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Piston aircraft

Landing gear malfunction involving a Cessna 210, VH-SMP

What happened

VH-SMP

Source: Keith Anderson, modified by the ATSB

On 1 February 2015, at about 0800 Western Standard Time (WST), a Cessna 210 aircraft, registered VH-SMP (SMP), departed from Kununurra Airport, Western Australia, for a scenic flight over King George falls with the pilot and five passengers on board.

The pilot returned to Kununurra after about 2 hours. During the approach, the pilot selected the landing gear selector to the down position. However, the green landing gear down indicator light did not illuminate. In addition, the landing gear pump continued to operate until the landing gear pump circuit breaker popped. The pilot observed that the right and left main landing gear appeared to be in the down and locked position. However, the pilot was unable to observe the nose landing gear.

As he was unable to verify the position of the nose landing gear, the pilot conducted a missed approach and held at about 1,500 ft above the ground level to investigate the reason for the malfunction. The pilot also broadcast on the common traffic advisory frequency (CTAF) his intentions and briefed the passengers.

The pilot selected the landing gear down and up another two times. However, in the down selection, there was no green landing gear down light and the landing gear pump continued to operate until the circuit breaker popped. The pilot inspected the landing gear down light globe and determined it was operational.

The pilot then used the 'landing gear fails to extend' and 'manual gear extension' checklists, and conducted a manual gear extension. The main landing gear was observed to be in the down position, but there was still no landing gear down green light.

The pilot contacted the operator first via a text message using a mobile phone, and then on the company radio frequency. After consulting with the operator, the pilot conducted a low-level pass over the runway to enable the operator to observe the landing gear position from the ground.

During the low-level pass, the operator observed the landing gear and reported to the pilot that the landing gear appeared to be in the down position. The operator told the pilot that it was likely to be an indication problem. The pilot returned SMP for a landing on runway 12 and briefed the passengers for the landing.

At about 1020, SMP landed, with the main landing gear wheels touching down first. The pilot held full back pressure on the elevator controls to hold the nose wheel off the runway for as long as possible. After about 100 m, the nose of the aircraft sank on to the runway. At this point, the nose wheel collapsed, the propeller struck the runway, and the aircraft came to a stop. Once the aircraft was stationary, the pilot completed the shutdown checks. The pilot and passengers then exited the aircraft through the two front doors.

The pilot and five passengers were uninjured. The aircraft sustained minor damage, including damage to the propeller, nose wheel, and engine cowling.

Pilot comment

The pilot reported that when the manual gear extension hand pump was used to pump the gear down, and was pumped until it could not be pumped further, it felt just like when the gear is in the down and locked position.

The pilot indicated that SMP last flew on 12 January 2015, about 3 weeks before the incident flight, and that there was no outstanding maintenance.

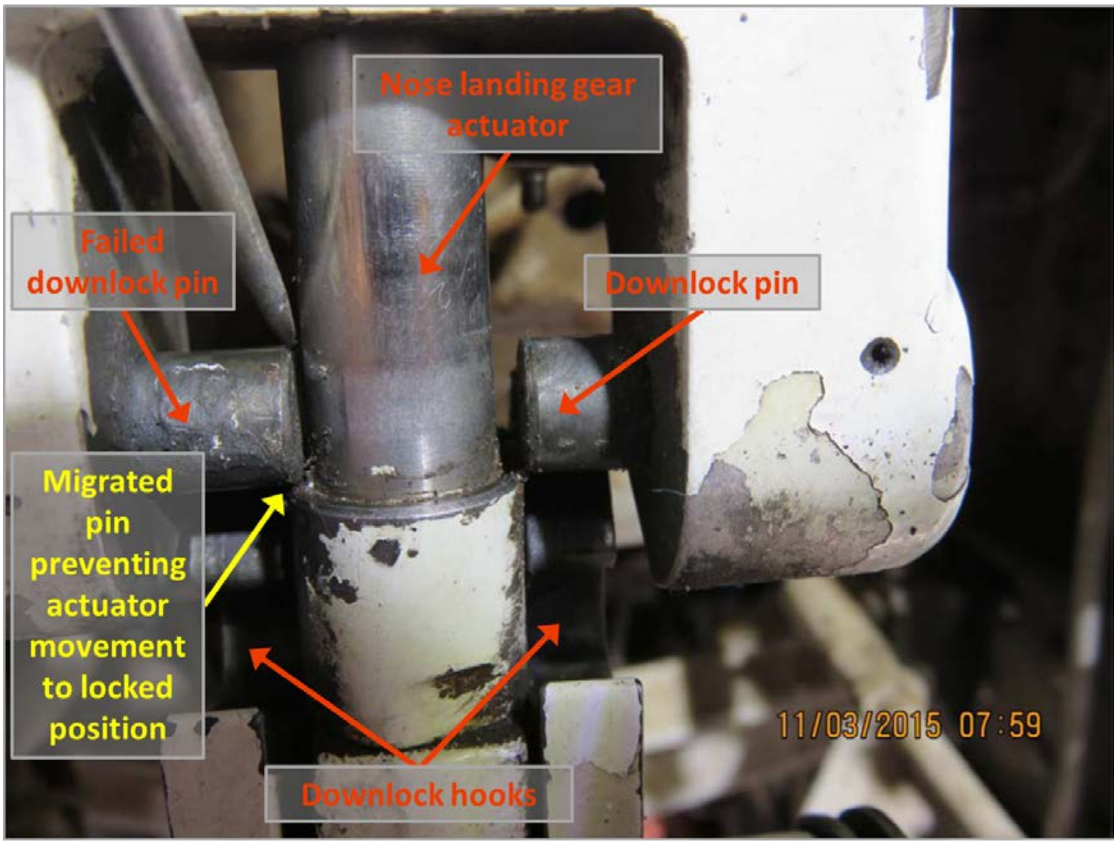
Owner investigation

The owner of the aircraft conducted an investigation into the incident. As part of their investigation, they determined that one of the nose landing gear down lock pins had failed. The pin had failed in the area of the machined groove for the pin retention roll pin (Figure 1). The failed down lock pin migrated out and interfered with the nose landing gear actuator. This movement prevented the nose landing gear down lock mechanism from engaging in the down and locked position (Figure 2). The other down lock pin was serviceable.

Figure 1: Failed nose landing gear downlock pin

Source: Aircraft owner

Figure 2: SMP nose landing gear downlock assembly, showing the failed downlock pin preventing actuator movement to the locked position



Source: Aircraft owner, modified by the ATSB

Cessna Service Bulletin

Cessna Service Bulletin *SEB95-20 Nose Landing Gear Actuator Downlock Inspection* dated 29 December 1995, recommended the inspection of the nose landing gear downlock actuator pins to determine the security of the pins.

Cessna had introduced the service bulletin as they had received reports that the nose landing gear actuator downlock pins had cracked and failed. It was found that the pins had failed at a circumferential groove that was used to secure the pin in the actuator bearing end. The service bulletin indicated that non-compliance could result in failure of the nose landing gear to lock in the down position and possibly collapse.

The recommended inspection was to be carried out initially within the next 200 hours operation or 12 months, whichever occurred first. Subsequent inspections at each landing gear retraction check were not to exceed 200 hours of operation thereafter. After the installation of the downlock actuator pin replacement, the repetitive inspection was not required.

Aircraft maintenance

SMP was manufactured in 1976 and, at the time of the incident, the aircraft had 9,965 hours total time in service. The aircraft was maintained under the Civil Aviation Safety Authority (CASA) maintenance schedule (*Civil Aviation Regulations 1988* (CAR) *Schedule 5*). As the nose landing gear was inspected in accordance with *Schedule 5*, the operator reported that they did not need to comply with Cessna *SEB95-20*.

The periodic (100 hourly or 12-month) maintenance inspections were carried out in August 2014 at 9,871 hours total time in service (94 hours prior to the accident). This maintenance was conducted in accordance with the CASA maintenance schedule (*Schedule 5*). *Schedule 5* did not include a specific inspection requirement to determine the security of the down lock pins.

NTSB investigation into similar failures

The US National Transport Safety Board (NTSB) investigated an accident involving a Cessna R182 aircraft, registered N6149S at Allegheny County Airport, West Mifflin, Pennsylvania on 18 May 2005 where the nose landing gear collapse during the landing.[1]

The NTSB determined that one of the downlock actuator pins (the same part number as SMP) on the nose landing gear actuator had failed and migrated out. The pin contacted the actuator arm piston, and prevented the full travel of the nose landing gear to the down and locked position. The NTSB examined the downlock pin and found that it had failed due to a fatigue crack. The investigation also found that the Cessna Service Bulletin *SEB95-20 Nose Landing Gear Actuator Downlock Pin Inspection* had not been carried out. The investigation found over 30 other nose landing gear collapses that were attributed to the actuator down lock pins on similarly equipped Cessna aircraft.

The NTSB also investigated another similar accident involving a Cessna R182 aircraft, registered N5274S, at Ames Municipal Airport, Ames, Iowa, on 22 October 2006 where the nose landing gear collapse during the landing.[2]

The NTSB determined that one of the downlock actuator pins (the same part number as SMP) on the nose landing gear actuator assembly bearing end had failed and migrated out. The pin contacted the actuator arm piston, and prevented the full travel of the nose landing gear to the down and locked position. Both downlock pins were found to have fatigue cracks. Again, there was no evidence that Cessna Service Bulletin *SEB95-20* had been complied with.

ATSB comment

On 12 September 2011, a flight control system event occurred involving Cessna 210N, VH-JHF, 48 km West of Bourke Airport, NSW. The ATSB investigation (AO-2011-115) found that reported elevator control input difficulties resulted from the fracture of the aircraft's two horizontal stabiliser rear attachment brackets. The nature of the failures was typical of the damage sustained by aircraft as they age and move beyond the manufacturer's originally intended design life.

The investigation identified that maintaining class B aircraft in accordance with the Civil Aviation Safety Authority (CASA) maintenance schedule, without due regard to the manufacturer's or other approved data, does not adequately provide for the continuing airworthiness of those aircraft.

As a result of the investigation the ATSB issued CASA a Safety Recommendation *AO-2011-115-SR-050*:

> *The Australian Transport Safety Bureau recommends that CASA proceed with its program of regulatory reform to ensure that all aircraft involved in general aviation operations are maintained using the most appropriate maintenance schedule for the aircraft type.*

Safety action

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. The ATSB has been advised of the following proactive safety action in response to this occurrence.

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1 The NTSB aviation accident report *IAD05IA066*, is available from the NTSB website.

2 The NTSB aviation accident report *CHI07LA011*, is available from the NTSB website.

Aircraft owner

As a result of this occurrence, the aircraft operator has advised the ATSB that the aircraft owner has taken the following safety actions:

Aircraft maintenance

Subsequent to the incident, the aircraft owner replaced the landing gear down lock pins with updated pins on two other aircraft that the owner is responsible for, and found no abnormalities with the removed pins or the nose landing gear actuator bearing ends.

Safety message

This accident highlights the importance of comprehensive, periodic maintenance inspections and the role manufactures continuing airworthiness instructions in maintaining ageing aircraft. As aircraft age, the original maintenance schedules may not be sufficient to ensure the aircraft's ongoing safety. As a result of investigation report AO-2011-115 the ATSB encourages registration holders of class B aircraft to review their aircraft's maintenance schedule to determine if it is the most appropriate for their aircraft and to ensure that it adequately provides for the continuing airworthiness of the aircraft.

In 2007, the ATSB released research report B20050205 - *How Old is Too Old? The impact of ageing aircraft on aviation safety* and is available from the ATSB website. The report found that some aircraft manufacturers have recognised that the original maintenance schedules may not be sufficient to ensure the aircraft's (ongoing) safety. Those manufacturers have developed additional continuing airworthiness information. The report concluded that adequate maintenance of ageing aircraft requires the participation and ongoing cooperation of aircraft manufacturers, regulatory authorities, owners, operators, and maintainers.

