



**Australian Government**

**Australian Transport Safety Bureau**



**ATSB TRANSPORT SAFETY REPORT**  
Aviation Occurrence Investigation AO-2008-076  
Final

**Collision with terrain**  
**VH-OPC**  
**Piper Aircraft Corp PA-31-350**  
**3 km N Bathurst Airport, NSW**  
**7 November 2008**





**Australian Government**  

---

**Australian Transport Safety Bureau**

**ATSB TRANSPORT SAFETY REPORT**

Aviation Occurrence Investigation

AO-2008-076

Final

**Collision with terrain**  
**3 km N Bathurst Airport, NSW**  
**7 November 2008**  
**VH-OPC**  
**Piper Aircraft Corp. PA-31-350 Chieftain**

*Published by:* Australian Transport Safety Bureau  
*Postal address:* PO Box 967. Civic Square ACT 2608  
*Office location:* 62 Northbourne Ave, Canberra City, Australian Capital Territory, 2601  
*Telephone:* 1800 020 616, from overseas +61 2 6257 4150  
Accident and incident notification: 1800 011 034 (24 hours)  
*Facsimile:* 02 6247 3117, from overseas +61 2 6247 3117  
*Email:* [atsbinfo@atsb.gov.au](mailto:atsbinfo@atsb.gov.au)  
*Internet:* [www.atsb.gov.au](http://www.atsb.gov.au)

© Commonwealth of Australia 2010.

This work is copyright. In the interests of enhancing the value of the information contained in this publication you may copy, download, display, print, reproduce and distribute this material in unaltered form (retaining this notice). However, copyright in the material obtained from other agencies, private individuals or organisations, belongs to those agencies, individuals or organisations. Where you want to use their material you will need to contact them directly.

Subject to the provisions of the *Copyright Act 1968*, you must not make any other use of the material in this publication unless you have the permission of the Australian Transport Safety Bureau.

Please direct requests for further information or authorisation to:

Commonwealth Copyright Administration, Copyright Law Branch  
Attorney-General's Department, Robert Garran Offices, National Circuit, Barton, ACT 2600  
[www.ag.gov.au/cca](http://www.ag.gov.au/cca)

ISBN and formal report title: see 'Document retrieval information' on page iv

---

# CONTENTS

---

<b>THE AUSTRALIAN TRANSPORT SAFETY BUREAU .....</b>	<b>v</b>
<b>TERMINOLOGY USED IN THIS REPORT .....</b>	<b>v</b>
<b>FACTUAL INFORMATION .....</b>	<b>1</b>
Sequence of events.....	1
Pilot information .....	3
Aeronautical qualifications and experience.....	3
Medical and health .....	3
Aircraft information .....	4
Aircraft maintenance.....	6
Meteorological information .....	6
Bureau of Meteorology.....	6
Other information sources .....	8
Airport-related information.....	8
Accident site and wreckage information.....	9
Further wreckage examination.....	11
Recorded information .....	14
Flight planning and departure procedures.....	15
Flight path derivation.....	16
Human factors information .....	17
Spatial disorientation.....	17
Pilot incapacitation .....	18
<b>ANALYSIS .....</b>	<b>19</b>
Introduction.....	19
Airworthiness.....	19
Operational considerations.....	20
<b>FINDINGS.....</b>	<b>22</b>
Contributing safety factors.....	22
Other key findings.....	22
<b>APPENDIX A: SOURCES AND SUBMISSIONS.....</b>	<b>25</b>

---

## DOCUMENT RETRIEVAL INFORMATION

---

Report No.	Publication date	No. of pages	ISBN
AO-2008-076	20 January 2010	30	978-1-74251-023-1

---

### Publication title

Collision with terrain – 3 km N Bathurst Airport, NSW – 7 November 2008 - VH-OPC, Piper Aircraft Corp. PA-31-350 Chieftain

---

### Prepared By

Australian Transport Safety Bureau  
PO Box 967, Civic Square ACT 2608 Australia  
[www.atsb.gov.au](http://www.atsb.gov.au)

### Reference Number

Jan20/ATSB48

---

### Acknowledgements

Figures 1, 2 & 9: Background image Google Earth  
Figures 3 & 4: Tony Sazonov  
Figure 5: Bureau of Meteorology

---

### Abstract

On 7 November 2008, a Piper Aircraft Corp. PA-31-350 Chieftain, registered VH-OPC, was being operated on a private flight under the instrument flight rules from Moorabbin Airport, Vic. to Port Macquarie via Bathurst, NSW. On board the aircraft were the owner-pilot and three passengers.

