Australian Government
Australian Transport Safety Bureau

Wirestrike and collision with terrain, involving Cessna 172, VH-REU

Coonabarabran Aerodrome, New South Wales, on 18 April 2022

ATSB Transport Safety Report
Aviation Occurrence Investigation (Short)
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Addendum

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Executive summary

What happened

On 18 April 2022, the pilot of a Cessna 172 aircraft, registered VH-REU, was conducting a private flight at Coonabarabran Aerodrome, New South Wales.

After completing several circuits and touch-and-go landings, the pilot flew a low pass at 15–25 ft above the ground over a tractor that was being used to slash a field adjacent to the aerodrome. During the low pass, the aircraft contacted powerlines over the field and impacted terrain. The pilot received fatal injuries and the aircraft was destroyed

What the ATSB found

No pre-impact defects were identified with the aircraft structure, flight controls or engine, and witnesses stated the aircraft was operating normally on the day of the accident. Although operations at low levels are normal in the vicinity of an airfield during take-off and landing, the aircraft's flight path just prior to the collision did not align with the runways and was not consistent with any part of a normal circuit pattern. It was therefore very likely that the pilot was conducting an intentional low-level pass over the tractor. The pilot was familiar with the aerodrome and was reported to be aware of the location of the powerlines. The pilot did not have a low-level rating and therefore had not undertaken the required training and assessment required to operate below 500 ft.

The pilot was wearing only the lap portion of the seatbelt during the accident flight, and not the sash-type upper torso restraint that was also fitted. However, it was not possible to determine with certainty whether, if worn, the upper torso restraint would have reduced the severity of injuries.

What has been done as a result

Based on a risk assessment conducted by the electricity provider post-accident, aerial safety markers were fitted to the powerlines in the field adjacent to the aerodrome where the aircraft contacted powerlines.

Safety message

Operations at low height expose an aircraft to several hazards like powerlines, which are typically very difficult to see and present a critical hazard to any low-flying aircraft. As identified in the ATSB publication Avoidable Accidents No. 1 - Low-level flying (atsb.gov.au), research has shown that an awareness of powerline location does not guarantee avoidance. In recognition of these and the other specific risks and hazards of low-level flying, the Civil Aviation Safety Authority requires pilots to receive special training and a specific low-level rating before conducting low-level operations. Even with appropriate training, flying at low-level carries a significant risk and should be avoided when there is no operational reason.

Additionally, research has shown that wearing an upper torso restraint significantly reduces the risk of serious or fatal injury. Therefore, pilots should always wear upper torso restraints when available.

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

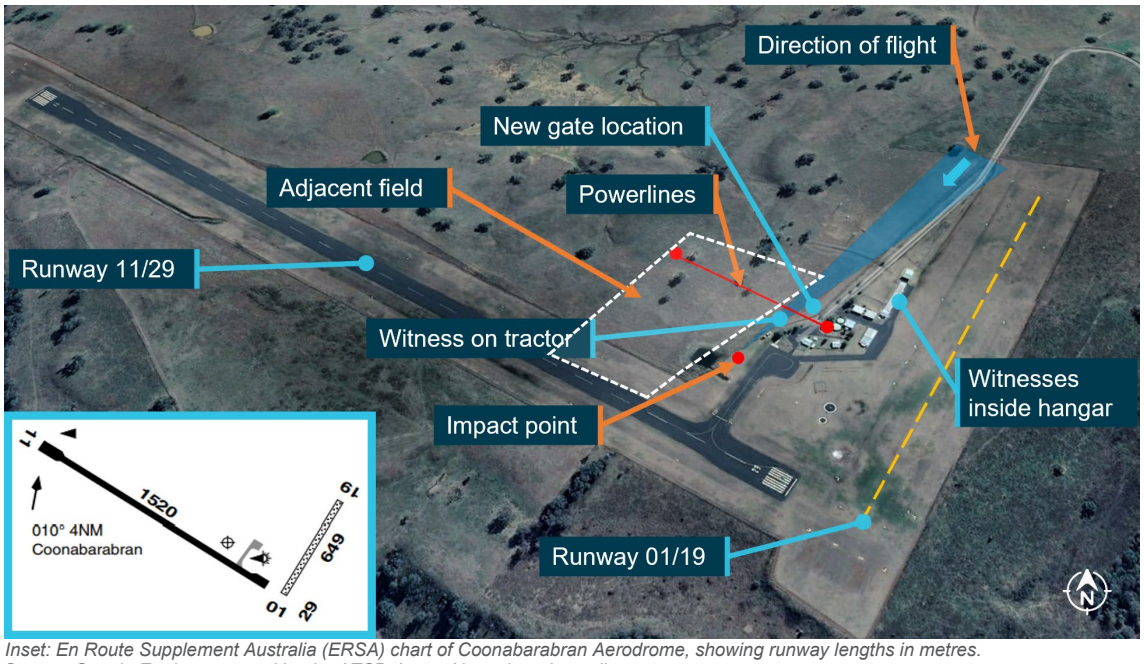
On 18 April 2022, the pilot of a Cessna 172, registered VH-REU, was conducting a private flight involving circuits[1] and touch-and-go landings[2] at Coonabarabran Aerodrome, New South Wales. The pilot was the only person on board.