In 2012, in recognition of the Australian general aviation aging aircraft fleet, CASA released a discussion paper *Ageing Aircraft Management Plan (AAMP)*. The discussion paper makes the following relevant points:

- As an aircraft ages up to and beyond its original design assumptions, the nominated maintenance program needs to be modified to take into account ageing issues. In particular, inspections of key areas or components not usually accessed.
- CASA and Authorised Persons are obliged to take into account all relevant maintenance data or information pertinent to a particular aircraft type. This includes manufacturer's data, Airworthiness Directives, Service Bulletins and other continuing airworthiness information.
- CASA Maintenance *Schedule 5* was originally conceived as a minimum schedule of maintenance activities, to be undertaken on a very limited range of relatively simple, 'orphan' aircraft
- CASA Maintenance *Schedule 5* was not originally intended to address ageing aircraft related issues. The literal application of this schedule on its own was not intended to replace the manufacturer's instructions for continued airworthiness, where available.

The adequate maintenance of ageing aircraft requires the participation and ongoing cooperation of aircraft manufacturers, regulatory authorities, owners, operators, and maintainers.

General details

Occurrence details

Date and time:	1 February 2015 – 1020 WST	
Occurrence category:	Serious incident	
Primary occurrence type:	Landing gear malfunction	
Location:	Kununurra Airport, Western Australia	
	Latitude: 15° 46.68' S	Longitude: 128° 42.45' E

Aircraft details

Manufacturer and model:	Cessna Aircraft Company 210L	
Registration:	VH-SMP	
Serial number:	21061544	
Type of operation:	Charter - passenger	
Persons on board:	Crew – 1	Passengers – 5
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Minor	

Collision with terrain involving a Victa 115 Airtourer, VH-MUV

What happened

On 29 May 2015, at about 1145 Eastern Standard Time (EST), a Victa 115 Airtourer aircraft, registered VH-MUV (MUV), departed from Leongatha Airport, Victoria, for crosswind circuit training, with an instructor and student on board.

The student pilot was flying the first circuit. The instructor reported that the circuit was normal and the approach was stable up to about 100 ft above ground level (AGL) when the student put the final stage of flap out. As the aircraft flared to land on runway 22, a strong gust of wind blew the aircraft off the runway centreline to the left and the aircraft bounced hard. The student initiated a go-around, applying full power, with the aircraft still drifting further to the left. As the aircraft was not climbing, the instructor called “taking over” and the student handed over control of the aircraft. The instructor lowered the nose of the aircraft to gain airspeed.

The aircraft continued to drift further away from the runway centreline. The student noticed the flaps were in the down position and, thinking that it would assist and without checking with the instructor, retracted the flaps to the up position. The aircraft descended and about 100 m past the threshold of runway 22, the aircraft collided with the airport perimeter fence. After a further 20 m, the aircraft flipped over the fence and came to rest upside down. The instructor and student exited the aircraft quickly through the broken canopy, as fuel was gushing from the fuel tanks. The instructor and student pilot received minor injuries and the aircraft was substantially damaged (Figure 1).

Figure 1: VH-MUV inverted after flipping over the airport perimeter fence

Source: Aircraft operator

Instructor comment

The instructor reported that the purpose of the flight was to instruct the student in crosswind landing techniques and then to conduct further flight training in the training area. The instructor indicated that, as they were planning to conduct 2 hours of flight training, the aircraft had full fuel on board and was near the aircraft maximum take-off weight.

The instructor described the wind as gusting between 15 to 22 kt at 270 degrees, with a crosswind component of between 10 to 15 kt.

Safety action

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. The ATSB has been advised of the following safety action in response to this occurrence.

Flight training organisation

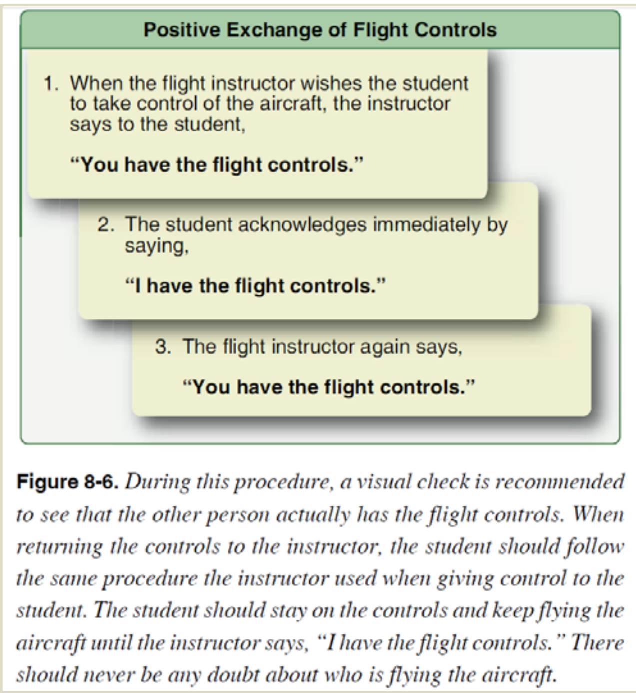
As a result of this accident, the flight training organisation advised the ATSB that they are taking the following safety actions:

- The instructor has been briefed on the importance of making sure students understand not to touch any of the aircraft's controls when the instructor is in control of the aircraft.
- The instructor has been briefed on the handing over and taking over procedures with the emphasis on handing over and taking over controls procedures.

Safety message

It is important in flight training to have a positive exchange of flight controls. The US Federal Aviation Administration (FAA) has found that numerous accidents have occurred due to a lack of communication or misunderstanding regarding who had actual control of the aircraft, particularly between students and flight instructors. The FAA publication Aviation Instructor's Handbook, includes a section on the Positive Exchange of Flight Controls. The handbook provides guidance to use for the positive exchange of flight controls (Figure 2).

Figure 2: FAA Positive exchange of Flight Controls



Positive Exchange of Flight Controls

1. When the flight instructor wishes the student to take control of the aircraft, the instructor says to the student,

   "You have the flight controls."

2. The student acknowledges immediately by saying,

   "I have the flight controls."

3. The flight instructor again says,

   "You have the flight controls."

Figure 8-6. *During this procedure, a visual check is recommended to see that the other person actually has the flight controls. When returning the controls to the instructor, the student should follow the same procedure the instructor used when giving control to the student. The student should stay on the controls and keep flying the aircraft until the instructor says, "I have the flight controls." There should never be any doubt about who is flying the aircraft.*

Source: US Federal Aviation Administration

General details

Occurrence details

Date and time:	29 May 2015 – 1200 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	Leongatha Airport, Victoria	
	Latitude: 38° 29.73' S	Longitude: 145° 51.58' E

Aircraft details

Manufacturer and model:	Victa 115 Airtourer	
Registration:	VH-MUV	
Serial number:	96	
Type of operation:	Flying Training	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 2	Passengers – 0
Damage:	Substantial	

Separation issue involving a Pacific Aerospace CT/4B, VH-YCU, and a Diamond DA 40, VH-UNV

What happened

Early in the afternoon on 4 June 2015, a Pacific Aerospace CT/4B, registered VH-YCU (YCU), was conducting an instrument training flight in the training area to the south-west of Tamworth, New South Wales, with an instructor and student on board. At the same time, a Diamond DA 40, registered VH-UNV (UNV), departed Tamworth on a visual navigation student assessment flight, bound for Bankstown, New South Wales, also with an instructor and student on board. Both aircraft were operating under the visual flight rules,[1] and the weather conditions were fine and clear.

As part of the training sequence, the instructor in YCU directed the student to intercept the 360 degree bearing from the Quirindi non-directional beacon (NDB)[2] The instructor further directed the student to track inbound to the Quirindi NDB at 4,500 ft[3] on that bearing (Figure 1), and carry out a Quirindi NDB-A approach.

When about 10 NM north of Quirindi, the student in YCU broadcast their position and intentions on the Quirindi Common Traffic Advisory Frequency (CTAF).[4] The pilot of a recreational aircraft responded to the effect that they were operating in the circuit area at Quirindi. There was no response from any other aircraft. When about 5 NM from Quirindi, the student in YCU made another broadcast on the CTAF, indicating their intention to enter a holding pattern from overhead the NDB, in preparation for the NDB-A approach. There was no response from any other aircraft to that broadcast.

At about the same time, UNV was tracking from Gate South (a reporting point south-west of Tamworth) towards Quirindi, also at 4,500 ft (Figure 1). The crew of UNV planned to overfly Quirindi then turn to the south-east and track towards Scone. The crew of UNV were monitoring the area VHF,[5] but not the Quirindi CTAF. As such, the crew of UNV did not hear the CTAF broadcasts made by the student in YCU. Even though the crew of both aircraft were monitoring the area VHF, neither had made any broadcasts on that frequency, so neither crew was aware of the other aircraft. At the time, both were tracking towards Quirindi at the same altitude.

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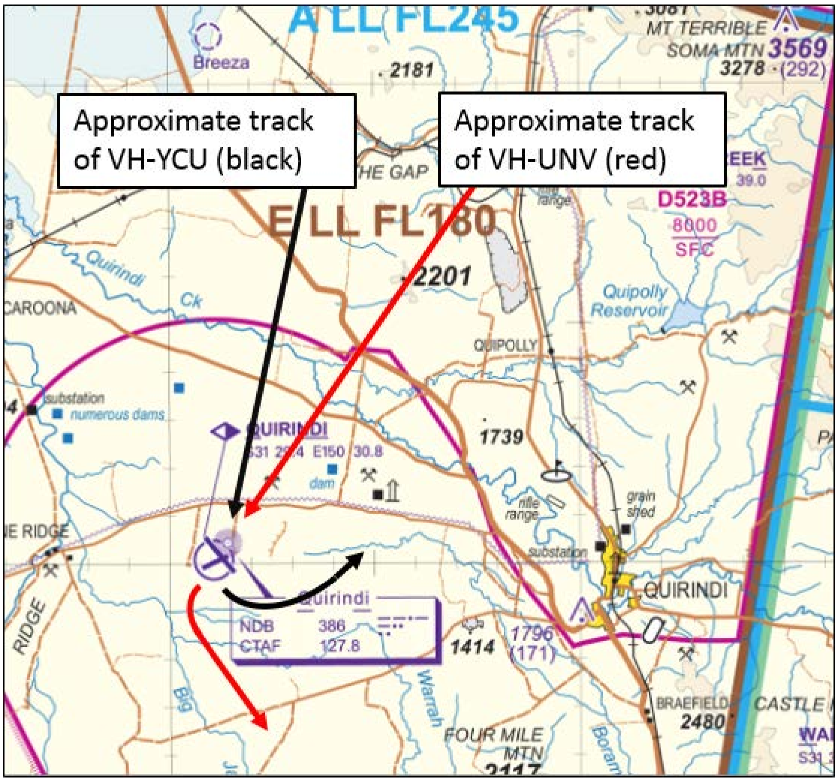
1 Visual flight rules are a set of regulations, which allow a pilot to only operate an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going.
2 An NDB is a radio transmitter used as an aid to navigation. The signal does not include inherent directional information.
3 4,500 ft above mean sea level is about 3,450 ft above ground level overhead Quirindi aerodrome.
4 The CTAF is the frequency on which pilots operating at a non-controlled aerodrome should make positional radio broadcasts.
5 Area VHF (very high frequency) is the appropriate flight information area frequency for a location.

Figure 1: Extract from a visual chart showing the manner in which the tracks of the two aircraft converged as they neared Quirindi, and the general direction of flight of each aircraft after they passed Quirindi (YCU turning to the north-east and UNV turning to the south-east)



Source: Airservices Australia, additions by the ATSB

Just north of Quirindi, the traffic collision avoidance device fitted to YCU alerted the crew to an aircraft in their vicinity, at a distance of 0.4 NM, at the same altitude. The instructor commenced an intensified lookout and soon sighted UNV. At that moment, UNV was in about the 10 o'clock position[6] relative to YCU, at the same altitude, on a slightly converging flight path. The instructor in YCU estimated that at the time UNV was sighted, YCU was in approximately the 4 o'clock position relative to UNV.

