reported by the pilot.

Prior to the deviations on approach in IMC, the pilot descended below the minimum sector altitude. However, after deviating from the approach and no longer meeting approach tolerances, the pilot did not conduct a missed approach as quickly as practicable to achieve an altitude that would remove the aircraft's exposure to the risks of collision with terrain.

Subsequently, the pilot was below MSA and no longer offered the protection of being on the approach. This situation was further exacerbated by the aircraft being in unusual attitudes and tracking perpendicular to the approach path, without intent. If this high-risk situation had been identified either by ATC issuing a safety alert or the pilot issuing a PAN PAN call, (a PAN PAN call should have triggered a safety alert to climb), a climb could have been expedited and the risk of proximity to terrain removed sooner than was the case.

Pilots should not hesitate to report an urgent condition when encountering situations that may not be immediately perilous but significantly increase risk.

ATC recordings indicated that the pilot notified ATC that they had incorrect artificial horizon information and had lost glidepath guidance. The pilot used their callsign twice, (which can often precede a distress call), and other verbal cues were also identified by the controller to indicate the pilot was under a level of stress. Being below the MSA and off the ILS, with indications of stress, was an opportunity for the controller to issue a safety alert to the pilot to climb immediately.

In an urgent situation such as this where the safety of the aircraft was uncertain, the broadcast of a PAN PAN call would have been appropriate. Had a PAN PAN call been broadcast, ATC would have almost certainly issued a safety alert. This would have required the pilot to conduct an immediate climb, removing their subsequent risk exposure to collision with terrain.

Flight data and recordings indicated that the aircraft was below MSA, from leaving the approach profile to commencing a sustained climb to a safe altitude, for greater than one minute. Additionally, the time elapsed from notifying ATC (below MSA), to commencing a sustained climb to a safe altitude, was greater than 30 seconds. During this time, in IMC, the aircraft came within 810 ft of terrain.

Instrument flight can be considered one of the more challenging operational environments to which a pilot can be exposed. Single-pilot operations have the potential to increase pilot workload (ALPA 2019).

Manually flying a single pilot approach in IMC increases the workload of any pilot. In this occurrence, the suspected loss of a primary instrument during an instrument flight rules approach, departing the ILS approach, experiencing unusual aircraft attitudes in IMC, and subsequently conducting a second approach all increased the workload of the pilot. Use of the autopilot system has the potential to significantly reduce the workload on pilots during this approach. This is achieved by the autopilot taking over routine tasks such as maintaining altitude, heading and airspeed. Thus, allowing the pilot to focus on other critical aspects of the flight. Whilst compliant with operator procedures at the time, use of the autopilot may have reduced the risk of spatial disorientation of the pilot on approach. The pilot reported that the autopilot could not be engaged post the occurrence, when positioning for the second approach.

Use of automation can afford the pilot spare mental capacity to recognise and address navigational deviations and tolerances. Thus, aiding the pilot to respond to the operational demands of the flight in a correct and timely manner.

Findings

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

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

From the evidence available, the following findings are made with respect to the flight below minimum sector altitude involving Cessna 310R, VH-ZMB, 14 km west-north-west of Alice Springs Airport, Northern Territory, on 1 July 2024.

Contributing factors

- At about 8 NM from Alice Springs whilst established on the ILS approach in instrument meteorological conditions, the pilot likely experienced spatial disorientation that led to directional changes of up to 90° from the approach track as well as left and right angles of bank up to 65°, whilst continuing to descend.
- The pilot did not maintain track or glidepath and deviated from instrument landing system below the minimum sector altitude. Once outside of the required tolerances, the pilot did not conduct a missed approach, which increased the risk of collision with terrain.
- Air traffic control did not issue a safety alert. This would have alerted the pilot that they were in unsafe proximity to terrain and needed to climb immediately.
- The pilot did not broadcast a PAN PAN call notifying air traffic control and other traffic of their situation, leading to the pilot remaining below minimum sector altitude for an extended period without air traffic control instruction to climb.

Other factors that increased risk

- Post occurrence fault-finding of the artificial horizon, identified gradual and inconsistent deviations outside the manufacturer's required tolerances.
- The pilot did not utilise the autopilot for the approach even thought they were in a high workload environment. The appropriate use of autopilot can reduce workload and subsequent risk of spatial disorientation such as during an instrument approach.

Safety actions

Safety action by Avcharter

The operator has since introduced an automation policy for the use of autopilot in conditions applicable to instrument meteorological conditions (IMC) and in high workload single-pilot environments.

General details

Occurrence details

Date and time:	01 July 2024 09:22 AUS Central Standard Time	
Occurrence class:	Serious incident	
Occurrence categories:	Avionics / Flight instruments, Flight below minimum altitude, Information / Procedural error, Warning devices	
Location:	13.9 303 degrees from Alice Springs Aerodrome	
	Latitude: 23.7391° S	Longitude: 133.7871° E

Aircraft details

Manufacturer and model:	CESSNA AIRCRAFT COMPANY 310R	
Registration:	VH-ZMB	
Operator:	AVLEASE PTY LTD	
Serial number:	310R0815	
Type of operation:	Part 135 Australian air transport operations - Smaller aeroplanes-Standard Part 135	
Activity:	Commercial air transport-Non-scheduled-Passenger transport charters	
Departure:	Willowra Aircraft Landing Area, NT	
Destination:	Alice Springs Aerodrome NT	
Persons on board:	Crew – 1	Passengers – 0
Aircraft damage:	Nil	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the pilot of the flight
- the head of flight operations for the operator
- Civil Aviation Safety Authority
- the aircraft manufacturer
- the maintenance organisation for VH-ZMB
- independent avionics specialists
- Airservices Australia
- recorded data from the GPS unit on the aircraft.

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Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section allows a peon receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the following directly involved parties:

- The pilot of the flight
- The operator
- Air traffic controller
- Airservices Australia
- Civil Aviation Safety Authority

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.