The pilot had been at the aerodrome the day prior, and it was reported by a friend (who had known the pilot for a significant period) that a discussion took place about a newly-erected gate, installed to permit access to a field adjacent to the aerodrome. Part of the discussion included the position of the gate, and that it had been installed in a different location than originally decided because of its proximity to overhead powerlines.

On the day of the accident, the pilot arrived at the aerodrome at about 1530 local time. Four other people were at the aerodrome: 3 in a hangar and the friend—who was the person who had talked with the pilot the day before—on a tractor that was towing a slasher in the adjacent field (Figure 1). One of the witnesses in the hangar recalled seeing the pilot take off to the north on runway 29.

The witness on the tractor recalled seeing the pilot do 2 touch-and-go landings on runway 11, before travelling to the north behind the witness, and banking right back towards the aerodrome. At the time, the witness initially thought that the pilot may have been going to conduct an approach to runway 19, but then realised that this was probably not the case as the aircraft was not turning left, which would have been normal for the approach to runway 19.

Figure 1: Aerodrome and flight path overview



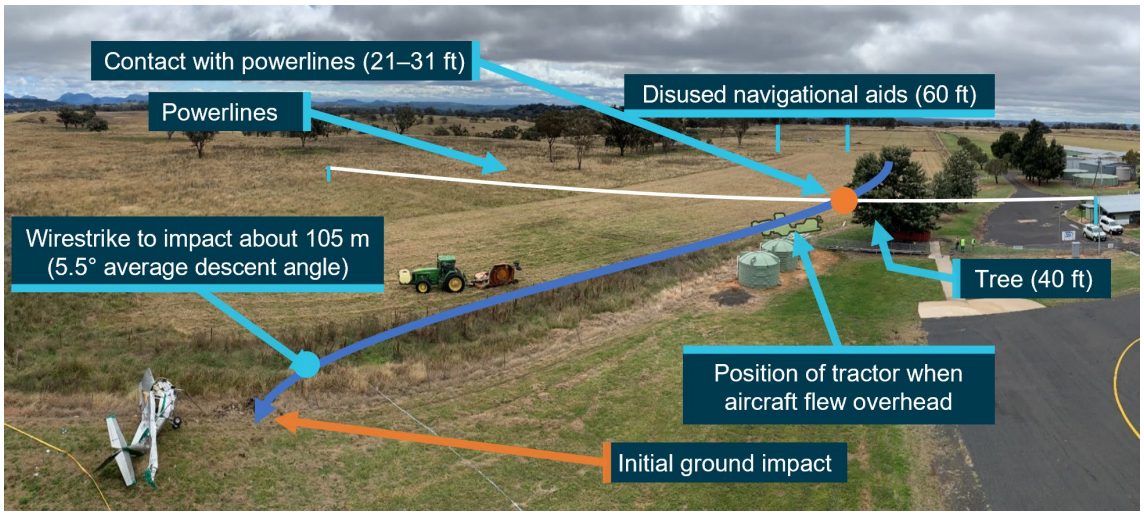
Inset: En Route Supplement Australia (ERSA) chart of Coonabarabran Aerodrome, showing runway lengths in metres.
Source: Google Earth, annotated by the ATSB. Inset: Airservices Australia

[1] Circuit: the specified path to be flown by aircraft operating in the vicinity of an aerodrome.

[2] Touch-and-go: a manoeuvre in which an aircraft conducts an approach, touches the runway, and immediately takes off again.

The witness on the tractor recalled that the next time they saw the aircraft, it was about 500 m away and was travelling back towards the field at about 70 ft (or about the same height as some unused navigational aids) (Figure 2). At this time, based on the direction and height of the aircraft, the witness thought that the pilot was likely going to fly directly over the tractor. When the witness turned again, the aircraft was directly behind them, flying straight and level. The witness estimated its speed as about 80–85 kt, or fast enough to maintain control of the aircraft but not at top speed. The witness observed the aircraft contact the powerlines just behind and above the tractor and recalled hearing a whistling and crack as the wires travelled over the tractor cab.