Although there was no immediate risk of a collision, the instructor in YCU took control of the aircraft from the student and made a heading adjustment through about 20 degrees to the right. On the new heading, the instructor was satisfied that the flight path of the two aircraft would diverge. In recalling the incident, the instructor in YCU estimated that, at their closest point, the separation between the two aircraft was about 60 m laterally, at the same altitude.

After sighting UNV, the instructor in YCU attempted to establish contact with the crew of UNV on the Quirindi CTAF. The pilot of the recreational aircraft operating at Quirindi responded, but there was no response from the crew of UNV.

Still unaware of the proximity of YCU, the crew of UNV passed over Quirindi then turned to the south-east towards Scone, and commenced a climb to 5,500 ft. As they climbed, the instructor in UNV sighted YCU behind and beneath them, in about their 8 o'clock position. By that time, the crew in YCU had also passed Quirindi, and were now turning towards the north-east for the NDB-A holding pattern. Having sighted YCU, the instructor in UNV was satisfied that the two aircraft were on divergent headings and vertical separation was increasing as UNV climbed.

6 The clock code is used to denote the direction of an aircraft or surface feature relative to the current heading of the observer's aircraft, expressed in terms of a position of an analogue clock face. Twelve o'clock is ahead while an aircraft observed abeam to the left would be said to be at 9 o'clock.

Following the separation issue, the instructor in YCU called air traffic control (Brisbane Centre) on the area VHF in an attempt to establish communications with the crew of UNV. The crew of UNV, who were still monitoring the area VHF, intercepted that call and responded. The crew of UNV then selected the Quirindi CTAF on one of their radios, and they had a brief discussion on that frequency. By the time communications were established on the CTAF, UNV was nearing 5,500 ft on a south-easterly heading towards Scone. The crew of YCU were resuming their planned exercise, entering the Quirindi NDB-A holding pattern.

Instructor comments - YCU

The instructor in YCU made a number of comments regarding the incident, including:

Use of radios. YCU was fitted with two VHF radios. During operations in the training area, the crew were monitoring the area VHF on one radio, and company operations on the other. The radio that was being used to monitor the company operations frequency, was switched to the Quirindi CTAF as they prepared for their NDB-A approach at Quirindi. As such, the crew were monitoring the area VHF and Quirindi CTAF at the time of the incident.

Instrument flight training hood. The student in YCU was wearing an instrument flight training hood. The hood projected forward from the student's helmet in a manner that denied the student external visual reference, but allowed the student to scan cockpit instruments (to simulate instrument meteorological conditions). Under these circumstances, the instructor maintained a lookout for other aircraft and hazards, but the position of the student's helmet and hood was such that the instructor's visibility to the left of the aircraft was partially obscured. With that in mind, when alerted to other traffic in the vicinity, the instructor targeted a lookout to the left of the aircraft, past the student's helmet and hood. During this targeted lookout, the instructor sighted UNV. When the instructor sighted UNV, the aircraft was remaining on a constant line of sight relative to YCU, in approximately the 10 o'clock position.

Density of training operations at Quirindi and Gunnedah. The instructor in YCU noted that even though Quirindi and Gunnedah are often used for flight training purposes, there is nothing in the En route Supplement Australia (ERSA) to alert pilots accordingly.

Instructor comments - UNV

The instructor in UNV made a number of comments regarding the incident, including:

Use of radios. UNV was fitted with two VHF radios. The instructor commented that depending on the circumstances, either radio could be used to monitor and broadcast on relevant CTAFs. At the time of this incident, the crew were monitoring the area VHF with one radio, and the company operations frequency on the other.

Monitoring the CTAF. The instructor in UNV was aware that the student in UNV was not monitoring the Quirindi CTAF as they approached from the north, even though it was normal practise to monitor a CTAF under these circumstances (overflying an aerodrome). On this occasion, the instructor elected not to prompt the student to monitor the CTAF in order to reinforce a teaching point to the student regarding frequency management. The instructor was satisfied that a visual lookout would suffice under the circumstances – the conditions were fine and clear, and there were no broadcasts or other transmissions on the area VHF to suggest that there was any potentially conflicting traffic in their area.

ATSB comment

The separation issue in this case may have been avoided if the pilots of the two aircraft involved had been monitoring and broadcasting on the same frequency. Both crews were monitoring the area VHF, but operating under the visual flight rules, there was no specific requirement for the crew of either aircraft to make a broadcast on that frequency. The crew of YCU broadcast their position and intentions on the Quirindi CTAF, but the crew of UNV were not monitoring that frequency.

The requirement to monitor a CTAF is subject to a level of interpretation, particularly with respect to the altitude above an airfield at which the requirement applies. The Aeronautical Information Package (AIP) requires a pilot to broadcast on the CTAF when he/she enters the vicinity of a non-controlled aerodrome. AIP goes on to describe the vicinity of a non-controlled aerodrome as being:

> *…within 10 nm of the aerodrome and at a height above the aerodrome that could result in conflict with operations at the aerodrome.*

Existing forums and processes (managed by CASA and Airservices Australia) allow airspace users to influence the manner in which airspace is managed and propose changes to relevant documents (such as the En Route Supplement Australia). Where changes have the potential to improve safety, operators are encouraged to present proposals for consideration, using those forums and processes. One relevant forum for proposing airspace-related safety improvements is the CASA Regional Airspace and Procedures Advisory Committee.

Safety message

Pilots are encouraged to 'err on the side of caution' when considering when to make broadcasts and whether specific frequencies should be monitored, particularly noting the fundamental importance of communication in the effective application of the principles of see-and-avoid. An ATSB report titled *Limitations of the See-and-Avoid Principle* outlines the major factors that limit the effectiveness of un-alerted see-and avoid.

The ATSB SafetyWatch programme highlights broad safety concerns that emerge from investigations and occurrence data reported to the ATSB by industry. One safety concern relates to operations around non-controlled aerodromes. The ATSB safety watch website page, *Safety around non-controlled aerodromes,* includes the following relevant comments:

> *Insufficient communication between pilots operating in the same area is the most common cause of safety incidents near non-controlled aerodromes.*

> *A search for other traffic is eight times more effective when a radio is used in combination with a visual lookout than when no radio is used.*

The CASA booklet titled *Operations at non-controlled aerodromes* provides guidance with respect to the limitations of the see-and-avoid principle and relevant radio procedures. Civil Aviation Advisory Publication 166-1 also provides relevant guidance with respect to CTAF procedures.

General details

Occurrence details

Date and time:	4 June 2015 – 1420 EST	
Occurrence category:	Incident	
Primary occurrence type:	Separation issue	
Location:	Near Quirindi, New South Wales	
	Latitude: 31° 29.92' S	Longitude: 150° 31.08' E

Aircraft details – VH-YCU

Manufacturer and model:	Pacific Aerospace Corporation CT/4B	
Registration:	VH-YCU	
Serial number:	079	
Type of operation:	Flying training	
Persons on board:	Crew – 2	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Aircraft details – VH-UNV

Manufacturer and model:	Diamond Aircraft Industries DA 40	
Registration:	VH-UNV	
Serial number:	40.1077	
Type of operation:	Flying training	
Persons on board:	Crew – 2	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Collision with terrain during landing, involving a PA32 aircraft, VH-BDG

What happened

On the afternoon of 26 July 2015, the pilot prepared a PA32-300 (Cherokee Six) aircraft, VH-BDG (BDG), for a private joy flight around the Whitsunday Islands off the Queensland coast, (Figure 1) departing from the Lakeside Airpark. The pilot had arranged for five acquaintances to come on the flight as passengers.

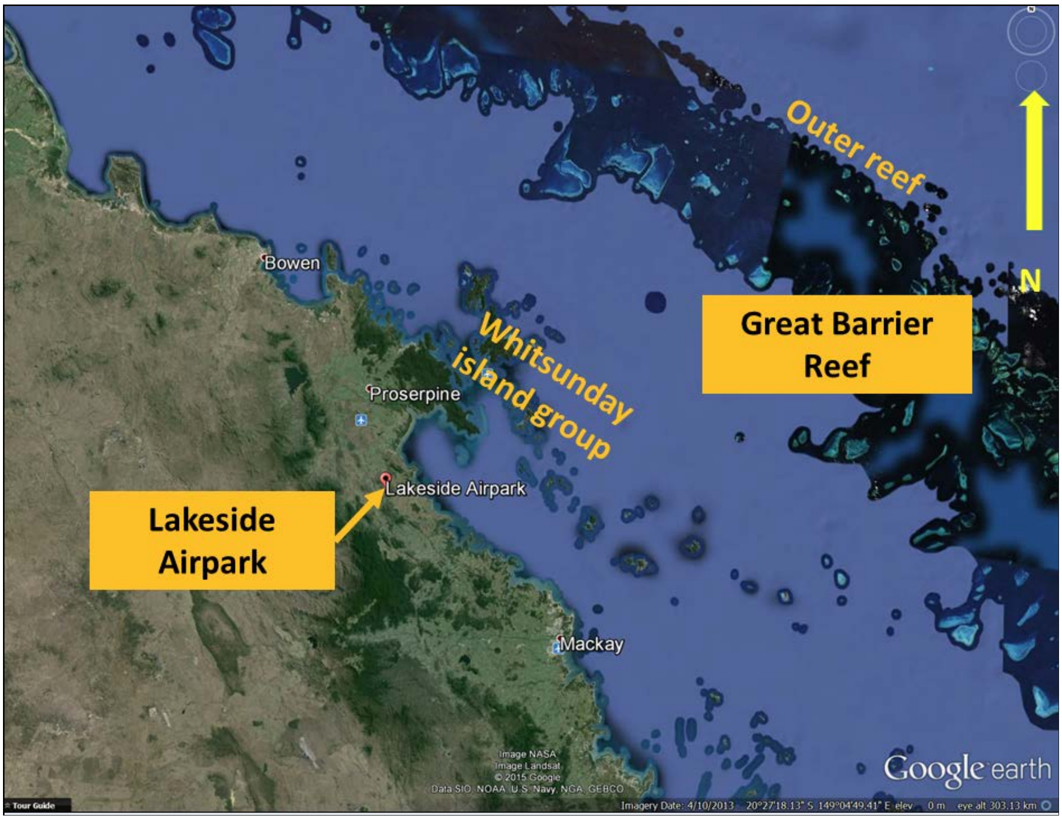
About a week earlier, the pilot, who had an injured right foot at the time, organised another pilot to fly BDG on a re-positioning flight to the Lakeside Airpark. Due to being unable to fly the re-positioning flight, the accident flight became the pilot's first time operating from the Airpark.

Pilot recollections

The pilot reported that they delivered a safety brief outlining the relevant safety features of the aircraft, just prior to loading the passengers. After loading the four rear passengers, the pilot secured the left rear cargo door, and then entered the cockpit through the front right door, followed by the front seat passenger.

The flight departed at about 1400 Eastern Standard Time (EST), and remained outside controlled airspace. The flight overflew some of the Whitsunday island group as well as the outer reef area of the Great Barrier Reef, prior to setting a return course to the Airpark about one and half hours later (Figure 1).

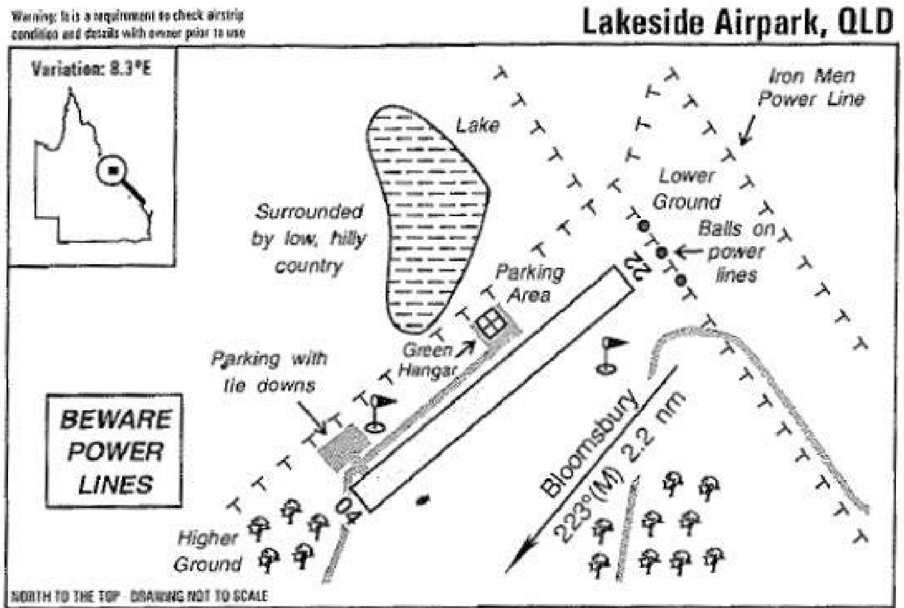
Figure 1: A google earth extract showing the general area where the joyflight was conducted



Source: Google earth, annotated by the ATSB

The pilot approached the extended centreline at an oblique angle and conducted a straight in approach to runway 22 (Figures 2 and 3). When about 6 NM from the airfield, at about 2,300 ft above mean sea level, the aircraft was configured for descent. After reducing the airspeed from about 135 to about 100 kt, and with 10° of flap selected, the aircraft descended to about 1,800 ft.