The flight from Moorabbin to Bathurst was conducted in accordance with the pilot's flight plan and a review of recorded air traffic control data and communications did not reveal any problems during that flight. After refuelling at Bathurst Airport, the pilot departed from runway 35 for Port Macquarie in dark-night conditions with light rain in the area. At about 2024, some 2½ minutes after reporting airborne, residents of Forest Grove to the north of Bathurst Airport, heard a sudden loud noise from an aircraft at low altitude. Shortly after, there was the sound of an explosion and the glow of a fire. The aircraft was found to have impacted terrain resulting in serious damage to the aircraft. The four occupants were fatally injured.

The aircraft had impacted the ground upright, slightly right wing low, at a descent angle greater than 20°. The wreckage trail, oriented on a ground track of 165° M, extended for about 300 m. Almost all of the major aircraft parts were seriously impact and fire damaged. The propellers indicated high rotational energy. The landing gear and wing flaps were retracted.

Due to fire and impact damage, and limited information about the sequence of events after takeoff, the evidence available to the investigation was limited. There were no indicators of aircraft malfunction or pilot impairment prior to the accident. After extensive examination, the investigation found there was no evidence of any aircraft unserviceability and that airworthiness was not likely to have been a contributing factor in the accident. The investigation was unable to establish why the aircraft collided with terrain; however, pilot spatial disorientation or pilot incapacitation could not be discounted.

---

---

# THE 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 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 enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

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

## **Developing safety action**

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

When safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation, the person, organisation or agency must provide a written response within 90 days. That response must indicate whether the person, organisation or agency accepts the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

**#About ATSB investigation reports:** How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site [www.atsb.gov.au](http://www.atsb.gov.au)



---

## TERMINOLOGY USED IN THIS REPORT

---

**Occurrence:** accident or incident.

**Safety factor:** an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, risk controls and organisational influences.

**Contributing safety factor:** a safety factor that, if it had not occurred or existed at the relevant time, then either: (a) the occurrence would probably not have occurred; or (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or (c) another contributing safety factor would probably not have occurred or existed.

**Other safety factor:** a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report.

**Other key finding:** any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which ‘saved the day’ or played an important role in reducing the risk associated with an occurrence.

**Safety issue:** a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

Safety issues can broadly be classified in terms of their level of risk as follows:

- Critical safety issue: associated with an intolerable level of risk.
- Significant safety issue: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable.
- Minor safety issue: associated with a broadly acceptable level of risk.