Figure 2: Estimated flight path based on impact with powerlines and witness account



Flight path of VH-REU indicated by blue line.
Source: ATSB

The witnesses inside the hangar recalled hearing the aircraft fly past the back of the hangar with the engine sounding like what one of the witnesses described as ‘high power’. Not long after, electrical power to the hangar was lost.

After the aircraft contacted the powerlines, it impacted the ground at a steep angle, cartwheeling to the right and coming to rest just inside the boundary fence of the aerodrome. The pilot was fatally injured and the aircraft was destroyed.

Context

Pilot information

The pilot held a valid private pilot licence (aeroplane), issued in 1994 and with class ratings for multi- and single- engine aeroplanes. The pilot did not hold a low-level rating or any other operational ratings. In August 2019, the pilot reported during an aviation medical examination, that they had accumulated 2,655 flight hours. The pilot’s flight hours at the time of the accident could not be determined.

In addition to obtaining their private licence, the pilot had been involved in several aviation activities throughout their career, including involvement in aerial firefighting (in non-piloting aerial support roles) in a rotary-wing context.

The pilot held a class 2 medical certificate, valid to 30 September 2023, with no identified medical conditions. The pilot was required to have reading correction available to exercise the privileges of the licence. There were no issues identified in the post-mortem examination and toxicological results (including carbon monoxide) that may have affected the pilot’s operation of the aircraft. The pilot was also reported to have slept well in the days leading up to the accident and be in good general health.

Aircraft information

The Cessna 172 is a high-wing, all-metal, unpressurised aircraft with a fixed landing gear. VH-REU had a single, Continental O-300-A piston engine driving a fixed-pitch propeller.

VH-REU was manufactured in 1958 with serial number 46237 and first registered in Australia in 1959. The aircraft had been owned by and registered to the pilot since 2016, and at the time of the accident had accumulated 1,046.3 hours total time in service.

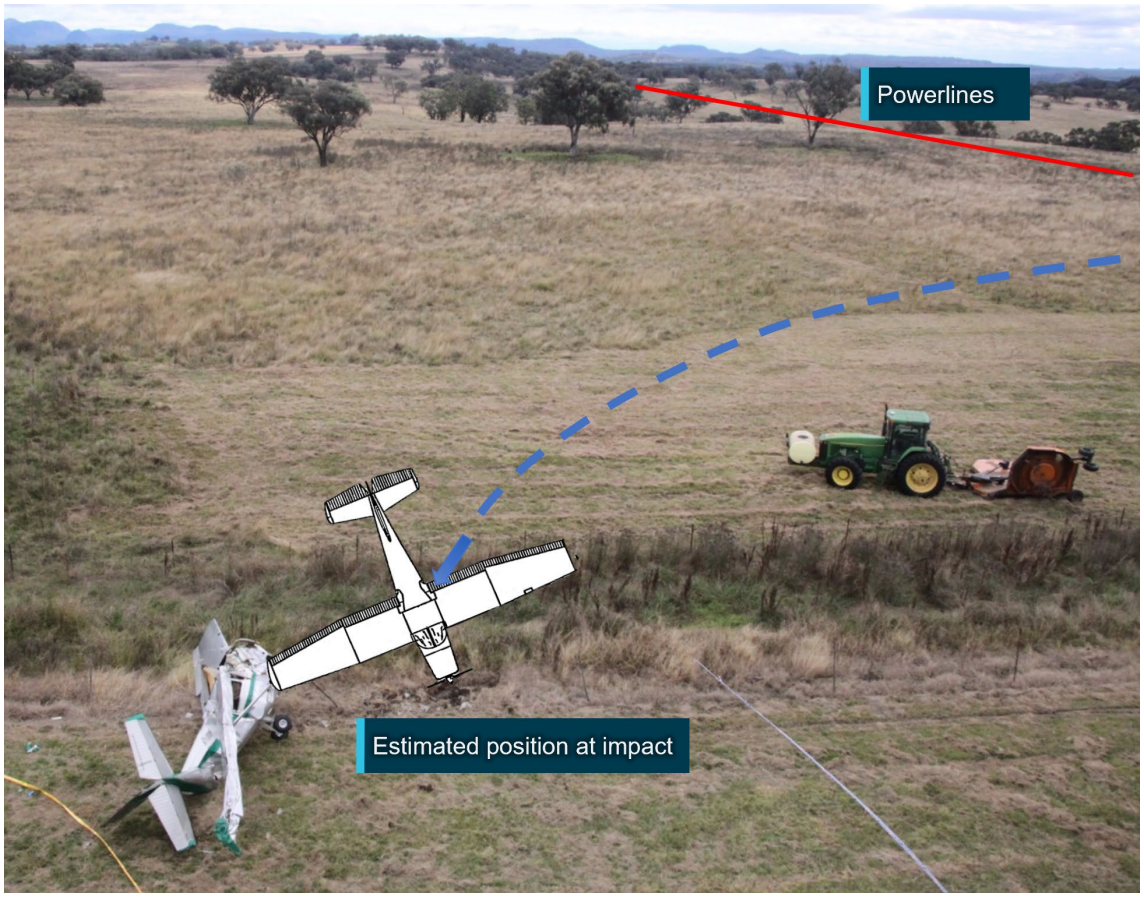
The most recent maintenance for the aircraft was completed in April 2022 with a current maintenance release issued on 6 April 2022. The primary purpose for the maintenance was to complete a periodic (100–hourly) inspection and have a BendixKing Aerocruze autopilot fitted to the aircraft. In the days following installation, 2 flights totalling 2.1 hours were undertaken by the maintenance provider to check and adjust the autopilot. The only subsequent flight was a 0.9-hour flight by the owner on 14 April 2022.