Figure 2: An extract from the Queensland Country Airstrip Guide. Diagrammatic representation of Lakeside Airpark and local hazards



Elevation:	175 Feet AMSL	Time Zone:	UTC + 10
GPS Position:	20° 40.852' South 148° 37.831' East	Area Forecast:	44
WAC Charts:	Clermont (3234), Rockhampton (3235)	ALA Code:	YLAK
Owner/Operator:	Lakeside Airpark 0418 711224, office@caboolturecommercial.com		
Strip Directions:	04-22		
Strip Lengths:	1000 metres (wet weather may shorten the NE end)		
Strip Surface:	Unsealed - slashed grass		
Windsock:	Yes - two		
Strip Markers:	White cones and tyres		
Lighting:	Nil		

Source: Queensland Country Airstrip Guide, 2012 edition

Figure 3: Approach to runway 22 at Lakeside Airpark. Note the unsealed and sealed portion of the runway. Also, note the difficulty in detecting the power lines on approach. Photo taken about a week prior to the accident

Source: Barry Dionysius

In order to maintain sufficient clearance over the two rows of power lines, and still land near the threshold, well before the sealed section of the runway, the pilot planned a steeper approach than normal. The flap was set to 40° (full flap) and the rate of descent increased to about 500-600 feet per minute.

On short final, the aircraft suddenly began to sink rapidly, and the pilot recalled seeing a tree pass close by the left window. Judging that the aircraft was now too low; the pilot applied full power, held the aircraft nose in a raised position, turned the aircraft left toward lower ground, and initiated a go-around.

However, the aircraft continued to sink throughout this manoeuvre, and the tail struck the runway about 20 m in from the threshold. Throughout this attempt to go-around, the tail continued to drag along the gravelled section of the runway, leaving a mark about 30-35° to the left of the runway direction for about 18m.

Although not yet showing a positive rate of climb, the aircraft seemed to be flying. The pilot reported that the stall warning had not sounded, so assessed there was a choice between removing the power and attempting to land back on the runway, or continuing with the go-around. The pilot elected to continue with the go-around and continued toward the lower ground.

A witness mark made by the right wheel, commenced at about the same spot where the mark made by the tail stopped. The wheel mark continued for about 35m into the grassed area beside the runway.

Once into the grassed area, and with the aircraft most probably airborne, it struck a wire fence (Figure 4) then the raised embankment of the dam, which ran perpendicular to the runway. The pilot reported that the left wing tip struck the water and the aircraft spun around and entered the water. At some point throughout this sequence, the main wheels detached from the aircraft. The pilot reported continuing to battle for control of the aircraft, up until it arrived in the water.

Figure 4: Looking along runway 22 taken a few days after the accident

Source: Pilot

Post water impact

When the aircraft settled on the surface of the water, the pilot reported yelling to the passengers to 'get out'. The pilot then opened the front right door, pushed the passenger occupying the front right seat out, and then exited. The opening of the door resulted in the muddy water gushing inside and rapidly filling the aircraft. The passengers seated in the rear of the aircraft were unable to open the rear door. The water almost filled the entire cabin during this time.

The pilot was eventually able to get the rear door open from outside the aircraft and assisted some of the passengers out. The remaining passengers either made their own way out, or were assisted by other passengers.

One of the passengers sustained serious injuries, and the pilot and another passenger, minor injuries. The aircraft was almost completely submerged resulting in substantial damage (Figures 5 and 6).

Figure 5: Post accident showing VH-BDG partially submerged in the dam

Source: Airpark operator

Figure 6: VH-BDG after retrieval from the lake. Passenger 2 (below) reported that the left wing crumpled during the 'cartwheeling' toward the lake. Note: Significant damage occurred during the retrieval process

Source: Pilot

Pilot experience and comments

The pilot had approximately 581 total flying hours with about 112 of these on Cherokee Six type aircraft. The pilot made the following points:

- the hazard briefing conducted by the airpark operator some weeks earlier, included a request to land on the gravel area of the runway, as the seal was recently laid but had proved to be quite soft
- both weight and balance, and performance calculations were conducted for the flight, however these documents were damaged when the aircraft became submerged
- there may have been some wind shear or a down draft which contributed to the aircraft sinking on the approach
- the tail scraping along the gravel and over the fence during the attempted go-around added extra drag, which detracted from the aircraft's performance

Passenger comments

Three of the five passengers elected to provide their accounts of what happened.

Passenger one recalled:

- there was no pre-flight safety briefing; the pilot just indicated where each of them should sit
- during the landing approach, this passenger recalled thinking how low they were, when still some distance from touchdown
- the tail struck the ground, and recalls power being applied after that
- the aircraft flipping over and 'cartwheeling' toward the lake

Passenger two recalled:

- there was no pre-flight safety briefing
- during the approach to land they heard the pilot verbalising that the aircraft needed to slow down, and noted a significant decrease in speed
- the aircraft tail dragging along the ground, and the pilot calling out for assistance
- the left wing striking the ground and instantly crumpling (Figure 6)
- the aircraft then 'cartwheeled' ending up in the lake
- the water rose quickly in the aircraft when the front door was opened, leaving a very small pocket of air for the rear passengers
- they were rescued by the pilot through the rear door

Passenger three recalled:

- there was no pre-flight safety briefing
- the aircraft struck the ground prior to the runway
- the pilot shouted for assistance as the aircraft "went out of control during the approach"
- the aircraft 'cartwheeled' before arriving in the dam

Meteorological data

The ATSB obtained the Bureau of Meteorology weather report for area 44 covering the time of the accident. Area 44 was in two divisions that day and the southern division, which applied to the area south of Proserpine, including Lakeside Airpark, forecast variable winds of about 10 knots.

Lakeside Airpark landing area

Lakeside Airpark Landing area was identified in Enroute Supplement Australia (ERSA) (28 May 2015 version) as "UNCR" meaning it is both uncertified and unregistered.

As per the requirement for operations at this aerodrome, the pilot sought prior permission to operate there and a briefing on local hazards from the aerodrome operator. This onsite briefing by the aerodrome operator pointed out local hazards such as the power-lines in the vicinity and the preferred protocol of taking-off on runway 04, and landing uphill on runway 22, wind permitting. There was no hazard map available as mentioned in the ERSA.

Advisory material

The Civil Aviation Advisory Publication (CAAP) 89O-1 (2) "*Published aerodrome information and reporting changes (November 2000)* is available on the CASA website. This publication provides advisory material for publishing aerodrome information and reporting changes in respect of both licenced and unlicensed aerodromes that are included in the (ERSA).

Unlicensed aerodromes:

> *Unlicensed aerodromes are not required, under the regulations, to provide aerodrome information to [Aeronautical Information Service] (AIS) or the [Civil Aviation Safety Authority] (CASA) and to have their aerodromes included in ERSA.*
>
> *…unlicensed aerodromes may also be included in ERSA, on request of the aerodrome operators. However, the aerodrome information published will be of limited format, being of a non-operational nature…"*

CASA is conducting a post-implementation review of CASR Part 139 – Aerodromes. As part of this project, this CAAP and other Part 139 CAAPs and ACs will be reviewed. Additionally, CASR Part 175, which regulates the publication of aeronautical information, commenced on 5 March 2015 and the contents of CAAP 89O-1 (2) will be reviewed, to be consistent with this new regulation.

ATSB comment

The ATSB did not undertake an onsite investigation into this accident, but were provided with information through telephone interviews, reports, and detailed photographs.

The ATSB was unable to reconcile the differences evident between the recollections of the pilot and those of the three passengers who provided information.

Safety message

This accident highlights the importance of thorough pre-flight planning and preparation to minimise safety critical decisions in flight.

CASA have an online kit 'CASA Flight Planning Always Thinking Ahead" available from the downloaded from the CASA website.

This tool kit addresses the three levels of flight planning (the straightforward elements, unusual situations and whether to go) and their application over eight stages of flight.

The ATSB research report, *Improving the odds: Trends in fatal and non-fatal accident in private flying operations* (AR-2008-045) is available from the ATSB website.

This report encourages pilots to make decisions before the flight, continually assess the flight conditions, evaluate the effectiveness of their plans, set personal minimums, assess their fitness to fly, and to seek local knowledge (and if necessary a check flight) on the route and / or destination as part of the pre-flight planning process.

Also on the ATSB website, is a copy of the investigation (199804109) into a fatal accident involving another Cherokee Six aircraft (VH-POW). The pilot attempted to conduct a go-around from a degraded performance configuration with full flap extended and a nose-high attitude. The ATSB found that the aircraft's climb performance would have been substantially degraded with this configuration. The aircraft's nose-high attitude during the climb would have obstructed the pilot's forward vision and he may have been unaware that the aircraft had diverged from the extended centreline of the airstrip.

Occurrence details

Date and time:	26 July 2015 – 1550 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	Lakeside Airpark, Queensland	
	Latitude: 20°41.10' S	Longitude: 148° 37.50' E

Aircraft details

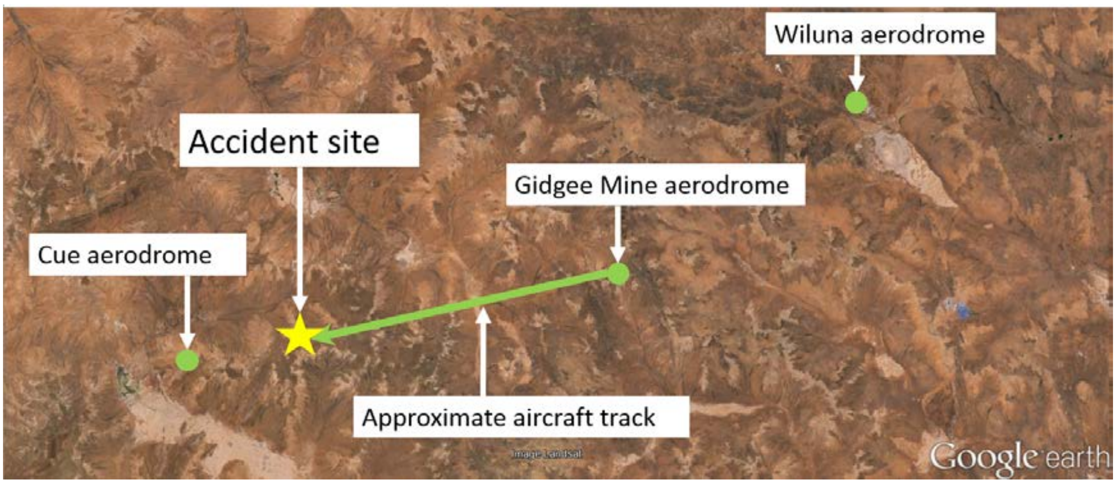
Manufacturer and model:	Piper Aircraft Corporation PA 32-300	
Registration:	VH-BDG	
Serial number:	32-7740092	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 5
Injuries:	Crew – Minor	Passengers – 1 serious, 1 minor
Damage:	Substantial	

Engine failure and collision with terrain involving a Cessna 210, VH-ERU

What happened

On 1 August 2015, at about 1110 Western Standard Time (WST), a Cessna 210 aircraft, registered VH-ERU, departed Gidgee Gold mine for a private flight to Cue, Western Australia (Figure 1). The pilot was the sole occupant of the aircraft. The pilot reported that all engine indications were normal from the start and into the cruise at 3,500 ft above mean sea level. The elevation of the terrain in the area was about 1,700 ft above mean sea level.