---

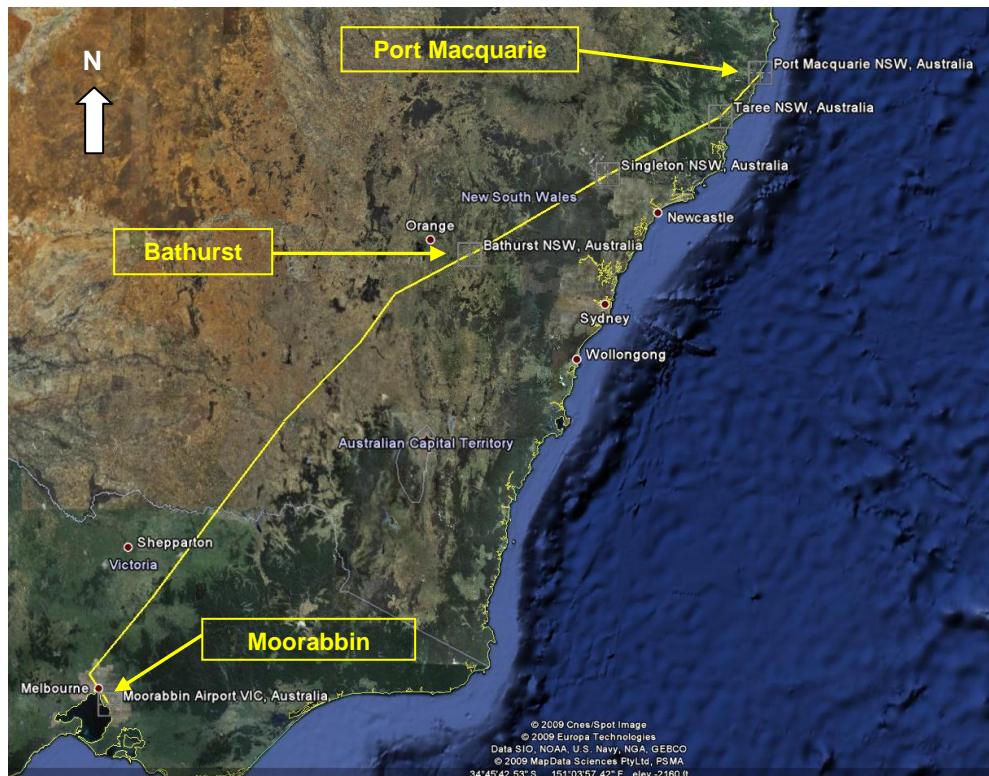
# FACTUAL INFORMATION

---

## Sequence of events

On 7 November 2008, a Piper Aircraft Corp. PA-31-350 Chieftain, registered VH-OPC, was being operated on a private flight under the instrument flight rules (IFR) from Moorabbin Airport, Vic. to Port Macquarie via Bathurst, NSW (Figure 1). On board the aircraft were the owner-pilot and three passengers.

**Figure 1: Representation of flight planned track**



The aircraft departed Moorabbin Airport at about 1725 Eastern Daylight-saving Time<sup>1</sup> and arrived at Bathurst Airport at about 1930. The pilot added 355 L of aviation gasoline (Avgas) to the aircraft from a self-service bowser and spent some time with the passengers in the airport terminal.

Recorded information at Bathurst Airport indicated that, at about 2012 (12 minutes after civil twilight), the engines were started and at 2016 the aircraft was taxied for the holding point of runway 35. The aircraft was at the holding point for about 3 minutes, reportedly at high engine power. At 2020, the pilot broadcast that he was entering and backtracking runway 35 and at 2022:08 the pilot broadcast on the common traffic advisory frequency that he was departing (airborne) runway 35. At 2023:30, the pilot transmitted to air traffic control that he was airborne at Bathurst

---

<sup>1</sup> The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time, as particular events occurred. Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

and to standby for departure details. There was no record or reports of any further radio transmissions from the pilot.

At about 2024, a number of residents of Forest Grove, a settlement to the north of Bathurst Airport, heard a sudden loud noise from an aircraft at a relatively low height overhead, followed shortly after by the sound of an explosion and the glow of a fire. A witness located about 550 m to the south-west of the accident site, (Figure 2) reported seeing two bright lights that were shining in a constant direction and ‘wobbling’. There was engine noise that was described by one witness<sup>2</sup> as getting very loud and ‘rattling’ or ‘grinding’ abnormally before the aircraft crashed. At 2024:51, the first 000 telephone call was received from witnesses and shortly after, emergency services were notified.

The aircraft was seriously damaged<sup>3</sup> by impact forces and fire, and the four occupants were fatally injured.

**Figure 2: Accident site location (circled)**



---

<sup>2</sup> This witness heard, but did not observe the aircraft.

<sup>3</sup> The Transport Safety Investigation Regulations 2003 definition of ‘serious damage’ included the ‘destruction of the transport vehicle’.