Wreckage and impact information

No pre-impact defects were identified with the aircraft's engine, flight controls or structure. There was no evidence of fire.

Damage to the aircraft and powerlines indicated that the aircraft had contacted the powerlines and then travelled about 105 m before ground impact. The aircraft impacted the ground about 57° nose-down, skidding to the right, and yawing to the left (Figure 3).

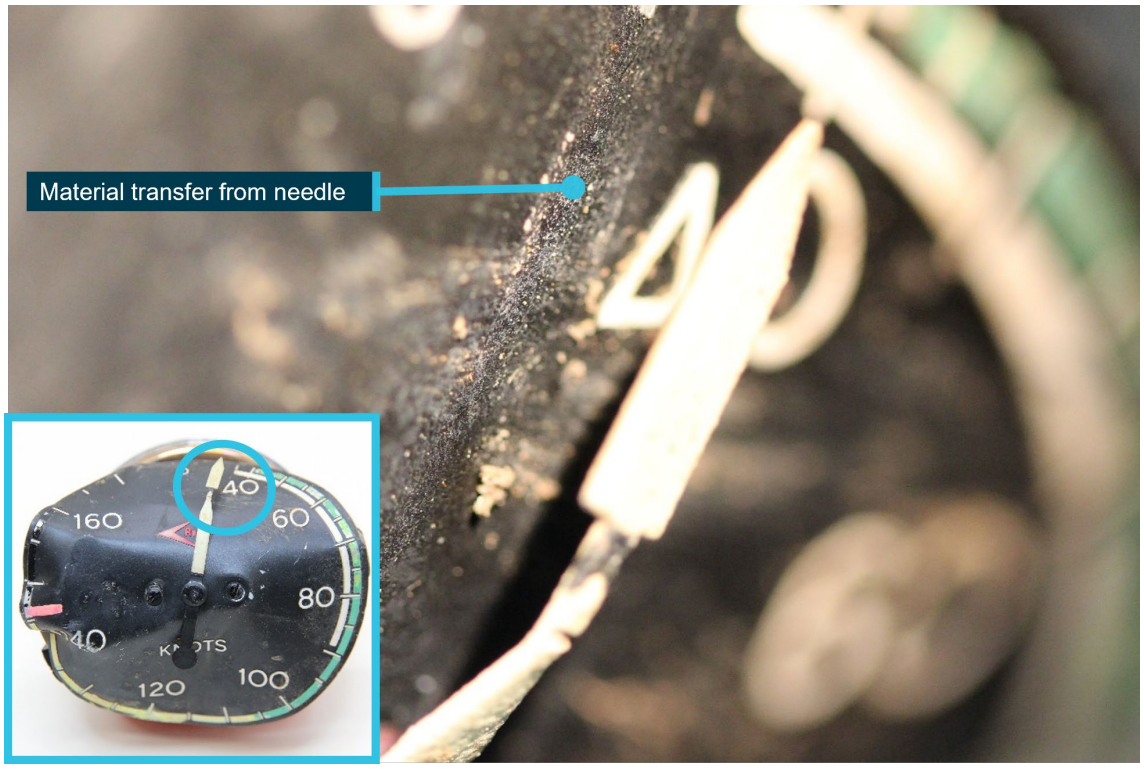
Figure 3: Estimated impact orientation



Source: ATSB

Based on a transfer of material from the airspeed indicator needle to its face, the aircraft likely impacted the ground at about 30 kt (or about 55 km/h) (Figure 4).