Figure 1: Aircraft track and accident location



Source: Google earth – annotated by the ATSB

About 25 minutes into the flight, the pilot observed the engine oil temperature rising rapidly. The pilot opened the cowl flaps in an attempt to reduce the engine oil temperature, and noted that the cylinder head temperature and engine oil pressure were still in the normal range. As the pilot tried to determine the cause of the problem, the manifold pressure started to increase. The pilot reduced the throttle to try to decrease the manifold pressure, but it continued to rise.

The pilot then felt a slight vibration in the engine and through the aircraft controls, and broadcast a PAN[1] call on the Melbourne Centre radio frequency. The pilot did not receive any response to the broadcast, probably due to the aircraft's remoteness and low altitude. The aircraft was descending steadily, and the pilot looked for a suitable place to conduct a precautionary landing. However, the surrounding area was heavily treed. After turning towards the north and more open country, the vibration increased, and the pilot broadcast two Mayday[2] calls. Again, the pilot did not receive any response.

When about 500 ft above ground level, the vibration further increased and the engine failed with a bang. Smoke emanated from the engine compartment and over the windscreen, reducing the pilot's visibility through it. The pilot then sighted a fence line to the right and prepared for a forced landing, aiming to touchdown in a cleared area alongside the fence.

1 An internationally recognised radio call announcing an urgency condition which concerns the safety of an aircraft or its occupants but where the flight crew does not require immediate assistance.

2 Mayday is an internationally recognised radio call for urgent assistance.

The pilot lowered the landing gear and extended the flap. When at about treetop height, the pilot selected the master switch and fuel off. The pilot also tightened the seatbelt and opened the aircraft door. As the pilot flared the aircraft to land, the right wing and strut collided with a tree. The aircraft yawed to the right, and the right main landing gear struck the ground and broke off. Although the pilot applied full left rudder to try to regain control of the aircraft, it collided with another tree and rolled onto its left side, before skidding and coming to rest against a third tree. The pilot suffered minor injuries and the aircraft sustained substantial damage (Figure 2).

The right fuel line ruptured during the impact sequence, causing fuel to run down into the cabin and onto the pilot. The pilot quickly exited the aircraft, concerned about the risk of fire, particularly as there was about 240 L of fuel in the tanks.

After waiting about half an hour for the fuel to stop running into the cockpit, the pilot returned to the aircraft and selected the master switch on. The pilot then made another radio broadcast requesting assistance, and again did not receive any response. The aircraft's emergency locator transmitter (ELT)[3] did not activate on impact, and its light had not illuminated. The pilot then tried, without success, to use the aircraft battery to power the ELT.

At about 1400, the pilot again made radio broadcasts without any response. As there was no mobile phone signal at the accident site, the pilot started walking towards higher terrain. At about 2200, after walking 25 km, the pilot gained mobile phone coverage and was able to call for assistance. After making the call, the pilot lit a fire to provide warmth and to deter a pack of wild dogs that had been circling. At about 0200 on 2 August, low cloud rolled in and it started to drizzle. About an hour later, the pilot provided rescue personnel with the coordinates of the location, obtained from the mobile phone. At about 0730, a rescue aircraft located the pilot and police arrived about 40 minutes later.

Figure 2: Accident site showing damage to VH-ERU

Source: Western Australia Police

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3 Crash-activated radio beacon that transmits an emergency signal that may include the position of a crashed aircraft. Also able to be manually activated.

Pilot comments

The pilot provided the following comments:

- The number three cylinder failed and blew a hole in the top of the engine casing.
- The pilot usually carried a satellite phone, but did not have it on this flight as it was being serviced.
- It was about a 40-minute flight to Cue, and the pilot would normally have advised someone of the planned route and expected arrival time, but omitted to do so on this day.
- The pilot had water, a first aid kit and a lighter in the aircraft, and planned to get a personal location beacon to carry in future.

Aircraft engine

The aircraft was fitted with a Continental IO-520 engine. The pilot had owned the aircraft for about 4 years, during which time the aircraft had accrued about 60 hours of flying time. Shortly after the pilot bought the aircraft, the number three cylinder had failed and been replaced. The pilot had recently replaced the propeller in accordance with an airworthiness directive.

The aircraft was damaged beyond repair. At the time of completing this report, no engineering inspection of the engine had been, or was expected to be, conducted following the accident.

Safety message

The ATSB reminds all pilots to let someone know where they are going, and what time they expect to arrive, before embarking on a flight. Although the incident flight was not in a designated remote area, it demonstrates that it is vitally important to carry emergency supplies, such as water, food, matches (or lighter), and first aid essentials. Where mobile and radio coverage is not available, a satellite phone can provide life-saving access to help.

Electronic locator transmitters installed in aircraft should be tested in accordance with the manufacturer's instructions. The ATSB research report AR-2012-128 found that ELTs function as intended in about 40-60% of accidents. NASA is currently conducting research to find ways to make ELTs more likely to function after a survivable crash.

General details

Occurrence details

Date and time:	1 August 2015 – 1140 WST	
Occurrence category:	Accident	
Primary occurrence type:	Engine failure	
Location:	035° M 77 km Mount Magnet Aerodrome, Western Australia	
	Latitude: 27° 32.93' S	Longitude: 118° 17.60' E

Aircraft details

Manufacturer and model:	Cessna Aircraft Company 210E	
Registration:	VH-ERU	
Serial number:	21058520	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – 1 Minor	Passengers – Nil
Damage:	Substantial	

Collision with terrain involving a Grumman G164, VH-LKN

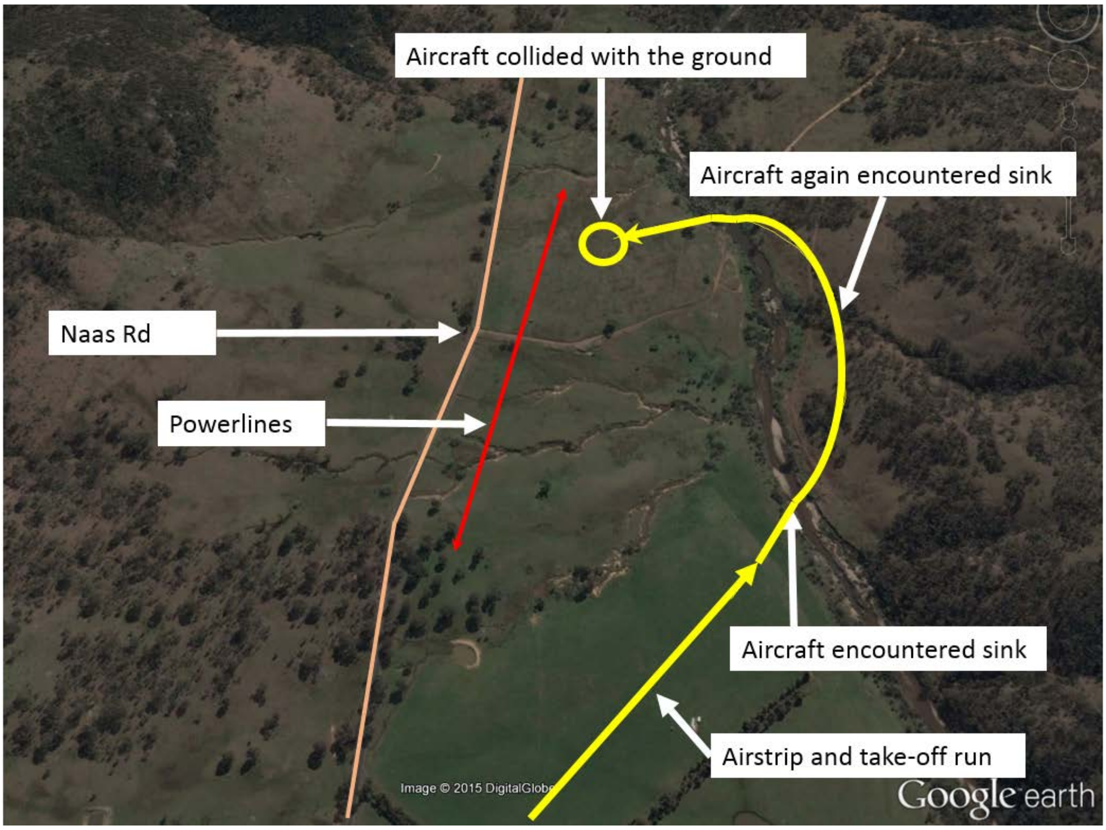
What happened

On 6 August 2015, the pilot of a Grumman G164 aircraft, registered VH-LKN, was conducting aerial spreading of superphosphate on a property about 33 km south-west of Tharwa, Australian Capital Territory. The target zone for the spreading was about 7 km to the south-east, and at an elevation about 1,000 ft higher than the airstrip and loading site.

The pilot commenced operations at about 1000 Eastern Standard Time (EST) and completed spreading of six loads of superphosphate. The pilot then had a lunch break and refuelled the aircraft to a total of about 180 L of fuel. The aircraft was also loaded with about 500 kg of superphosphate, which was about half its carrying capacity. The pilot observed a light, westerly wind of about 2 to 5 kt in the vicinity of the airstrip.

At about 1400, the pilot commenced the take-off run for the seventh load of the day. As the aircraft became airborne, the aircraft started to sink (Figure 1). To stop the aircraft sinking, the pilot applied the dump lever to start dumping the load of superphosphate. The aircraft then started to climb, so the pilot stopped dumping the load. The pilot also commenced a shallow left turn, away from rising terrain. As the aircraft turned, when at about 100 ft above ground level, it started to sink again. As it sank, the pilot felt a shake through the airframe, indicating that the aircraft was close to stalling. The pilot re-applied the dump lever to open the hopper door and try to reduce the aircraft load. Simultaneously, the pilot lowered the aircraft's nose and rolled the wings level, to try to recover from the incipient stall.

Figure 1: Departure airstrip, aircraft track and accident location



Source: Google earth and pilot recollection – annotated by the ATSB

The pilot sighted powerlines, a road and a row of trees ahead, beyond which the terrain rose steeply. The aircraft continued to descend and the pilot maintained the aircraft in a normal nose attitude for landing. As the aircraft neared the ground, the pilot reduced the throttle to idle and held the aircraft control stick in the full back position. The tailwheel struck the ground first, and then the right main landing gear dug into soft ground. The aircraft flipped over and came to rest inverted.

The pilot sustained minor injuries and the aircraft was substantially damaged (Figure 2).

Figure 2: Damage to VH-LKN

Source: Pilot

Pilot comments

The pilot provided the following comments:

- The airstrip was at an elevation of about 2,100 ft above mean sea level. The target pasture was about 1,000 ft higher than the airstrip.
- The airstrip was about 500 m in length and the fuel and chemical load was relatively light. The aircraft was well within its operational limitations.
- The weather forecast had indicated calm conditions, and the temperature was about 14°C.
- The sink that the aircraft encountered may have been a downdraft coming off the hill.
- If the airstrip had been higher up and closer to the target zone, the pilot would have had more time to dump the load, less distance to climb on each load, and a more accurate assessment of the wind conditions.
- Dumping liquid takes a few seconds, but granular substances like superphosphate take minutes for the hopper to empty when dumping the load.
- After the accident, the pilot verified that the hopper door was open, and superphosphate was present in the paddock, indicating that it had been dumping at the highest rate. Despite that, about 300 kg of superphosphate remained in the hopper.

Safety message

The pilot stated that the key to avoiding similar incidents was to understand the atmospheric conditions in steep mountainous country. Variations in wind strength and direction due to terrain can have serious consequences on flight safety, particularly when operating at low airspeeds and close to the ground.

ATSB investigated a similar accident involving a Grumman G-164A, in AO-2014-001.

General details

Occurrence details

Date and time:	6 August 2015 – 1400 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	33 km SW of Tharwa, Australian Capital Territory	
	Latitude: 35° 33.30' S	Longitude: 148° 59.68' E

Aircraft details

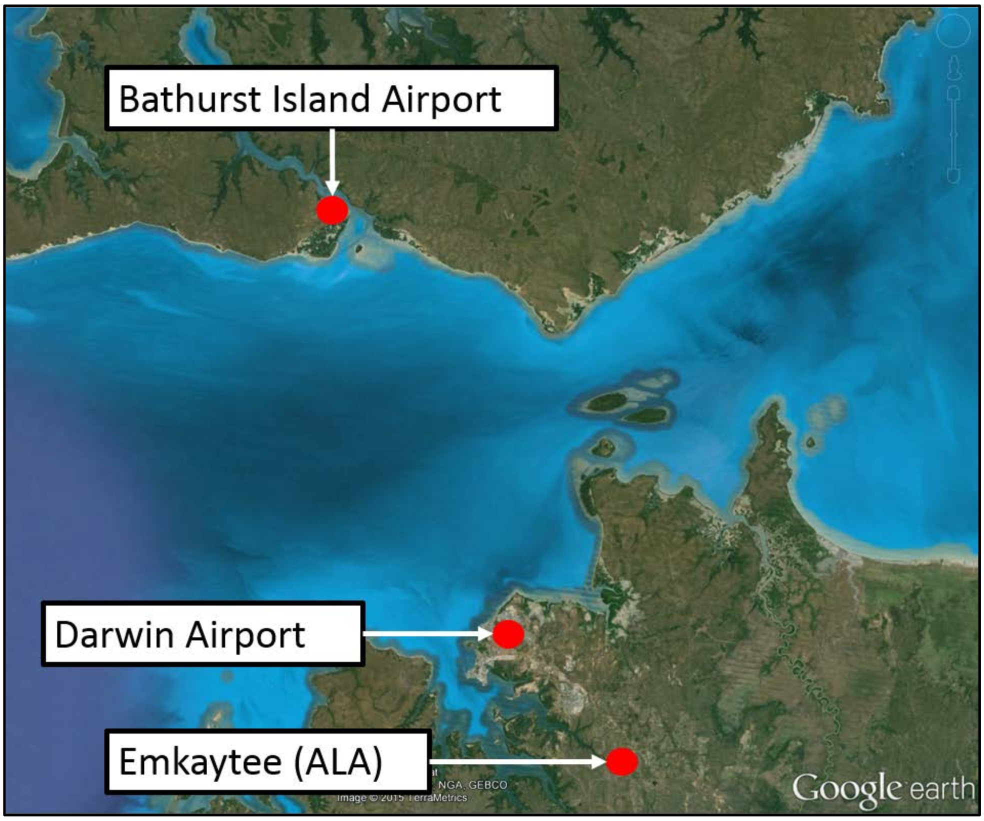
Manufacturer and model:	Grumman American Aviation Corporation G-164B	
Registration:	VH-LKN	
Serial number:	10B	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – 1 (Minor)	Passengers – Nil
Damage:	Substantial	

Separation issue involving a Cessna 404, VH-ANM, and a Cessna 172, VH-MJK

What happened

On 15 August 2015, the student pilot of a Cessna 172 aircraft, registered VH-MJK (MJK) conducted a solo flight from Emkaytee aeroplane landing area (ALA) to Bathurst Island Airport, Northern Territory (Figure 1). There the student pilot completed touch-and-go circuits for about 30 minutes on runway 15.

Figure 1: Image showing Bathurst Island, Darwin and Emkaytee airports



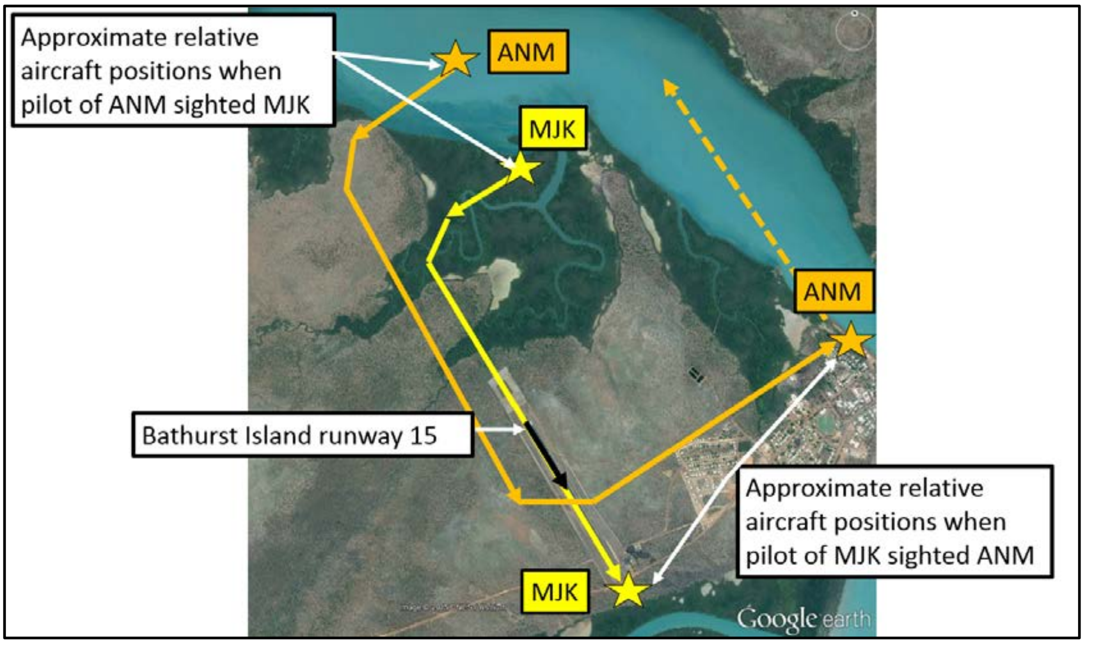
Source: Google earth – annotated by the ATSB

At about 1210 Central Standard Time (CST), a Cessna 404 aircraft, registered VH-ANM (ANM) and operated by Hardy Aviation, departed from Darwin Airport, Northern Territory, on a scheduled flight to Bathurst Island, with a pilot and five passengers on board. The pilot broadcast when inbound and about 15 NM from Bathurst Island Airport on the common traffic advisory frequency (CTAF) of 126.5 MHz, and did not receive any response. At about 1220, the aircraft joined on the downwind leg of the circuit for runway 15 at 1,000 ft above ground level and broadcast joining the circuit. As the aircraft turned onto base, the pilot sighted MJK also on base, at the same height, closer to the runway and estimated it was about 150 m away (Figure 2).

The pilot of ANM immediately manoeuvred the aircraft to the west to increase separation between the two aircraft. After unsuccessfully trying to contact the pilot of MJK on the CTAF, the pilot of ANM briefly selected frequency 126.7 MHz to try to communicate with the pilot of MJK, but again did not receive a response. The pilot of ANM observed MJK conduct a touch-and-go, and kept that aircraft in sight, while overflying and re-joining the circuit on the crosswind leg.

After the touch-and-go, when upwind of the runway at about 500 ft above ground level, the pilot of MJK sighted ANM. ANM was then to the left, above MJK at 1,000 ft, and turning onto the downwind leg. The pilot of MJK then saw that the radio was selected to frequency 126.6 MHz. The pilot checked their flight plan, noted that the correct frequency was 126.5, and immediately changed the radio to that frequency. The pilot of MJK then broadcast a departure call on the CTAF. The pilot of ANM then contacted the pilot of MJK, who advised that the radio had been on the wrong frequency.

Figure 2: Bathurst Island Airport showing approximate aircraft tracks and relative positions

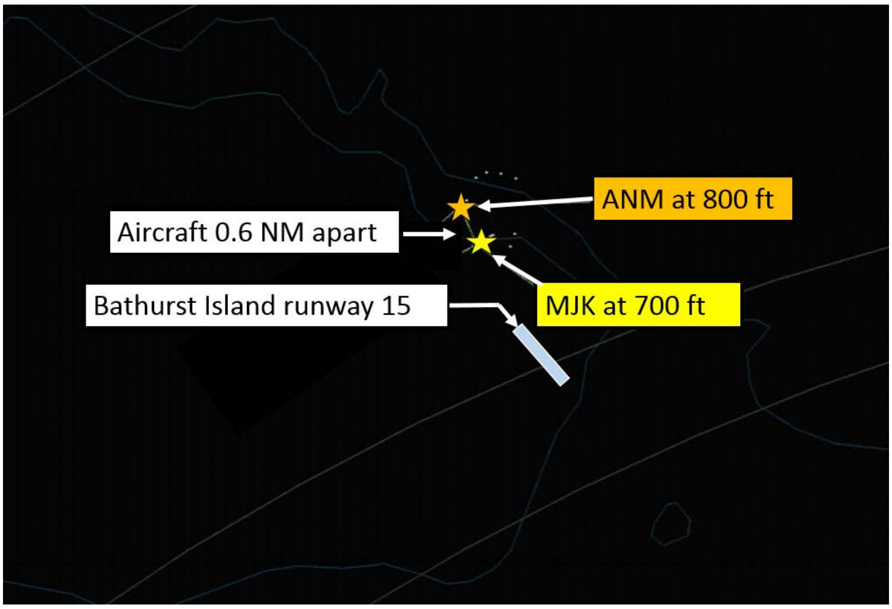


Source: Google earth – annotated by the ATSB

The pilot of ANM continued the approach, and landed at Bathurst Island, and MJK returned to Emkaytee without further incident.

The radar data provided to the ATSB by Darwin air traffic control, indicated the aircraft came within about 100 ft vertically and 0.6 NM at the closest proximity (Figure 3).

Figure 3: Radar display showing relative aircraft positions



Source: Department of Defence – annotated by the ATSB

Safety action

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. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Operator of VH-ANM

As a result of this occurrence, the operator of VH-ANM advised the ATSB that they have taken following safety action:

Notice to company pilots

The Chief Pilot distributed a notice to all company pilots advising them of the incident. The notice stated that the Tiwi Islands continue to be a hot spot for traffic, and reminded pilots to be 'doubly aware' when operating in the area.

Safety message

The pilot of MJK commented that there were three important learnings from this incident:

- crosscheck the selected frequency against the flight planning notes
- ensure the selector reaches the detent when selecting a radio frequency
- listen for the 'beep-back' response from the CTAF to verify the correct frequency has been selected.

An aerodrome frequency response unit (AFRU) identifies correct radio frequency selection at non-towered aerodromes. The AFRU automatically responds to a transmission on the CTAF either with a pre-recorded voice message, if no transmission has been received in the previous five minutes, or with a beep-back.

Insufficient communication between pilots operating in the same area is the most common cause of safety incidents near non-towered aerodromes. 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. One of the safety concerns is safety around non-towered aerodromes.

The booklet *A pilot's guide to staying safe in the vicinity of non-controlled aerodromes* outlines many of the common problems that occur at non-towered aerodromes, and offers useful strategies to keep yourself and other pilots safe.

General details

Occurrence details

Date and time:	15 August 2015 – 1220 CST	
Occurrence category:	Incident	
Primary occurrence type:	Separation issue	
Location:	Bathurst Island Airport, Northern Territory	
	Latitude: 11° 46.15' S	Longitude: 130° 37.18' E

Aircraft details: VH-ANM

Manufacturer and model:	Cessna Aircraft Company 404	
Registration:	VH-ANM	
Operator:	Hardy Aviation	
Serial number:	4040010	
Type of operation:	Air transport low capacity - Passenger	
Persons on board:	Crew – 1	Passengers – 5
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Aircraft details: VH-MJK

Manufacturer and model:	Cessna Aircraft Company 172N	
Registration:	VH-MJK	
Serial number:	17268245	
Type of operation:	Flying training – solo	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Helicopters

Engine failure involving an Enstrom 280, VH-YHD

What happened

On 28 February 2015, at about 1232 Eastern Standard Time (EST), an Enstrom 280 helicopter, registered VH-YHD (YHD), departed from Caloundra Airport, for a flight to Redcliffe Airport, Queensland, with the pilot, who was the only person on board.