Figure 4: VH-REU airspeed indicator with material transfer



Source: ATSB

The wreckage examination also showed:

- damage to the left wing and strut indicated that the aircraft was likely close to level flight (about 11–12° right wing low) when it contacted the powerlines, with one of the powerlines remaining entangled with the left wing and left wing strut (Figure 5)
- one of the propeller blades had marks likely from contact with the powerlines, and had a significant forward bend and tip curl, which was consistent with the engine producing power when the aircraft impacted the ground (Figure 6)
- the other propeller blade was bent rearwards and had damage consistent with ground impact during the cartwheeling motion of the aircraft
- liveable space in the cabin was maintained
- the seat tracks were in place and the pilot's seat was still attached to the aircraft structure
- the pilot's upper torso restraint (shoulder harness) was found stowed.[3]

[3] The upper torso restraint (shoulder harness) was physically attached to the roof of the cabin at one end, and when in use, the other end is secured to the lap portion of the restraint.

Figure 5: Powerline, left wing and strut

Source: ATSB

Figure 6: Damage to propeller from powerlines and ground impact

Source: ATSB

Meteorological conditions

The aerodrome forecast (TAF) for Coonabarabran Aerodrome issued on 18 April 2022 and valid from midday included a forecast wind 350° at 12 kt, visibility more than 10 km, scattered cloud at 3,000 ft and temperature of 22 °C. Actual conditions at about the time of the accident were consistent with the forecast and indicated a temperature of 23° C, wind 360° at 7 kt, nil cloud with visibility greater than 10 km.

Aerodrome information

Coonabarabran Aerodrome was a certified, non-controlled aerodrome. It had a 1520-m long asphalt runway 11/29[4], and a 649-m long grass runway 01/19.

The normal circuits for all runways at Coonabarabran had left-hand patterns (turns made in the circuit were to the left).

Powerline information

The 22-kV powerlines that were struck by the aircraft consisted of a pair of 3-strand galvanised steel wires. The wires spanned across timber poles that were 314 m apart. The powerlines had to be maintained so that the wires had a clearance of 5.5 m from the ground. The powerlines at the aerodrome (including an allowance for catenary) were reportedly compliant with this requirement, and were estimated to be at a height of 21–31 ft (6–9 m) above the ground at the point of impact

[4] Runway numbering: represents the magnetic heading closest to the runway orientation (for example, runway 29 is oriented 292º magnetic).

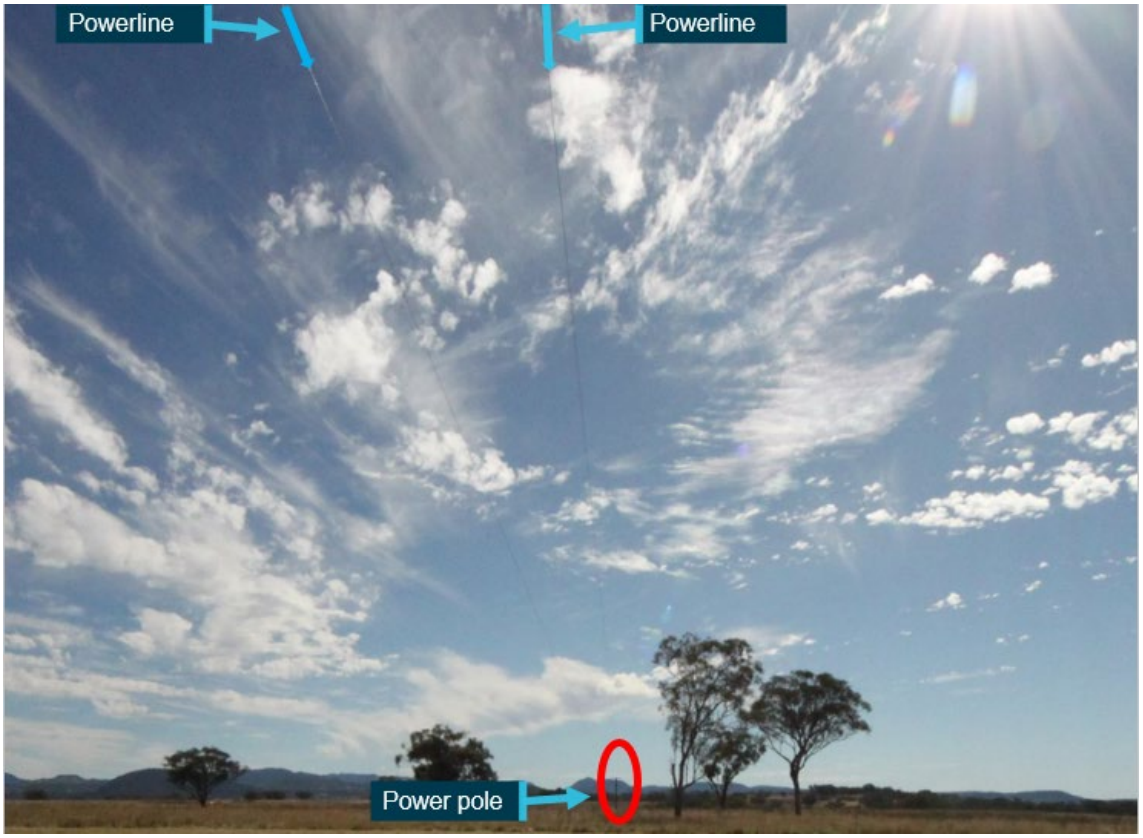
at the time of the accident. The nearest power pole was a terminus of the line that ran to the aerodrome (Figure 1).