After about half an hour, the pilot commenced a descent from 1,500 ft above ground level (AGL). The pilot then broadcast on the Redcliffe common traffic advisory frequency (CTAF) that YHD would join the Redcliffe circuit in about 6 minutes and navigated along the coastline toward Redcliffe.

At about 1,000 ft AGL, the pilot heard a bang and the engine stopped. This caused the helicopter to yaw to the left violently. The pilot then attempted to restart the engine but was unsuccessful. At about 800 ft AGL, the helicopter entered autorotation[1] and the pilot prepared to land on the beach. The pilot observed people swimming in the sea and manoeuvred the helicopter to an area where there were no people. The pilot arrested the descent and the skids contacted the sand. The helicopter continued to move forward along the sand, and then a few seconds later the helicopter blades impacted the sand, and the helicopter rolled over. The pilot received minor injuries and the helicopter was destroyed (Figure 1).

Figure 1: Accident site showing the damage to VH-YHD

Source: Queensland police

[1] Autorotation is a condition of descending flight where, following engine failure or deliberate disengagement, the rotor blades are driven solely by aerodynamic forces resulting from rate of descent airflow through the rotor. The rate of descent is determined mainly by airspeed.

Witness

A witness to the accident reported that the helicopter was first sighted at about 100 m above the ground, descending and approaching from the north. The only noise was from the rotor blades, with no engine sound. The witness reported that the wind was quite strong coming from the east. A stronger easterly gust came when the helicopter was close to the ground. The helicopter landed and continued to move forward, but then flipped upside down and the rotor blades contacted the sand. The helicopter came to rest about 150 m from where the witness was located. A passer-by assisted the pilot to exit the helicopter.

Pilot comment

The pilot provided the following comments:

- This was the first flight after the completion of the periodic (100 hourly or 12-month) maintenance inspection.
- The helicopter operated normally during the engine run-up checks and the flight, up to the engine failure.
- The pilot commented not to delay in lowering the collective[2] and setting the airspeed as everything happened very quickly after the engine failed and the pilot instinctively conducted an autorotation.
- The landing was smooth with no bump.
- The weather was fine with a slight breeze from the north-east and the wind speed at Caloundra was about 10 kt.
- Rather than fly direct to Redcliff airport the pilot had selected to fly along the shoreline. If YHD had flown direct to Redcliff then the engine may have failed over Deception Bay and YHD may have landed in the water.
- The pilot stated that the number of flight hours experience on the helicopter type was about 60, with about eight flight hours on the type in the 90 days prior.

Helicopter maintenance

The helicopter engine was overhauled and installed in YHD in April 2006. At the time of the accident, the engine had completed about 146 hours since overhaul. The periodic (100 hourly or 12-month) maintenance inspection included overhaul of the engine magneto.

Maintenance organisation investigation

The maintenance organisation inspected the engine externally and removed the number three cylinder. They determined that the damage found to the number three cylinder and piston (Figure 2) was consistent with detonation. Extreme heat from uncontrolled burning of the combustion gases resulted in melting of the cylinder between the spark plug hole and the exhaust valve seat. This melting damaged the piston to an extent that the combustion gases would blow past the piston rings. The maintenance organisation did not remove the other cylinders.

The maintenance organisation also removed the engine magneto and fuel control unit. Both units were examined at a component overhaul facility. The examination of the magneto found no defects. The examination of the fuel control unit found that it was functioning normally and was set to a lean position, although this position could not be validated due to disruption during the accident.

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[2] Collective is the primary helicopter flight control that simultaneously affects the pitch of all blades of the lifting rotor. Collective input is the main control for vertical velocity.

Figure 2: Damage to number three cylinder and piston

Source: Aircraft maintenance organisation

ATSB comment

In 2007, the ATSB published an aviation safety research and analysis report, *Aircraft Reciprocating-Engine Failure An Analysis of Failure in a Complex Engineered System B2007/0191*. The safety study discussed detonation in more detail including the examination of the factors that contribute to detonation free - operation (normal combustion) and the factors that contribute to detonation.

Safety message

When planning a particular flight it is important for pilots to consider options and risk. In this accident, the pilot opted to follow the coastline, allowing for the option to land on the beach. The pilot in the pre-flight planning identified the hazard (flying over water) and although the likelihood of an engine failure was low, the consequences were high and made the decision to follow the coastline to mitigate the risk. If the pilot had selected the option to fly the most direct path then the engine would have failed over the water.

The US Federal Aviation Administration (FAA) has published information on risk management in a *Risk Management Handbook (FAA-H-8083-2)*. They have also published a guide *Tips for Teaching Practical Risk Management and Practical Risk Management for local VFR Flying*. The guide contains the Perceive-Process-Perform model that offers a structured way to manage risk for local visual flight rules flying (Figure 3).

Figure 3: Risk Management Decision Path: Perceive-Process-Perform

Source: US Federal Aviation Administration

General details

Occurrence details

Date and time:	28 February 2015 – 1305 EST	
Occurrence category:	Accident	
Primary occurrence type:	Engine failure	
Location:	5 km north-west of Redcliffe Airport, Queensland	
	Latitude: 27° 10.85' S	Longitude: 153° 01.78' E

Helicopter details

Manufacturer and model:	Enstrom 280	
Registration:	VH-YHD	
Serial number:	1187	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – Minor	Passengers – Nil
Damage:	Destroyed	

Windscreen fogging and collision with terrain involving a Robinson R22, VH-RBT

What happened

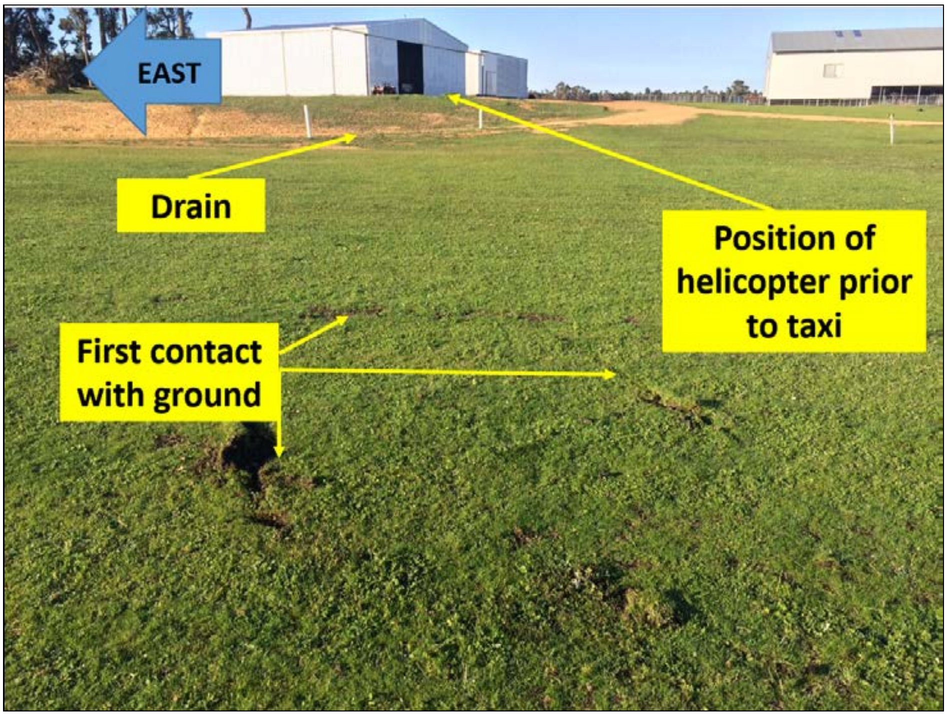
Early on the morning of 23 June 2015, the pilot pulled the Robinson R22 helicopter registered VH-RBT from the hangar on a property about 6 NM east of Boyup Brook aeroplane landing area (ALA), and prepared for a private flight with one passenger to Jandakot, Western Australia.

Prior to commencing the flight, the pilot re-checked the area meteorological forecast (ARFOR). The ARFOR indicated the probability of low cloud with fog, west of Boyup Brook ALA. The pilot reported that it was a cold and clear morning, with calm conditions. Although there was fog in a gully, about 200-300 m down the slope from the hangar, the general area and intended flight path were completely clear (Figure 1).

At about 0650 Western Standard Time (WST), the pilot started the helicopter engine and allowed the engine to warm up. The pilot then completed final preparations for departure while waiting for first light[1]

At about 0700, just after first light, the pilot reported that the horizon and the outline of the buildings and trees were clearly visible. After broadcasting intentions on the radio, the pilot established the helicopter into a hover about 2-3ft above the ground.

Figure 1: Marks where the helicopter tail and skid struck the ground. The drain the pilot planned to clear prior to transitioning to forward flight and hangar are in the background



Source: Pilot

[1] First light is when the centre of the sun is at an angle of 6° below the horizon before sunrise. At this time, the horizon is clearly defined but the brightest stars are still visible under clear atmospheric conditions.

After completing a power check, the pilot conducted a pedal turn to the east. The pilot intended to gain some height prior to transitioning the helicopter into forward flight, in order to clear the hangar and drain areas.

Due to the down-sloping terrain, the helicopter was about 15ft above the ground soon after lift-off. As the pilot began to raise the collective[2] and with their attention momentarily inside the cockpit, the passenger alerted them to the almost instantaneous external fogging of the windscreen. The pilot was briefly able to see the ground through the side window, before that also became shrouded in condensation. The pilot described this instant lack of external reference, as like being in a 'white room'. In an attempt to keep some necessary visual reference, the pilot reached down and flipped open the small vent located in the right door. Although a snapshot of ground was visible, it was insufficient to pinpoint the helicopter's actual position.

Now about 30-40 ft above the ground, the pilot elected to put the helicopter back on the ground. Manoeuvring slightly left to avoid the assumed position of the drain, the pilot unexpectedly felt the tail and rear skids of the helicopter strike the ground. The pilot stated this was a heavy collision, and resulted in the helicopter bouncing back into the air. The pilot applied some collective and the helicopter bounced again then yawed rapidly to the right. The pilot applied full left pedal in an attempt to prevent the helicopter from entering a spin, however the yaw continued, so the pilot rapidly reduced the throttle to idle. As the yaw decreased, the helicopter fell onto its left side (Figure 2).

Figure 2: VH-RBT at rest on the left side. Note the broken tail boom and rotor blades

Source: Pilot

Although hanging in the seatbelt, the pilot reached forward and shut off the mixture control and master switch. The pilot then egressed and assisted the passenger to undo their seatbelt and safely egress. Ground assistance arrived shortly after. The pilot reported that the fog was no longer on the windscreen.

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[2] A primary helicopter flight control that simultaneously affects the pitch of all blades of a lifting rotor. Collective input is the main control for vertical velocity.

The pilot was uninjured; however the passenger sustained minor injuries. The helicopter was substantially damaged.

Pilot experience and comments

The pilot had a total of about 915 helicopter and fixed wing hours, with about 756 of these on Robinson 22 helicopters.

The pilot commented that:

- the frost on the ground and the cold moist air above may have been mixed by the movement of the helicopter blades and caused the windscreen fogging
- when the windscreen fogged, the pilot thought that the helicopter had been moving forward, however when the helicopter tail struck the ground, the pilot realised that the lack of visual reference had led to a loss of situational awareness. The helicopter had in fact been moving backwards
- in hindsight, although the take-off was attempted immediately after first light, it may have been more prudent to delay the departure until the sun was properly up. This would have allowed a better natural horizon and a slight increase in temperature

Helicopter information

The helicopter had all the fittings and wiring to have a heater,[3] however the operator had removed the heater at the start of summer, and it had not been re-installed.

The pilot advised that there was a fresh air vent at the front of the windscreen, which ran up on the inside of the windscreen. It was their practice to keep this open, although the pilot could not be sure that is was open on the accident flight. The vents fitted to each door were initially closed.