The powerlines were not marked and were not required to be marked by Australian Standards (AS) 3891.1 (*Permanent marking of overhead cables and their supporting structures for other than planned low level flying*) or AS 3891.2.4 (*Marking of overhead cables for planned low level flying operations, addressed the requirements for marking overhead cables, including powerlines*).

Separately, the Civil Aviation Safety Authority detailed restrictions in the Civil Aviation Safety Regulations (CASR) Part 139 Manual of Standards (MOS) in relation to obstacles around an aerodrome. The adjacent field was located in the area defined as the aerodrome's outer horizontal surface. In this area, markings were required on any object that was 150 m or higher. Markings were also required on any object in the take-off or approach path of aircraft. Neither of these requirements applied to the powerlines located at Coonabarabran Aerodrome.

Figure 7, looking west-north-west, shows reinstalled powerlines above the field after the accident.

Figure 7: Reinstalled powerlines in the adjacent field



Source: ATSB

Low-level rating

CASR 91.267 stated that a pilot could not fly below 500 ft (above the highest feature or obstacle within a horizontal radius of 300 m of the point on the ground or water immediately below the aircraft) unless in certain circumstances. These circumstances included (but were not limited to) the aircraft being in the process of taking off, landing or a missed approach, or the pilot holding an approval to conduct such flights.

The CASR Part 61 MOS required that, for pilots to obtain a low-level rating, which enabled them to undertake certain operations below 500 ft (such as agricultural, aerial survey or aerial firefighting), they must first demonstrate competency against certain performance criteria. In terms of operational techniques, this required (among other things) theoretical knowledge of how to

manage obstructions such as powerlines and that a pilot could plan low-level operations, specifically identify hazards, evaluate and manage risks at low level.

Survivability

When assessing whether an aircraft accident is survivable, a number of aspects need to be considered, including:

- forces imparted on the aircraft occupants
- occupant restraints
- liveable space inside the aircraft being maintained.

ATSB analysis indicated that the level of deceleration exerted on the pilot of VH-REU during ground impact was likely to result in severe or fatal injuries.

CASR 90.105 required that the seats in the front row of an aircraft be fitted with an approved safety harness. For small aeroplanes (with maximum take-off weight less than 5,700 kg), the safety harness needed to consist of a lap belt and at least one shoulder restraint (that is, a 3-point restraint).[5]

Upper torso restraints in aircraft serve 2 purposes:

- to reduce upper body flailing and subsequent contact with aircraft structures and strike hazards
- to distribute acceleration forces across a larger body area to reduce local transmission of force.

Although the upper torso section of a 3-point harness (with a sash-type upper restraint) provides restraint in the forward direction, it may provide very limited lateral restraint (Douglas and others 2007). Furthermore, if the occupant moves in a lateral (side) or diagonal direction away from the shoulder harness upper mounting point, it is possible to slip out of the shoulder harness.

VH-REU was fitted with 3-point restraints in each of the 2 front seats and the 2 rear seats. The pilot's upper torso restraint was installed to cover the left shoulder. After the initial front-right impact, the pilot remained restrained by the lap belt. The upper torso restraint was not being worn.

Previous occurrences involving low-level flying and wirestrikes

ATSB educational publications discussing occurrences prior to 2013

The 2013 ATSB educational publication *Avoidable Accidents No. 1: Low-level flying* (AR-2009-041) focused on accidents involving unnecessary and unauthorised low flying:

> Recognising the risks and hazards of low-level flying, CASA requires pilots to receive special training and endorsements before they can legally conduct low-level flying. In the accidents examined, many of the pilots did not have low-level training or an endorsement to do so, and none had a legitimate reason to be flying below the minimum limits. For most private pilots, there is generally no reason to fly at low levels, except during take-off and landing, conducting a forced or precautionary landing, or to avoid adverse weather conditions.

Another 2013 ATSB publication *Avoidable Accidents No. 2: Wirestrikes involving known wires: A manageable aerial agriculture hazard* (AR-2011-028) detailed a wirestrike accident where the pilot was aware of the powerline location:

> Studies into 'inattentional blindness' have shown that we fail to perceive unexpected objects (even if they appear in the field of vision) if we are not paying attention to them (for example, focusing on another object or task). Without attention, there is no perception. Thus, you are unlikely to notice an approaching wire if you are not looking for it, even if you were previously aware of it. Add to this the inherent difficulty of visually spotting wires, the likelihood of hitting a wire is increased.

[5] The shoulder harness and/or restraint is referred to as an upper torso restraint in this report.

AO-2014-068 Wirestrike involving Maule M-5, VH-HOG, 50 km WSW of Casino NSW on 12 April 2014

On 12 April 2014, a Maule M-5 aircraft collided with a powerline spanning the Clarence River west-south-west of Casino, New South Wales. The pilot was accompanied on the private category flight by 2 passengers. The aircraft departed controlled flight after the wirestrike and impacted the water, coming to rest inverted with the cabin submerged. A child passenger was fatally injured.

The ATSB found that the pilot 'made a spur of the moment decision to fly along an unfamiliar section of a river at very low level and collided with a powerline.'

AO-2014-131 Wirestrike and impact with terrain involving Cessna 182L, VH-TRS at Burrumbuttock, NSW on 20 July 2014

On 20 July 2014, a Cessna 182L aircraft collided with a powerline above a paddock. Prior to hitting the powerline, witnesses observed the aircraft flying at a low height. After hitting the powerline, the aircraft rolled inverted and impacted terrain. The pilot was fatally injured, and the aircraft was destroyed.

The ATSB found that the pilot did not hold an approval to fly at low level and therefore had not received any training in the identification of hazards or in operating techniques for flight close to the ground.

Previous occurrences involving not wearing upper torso restraints

The ATSB has conducted a number of investigations that found that pilots or passengers in the front seats of small aeroplanes that were fitted with upper torso restraints were not wearing the restraint. In all cases this increased the risk of serious or fatal injury and in some accidents, was found to have exacerbated the injuries received. Examples include:

- AO-2010-053 Controlled flight into terrain - Cessna 210M, VH-TIJ, 59 km NE Norseman WA, 13 July 2010
- AO-2012-083 Collision with terrain, Cessna Aircraft Company 182P, VH-WTS, 53 km east-north-east of Cunnamulla, Qld, 19 June 2012
- AO-2012-142 Wirestrike involving Cessna 172, VH-TKI, 13 km NE of Bendigo, Victoria, 29 October 2012
- AO-2016-074 Loss of control and collision with terrain, Cessna 150, VH-RXU 270 km SE Alice Springs, Northern Territory, on 12 July 2016
- AO-2019-002 Loss of power on take-off and forced landing involving Cessna 182, VH-DGF, Tooradin, Victoria on 6 January 2019.

Safety analysis

Intentional low-level flight

An examination of the wreckage found no pre-impact defects involving the aircraft structure, flight controls or engine. There were no recorded issues following flights undertaken to check and adjust the autopilot after its installation, or after the aircraft had returned to Coonabarabran.

Witnesses saw and heard the aircraft operating normally, other than the abnormal flight path. If the pilot had encountered a problem while conducting circuits, there were 2 runways available for an emergency landing. However, the flight path did not align with an approach to either runway. Based on the tractor driver's observations, the aircraft was heading directly overhead the tractor, flying straight and level at a height of about 70 ft and at a normal speed. Therefore, it was unlikely that a mechanical or other operational problem was involved.

The height of the powerlines was about 21–31 ft (6–9 m) where the impact occurred, and the aircraft was therefore at a height above the ground of about 15–25 ft at the time (allowing about 6

ft for the impact point on the wing). There was no apparent operational reason for the pilot to have been flying at such a low height over the field other than to conduct an intentional overflight of the tractor and its driver. Given the absence of operational reasons or the low flight, and the witness's observation of the aircraft just prior to the contact with the powerlines, it is likely that the pilot was flying at low-level with an intention of flying directly overhead the friend in the tractor.

Low-level rating

The pilot did not have a low-level rating, which requires specific training on hazard identification and flying techniques when operating at low-level. Generally, a low-level rating is required for occupations or operations where there is a requirement or purpose to be flying below the minimum permitted height, that is below 500 ft. Examples of activities that would require this include agricultural, aerial survey or aerial firefighting and provide a balance between operational necessity and risk.