Pilot operating handbook

The Robinson Helicopter Company Safety Notice SN-18 R Issued: January 85 and revised in February 1989 and June 1994 states:

> *<u>LOSS OF VISIBILITY CAN BE FATAL</u>*
>
> *Flying a helicopter in obscured visibility due to fog, snow, low ceiling, or even a dark night can be fatal. Helicopters have less inherent stability and much faster roll and pitch rates that airplanes. Loss of the pilot's outside visual references, even for a moment, can result in disorientation, wrong control inputs, and an uncontrolled crash. This type of situation is likely to occur when a pilot attempts to fly through a partially obscured area and realizes too late that he is losing visibility. He loses control of the helicopter when he attempts to turn to regain visibility but is unable to complete the turn without visual references.….*

ATSB comment

A cold windshield that is exposed to slightly warmer or moist air can 'fog up'. It is likely that the helicopter moved between different temperature layers as it moved forward and up, and this may have led to a combination of temperatures suitable to allow fog.

The use of heaters, demisters (if fitted) and air vents should always be operated as per the manufacturer's recommendations.

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[3] The heater warms the air in the cabin and thus the windscreen

General details

Occurrence details

Date and time:	23 June 2015 – 0700 WST	
Occurrence category:	Accident	
Primary occurrence type:	Weather - other	
Location:	11 km east of Boyup Brook ALA, (Longridge Farm), Western Australia	
	Latitude: 33° 54.03' S	Longitude: 116° 19.80'

Aircraft details

Manufacturer and model:	Robinson Helicopter Company R22 BETA	
Registration:	VH-RBT	
Serial number:	1980	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – Nil	Passenger –Minor
Damage:	Substantial	

Loss of control involving a Bell 206L3, VH-BLV

What happened

On 20 July 2015, the pilot of a Bell 206L3 (Longranger) helicopter, registered VH-BLV (BLV), conducted a charter flight from Essendon Airport to Falls Creek, Victoria, with five passengers on board. The aircraft took off from Essendon close to its maximum take-off weight. Due to the weight, and therefore fuel limitations, the pilot landed and refuelled at a property near Lake Eildon. At about 1000 Eastern Standard Time (EST), the helicopter departed from the property for the 60 NM flight to Falls Creek, again close to its maximum take-off weight.

At about 1030, while 700 ft above ground level and tracking from the north-west, the pilot conducted a shallow approach towards the helipad at Falls Creek (Figure 1). As the helicopter descended to about 50 ft above ground level, the pilot found that significantly more power was required to conduct the approach than anticipated. The pilot assessed that there was insufficient power available to continue to land, and elected to abort the approach. The pilot pushed forwards on the cyclic[1] to increase the helicopter's airspeed and conducted a left turn towards the valley.

Figure 1: Falls Creek helipad, approximate helicopter track and wind direction

Source: Google earth and pilot recollection – annotated by the ATSB

As the helicopter turned left, it started to yaw[2] rapidly towards the right. The pilot applied full left pedal to counteract the yaw, but the helicopter continued to yaw. The helicopter turned through one and a half revolutions, as the pilot lowered the collective.[3] Lowering the collective reduced the

1 A primary helicopter flight control that is similar to an aircraft control column. Cyclic input tilts the main rotor disc varying the attitude of the helicopter and hence the lateral direction.

2 Term used to describe motion of an aircraft about its vertical or normal axis.

3 A primary helicopter flight control that simultaneously affects the pitch of all blades of a lifting rotor. Collective input is the main control for vertical velocity.

power demand of the power rotor system, thereby increasing the ability of the anti-torque pedals to stop the right yaw. The combination of lowering collective and applying forward cyclic to gain forward airspeed, allowed the pilot to regain control of the helicopter. The pilot then conducted a left turn towards the helipad and made an approach to the helipad from an easterly direction. The helicopter landed following the second approach without further incident.

The pilot and passengers did not sustain any injuries and the helicopter was undamaged.

Weather

The pilot expected that the wind at Falls Creek would be variable at 2 kt, as it had been on departure from Essendon. The pilot did not see the windsock at the helipad prior to conducting the approach.

The Bureau of Meteorology provided the ATSB with a report of weather observations for Falls Creek. The automatic weather station is located south of the helipad at about 5,790 ft above mean sea level, above the village. Between 1020 and 1040, the recorded wind speed was from 17 to 20 kt, gusting to 24 kt, and wind direction was from 327° to 344° (degrees true), or 314° to 331° (degrees magnetic). The temperature was -1 °C.

Pilot comments

The pilot reported that the following combination of factors contributed to the incident:

- Unfamiliarity with the landing site and area.
- Inexperience operating at altitude, and unfamiliarity with the associated power requirements. The helipad at Falls Creek is at an elevation of about 5,000 ft above mean sea level.
- Lack of experience in the aircraft type – although the pilot had about 60 hours experience in the Bell Jetranger, this was only the pilot's second flight in the Longranger.
- High all up weight.
- Incorrect assessment of the wind direction – the pilot assumed that the wind would be light and variable at Falls Creek as it was had been on departure from Essendon. During the approach, the pilot assessed that the wind was from the right or a tailwind gusting to about 15 kt.

Operator comment

The operator of VH-BLV assessed that the unanticipated yaw was a result of too little pedal input, applied too late. This was most likely due to a combination of the pilot's inexperience on the 206L3, and being surprised by the downwind approach.

Hover ceiling

Hovering requires more power than any other flight regime. Additionally, hovering at higher altitudes requires more power than to hover at lower altitudes. The 'hover ceiling' is the height at which the power available equals the power required to hover. An increase in power increases the main rotor torque. This additional torque needs increased tail rotor thrust, to prevent the helicopter from yawing.

The Bell 206 L3 flight manual provides a *Hover ceiling – out of ground effect*[4] chart. At 5,000 ft, a temperature of 0 °C, and a gross weight of about 1,814 kg (4,000 lb), the helicopter was just within the chart's hover ceiling envelope. This indicates that adequate power should have been available to hover with those parameters. However, the wind direction and velocity also affect hovering performance.

4 Helicopters require more power to hover out of ground effect due to the absence of a cushioning effect created by the main rotor downwash striking the ground. The distance is usually defined as more than one main rotor diameter above the surface.

A stronger head wind reduces the power required to hover, while a tailwind increases the power required to hover. On the initial approach to the helipad, a tailwind meant that an increase in power and tail rotor thrust was required. The increased tail rotor thrust absorbs power from the engine, which means less power is available for the main rotor to produce lift. This led to the pilot's assessment of insufficient power available, and decision to discontinue the approach.

Unanticipated right yaw

The US Federal Aviation Administration (FAA) Helicopter flying handbook describes loss of tail rotor effectiveness (LTE) or an unanticipated yaw, as 'an uncommanded, rapid yaw towards the advancing blade which does not subside of its own accord'. It is caused by an interaction between the main rotor and tail rotor.

At high altitudes, the lower air density reduces tail rotor thrust and efficiency. Therefore, when operating at high altitudes and high gross weights, particularly while hovering or at low airspeeds, the tail rotor thrust may not be sufficient to maintain directional control. This can result in unanticipated yaw or LTE. In these circumstances, the hover ceiling is effectively limited by the tail rotor thrust, rather than the power available.

In this incident, other factors may also have contributed to the unanticipated yaw: low and slow flight outside of ground effect, a low speed downwind turn and a large change of power at low airspeed as the pilot aborted the approach.

The US Federal Aviation Administration Advisory Circular, *Unanticipated right yaw in helicopters*, stated that unanticipated right yaw, or loss of tail rotor effectiveness (LTE) has been determined to be a contributing factor in a number of accidents. These mishaps have occurred at low altitude and in low-speed flight, often on final approach to landing. Unanticipated right yaw may occur during any manoeuvre in which the pilot is operating in a high-power, low-airspeed environment with a left crosswind (in aircraft with counter-clockwise blade rotation) or tailwind.

Three additional factors can significantly influence the severity of LTE:

- gross weight and density altitude
- low indicated airspeed
- a rapid application of power, causing power droop.

In order to reduce the onset of LTE, when manoeuvring between hover and 30 kt, the pilot should:

- Avoid tailwinds.
- Avoid out of ground effect hover and high power demand situations, such as low-speed downwind turns.
- Be aware of wind direction and velocity. A loss of translational lift results in an unexpected high power demand and an increased anti-torque requirement.
- Be aware that if a considerable amount of left pedal is being maintained, a sufficient amount of left pedal may not be available to counteract an unanticipated right yaw.
- Stay vigilant to power and wind conditions.

If a sudden unanticipated right yaw occurs, the pilot should:

- apply full left pedal
- simultaneously move cyclic forward to increase speed
- if altitude permits, reduce power.

Safety message

Pilots should understand and avoid conditions that are conducive to uncontrolled yaw or loss of tail rotor effectiveness. Pilots can reduce their exposure to LTE by maintaining awareness of the wind and its effect on the helicopter. If a pilot encounters unanticipated yaw, quick application of the correct response is essential to recover control of the helicopter. The ATSB reported on an incident involving LTE in AO-2013-121.

This incident also highlights the effect of gross weight and airfield elevation on aircraft performance. Understanding controllability issues at the limits of the normal operating envelope can assist pilots in recognising the symptoms of reduced aircraft performance. Further information is available in ATSB report AO-2013-203.

General details

Occurrence details

Date and time:	20 July 2015 – 1030 EST	
Occurrence category:	Serious Incident	
Primary occurrence type:	Loss of control	
Location:	Falls Creek, Victoria	
	Latitude: 36° 52.00' S	Longitude: 147° 17.00' E

Helicopter details

Manufacturer and model:	Bell Helicopter Company 206L3	
Registration:	VH-BLV	
Serial number:	51582	
Type of operation:	Charter – passenger	
Persons on board:	Crew – 1	Passengers – 5
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: 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 that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

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

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

It is not a function of the ATSB to apportion blame or determine 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.

About this Bulletin

The ATSB receives around 15,000 notifications of Aviation occurrences each year, 8,000 of which are accidents, serious incidents and incidents. It also receives a lesser number of similar occurrences in the Rail and Marine transport sectors. It is from the information provided in these notifications that the ATSB makes a decision on whether or not to investigate. While some further information is sought in some cases to assist in making those decisions, resource constraints dictate that a significant amount of professional judgement is needed to be exercised.

There are times when more detailed information about the circumstances of the occurrence allows the ATSB to make a more informed decision both about whether to investigate at all and, if so, what necessary resources are required (investigation level). In addition, further publically available information on accidents and serious incidents increases safety awareness in the industry and enables improved research activities and analysis of safety trends, leading to more targeted safety education.

The Short Investigation Team gathers additional factual information on aviation accidents and serious incidents (with the exception of 'high risk operations), and similar Rail and Marine occurrences, where the initial decision has been not to commence a 'full' (level 1 to 4) investigation.

The primary objective of the team is to undertake limited-scope, fact gathering investigations, which result in a short summary report. The summary report is a compilation of the information the ATSB has gathered, sourced from individuals or organisations involved in the occurrences, on the circumstances surrounding the occurrence and what safety action may have been taken or identified as a result of the occurrence.

These reports are released publically. In the aviation transport context, the reports are released periodically in a Bulletin format.

Conducting these Short investigations has a number of benefits:

- Publication of the circumstances surrounding a larger number of occurrences enables greater industry awareness of potential safety issues and possible safety action.
- The additional information gathered results in a richer source of information for research and statistical analysis purposes that can be used both by ATSB research staff as well as other stakeholders, including the portfolio agencies and research institutions.
- Reviewing the additional information serves as a screening process to allow decisions to be made about whether a full investigation is warranted. This addresses the issue of 'not knowing what we don't know' and ensures that the ATSB does not miss opportunities to identify safety issues and facilitate safety action.
- In cases where the initial decision was to conduct a full investigation, but which, after the preliminary evidence collection and review phase, later suggested that further resources are not warranted, the investigation may be finalised with a short factual report.
- It assists Australia to more fully comply with its obligations under ICAO Annex 13 to investigate all aviation accidents and serious incidents.
- Publicises ***Safety Messages*** aimed at improving awareness of issues and good safety practices to both the transport industries and the travelling public.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Short Investigations
Aviation Short Investigations Bulletin Issue 44
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