Although the pilot had previous exposure to low-level flying (aerial firefighting), it was not as a pilot. The pilot did not hold a low level rating and had not undergone the required training and assessment for low level flying which may have better equipped them to identify potential hazards (such as powerlines). Even with the appropriate training, flying at low levels carries a considerable risk and should be avoided when there is no operational reason.

Powerline strike

The pilot was familiar with the aerodrome and had discussed the location of the powerlines the day prior to the accident. However, even if a pilot is aware of powerline locations, this does not guarantee avoidance. There have been several previous accidents whereby pilots who have known the location of powerlines have forgotten about them. Given the difficulty to see powerlines, there is often insufficient time to react and avoid them.

The location and height of the powerlines at Coonabarabran Aerodrome meant that they were not required to be fitted with markers and they would have been very difficult to see from the air. Had markers been fitted, the pilot may have seen the powerlines earlier. Nevertheless, the powerlines were not close to any area that an aircraft would have an operational reason to be operating.

Upper torso restraints and survivability

Research by the United States National Transportation Safety Board (NTSB) and others has shown that pilots wearing the lap portion of a seatbelt only are more likely to receive a serious or fatal injury. An NTSB study published in 2011 examined the effectiveness of upper torso restraints on pilots in small aeroplanes. The study found that a pilot would be 49% more likely to receive a serious or fatal injury when wearing a lap belt only, compared to those wearing both the lap belt and upper torso restraint.

The pilot of VH-REU was not wearing the aircraft's sash-type upper torso restraint (mounted above the pilot's left shoulder) at the time of the accident. However, the significant right yaw at impact would have limited the effectiveness of this type of upper torso restraint. Therefore, it was not possible to determine with certainty whether, if worn, the upper torso restraint would have reduced the level of injuries in this case. Nevertheless, in many other types of accident scenarios, wearing an upper torso restraint will significantly reduce the risk of injury.

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 wirestrike and collision with terrain involving Cessna 172, registration VH-REU, on 18 April 2022.

Contributing factors

- While the pilot was conducting a low pass at a height of 15–25 ft over a field adjacent to the aerodrome, the aircraft contacted powerlines and collided with terrain.

Other factors that increased risk

- The pilot was not wearing an upper torso restraint during the accident flight, increasing the likelihood of serious injury in a collision.

Other findings

- The pilot did not have a low-level rating, which requires specific training on hazard identification and flying techniques when operating at low level.
- The powerlines that were contacted by the aircraft were not fitted with a visual marker and, given the height and location of the powerlines, there was no requirement for such markers.

Safety actions

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. All of the directly involved parties are invited to provide submissions to this draft report. As part of that process, each organisation is asked to communicate what safety actions, if any, they have carried out to reduce the risk associated with this type of occurrences in the future. The ATSB has so far been advised of the following proactive safety action in response to this occurrence.

Safety action by Essential Energy

Following the wirestrike accident involving VH-REU and in accordance with its company policy, Essential Energy field workers assessed the risk of another wirestrike to the powerlines that crossed the fields north of Coonabarabran Aerodrome. Subsequently, Essential Energy installed aerial markers to these powerlines.

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the witnesses
- the NSW Police Force
- the Civil Aviation Safety Authority
- the maintenance provider for VH-REU
- Essential Energy
- Warrumbungle Shire Council (aerodrome manager).

References

Douglas CA, Fildes BN, Gibson TJ, Boström O & Pintar FA 2007, 'Factors influencing occupant-to-seat belt interaction in far-side crashes', *Annual Proceedings of the Association for the Advancement of Automotive Medicine*, 51:319–39.

National Transportation Safety Board 2011, *Airbag performance in general aviation restraint systems*, Safety Study NTSB/SS-11/01.

Submissions

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

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

- the Civil Aviation Safety Authority (CASA)
- Essential Energy
- the maintenance provider for VH-REU
- Warrumbungle Shire Council.

Submissions were received from CASA and Essential Energy. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

General details

Occurrence details

Date and time:	18 April 2022 – 1556 EST	
Occurrence class:	Accident	
Occurrence categories:	Terrain collisions – Wirestrike	
Location:	Coonabarabran aerodrome, New South Wales	
	Latitude: 31° 19' 56.9" S	Longitude: 149° 16' 07.5" E

Aircraft details

Manufacturer and model:	Cessna Aircraft Company 172	
Registration:	VH-REU	
Serial number:	46237	
Type of operation:	Private	
Activity:	Pleasure and personal transport	
Departure:	Coonabarabran Aerodrome, NSW	
Destination:	Coonabarabran Aerodrome, NSW	
Persons on board:	Crew – 1	Passengers – nil
Injuries:	Crew – 1 (fatal)	Passengers – nil
Aircraft damage:	Destroyed	