## Pilot information

### Aeronautical qualifications and experience

The pilot held a Commercial Pilot (Aeroplane) Licence that was issued in 1983. The pilot also held a Command (Multi-engine aeroplane) Instrument Rating that was issued in 1982. That rating included approval to use the non-directional beacon (NDB) and area navigation global navigation satellite system (RNAV(GNSS)) navigational aids. The pilot was endorsed on a number of light twin-engined aircraft including the PA31 Navajo/Chieftain.

The pilot's logbook was not found, so preparation of an accurate summary of the pilot's flying experience was not possible. An incomplete printout of the pilot's experience, which was found at the accident site, recorded a total of 203 hours of night flying and 376 hours of instrument flying up to September 2006. On 27 May 2008, the pilot stated on an aviation medical form that he had a total flying time of 2,061 hours and, in the last 6 months, a total flying time of 38 hours. The investigation was unable to establish if the pilot met the requirements for minimum instrument flight time in the 90 days preceding the flight, as stipulated in Civil Aviation Order 40.2.1 sub-section 11.<sup>4</sup>

An Approved Testing Officer (ATO), who had conducted the pilot's annual instrument rating renewals since 1996, conducted the most recent renewal on the evening of 24 June 2008. The flight was performed in VH-OPC and consisted of a routine pattern of airwork sequences and practice instrument approaches in the Moorabbin - Avalon area near Melbourne. The airwork included steep turns, limited panel<sup>5</sup> and unusual attitudes<sup>6</sup>. Also included were simulated engine failures after takeoff and during an approach to land. The ATO advised that the pilot was always conscientious and his performance during the renewal was 'absolutely fine'.

A Grade 1 instructor,<sup>7</sup> who periodically flew with the pilot in VH-OPC, reported that the pilot's flying was of a good standard.

### Medical and health

The pilot held a Class 1 Medical Certificate, valid to 27 May 2009, with a requirement for reading correction to be available.

A review of the available medical records did not reveal any preconditions for incapacitation in the pilot's recent history.

The post mortem examination did not identify any significant disease or indicators of likely physiological impairment. There was no evidence of smoke or fume inhalation. Quinine was detected in the toxicology testing, but any effect on the pilot's performance was not able to be established.

---

<sup>4</sup> A copy of the Civil Aviation Orders is available on the Civil Aviation Safety Authority website [www.casa.gov.au](http://www.casa.gov.au).

<sup>5</sup> Instruction of a pilot with key aircraft instruments unavailable for use and in the absence of external cues.

<sup>6</sup> Recovery of an aircraft to normal flight from an unintended attitude.

<sup>7</sup> Highest grade of flying instructor.

Persons identified by the investigation who had contact with the pilot on the day of the accident, generally reported observing no indications of any health problems. One person who saw the pilot at the airport on the morning of the flight, reported that the pilot looked ‘a bit red and rashy’, but was otherwise healthy. There was, however, no context available to ascertain the significance of that observation. Closed circuit television footage recorded at Moorabbin and Bathurst Airports did not show any signs of pilot or passenger ill-health.

## Aircraft information

The aircraft was manufactured in the United States in 1979 and was first registered in Australia in 1989. At the time of the accident, the aircraft had about 11,000 hours total time in service (Figure 3).

In 2001, the pilot purchased the aircraft and arranged for it to be refurbished and modified. The refurbishment was extensive and included the renewal of flight control system components such as control cables and pulleys and the replacement of the engine control cables. The landing gear and both engines were also overhauled. The modifications that were incorporated into the aircraft included:

- a Colemill Enterprises Inc. Panther II modification kit, including the installation of; winglets, four-bladed propellers, unfeathering accumulators, wingtip landing lights and modified engine cowlings
- the installation of American Aviation Inc. Ultra Cooling System engine intercoolers
- the fitment of Boundary Layer Research vortex generators, providing for a gross weight increase.

Other pilots who had flown the aircraft since its refurbishment, reported that the aircraft was in very good condition and performed very well. They generally considered the aircraft handled as well or better than the standard Chieftain, especially at slow speed.

**Figure 3: VH-OPC post refurbishment and modification**



The aircraft was equipped and certified for flight under the IFR. The flight instruments and avionics included:

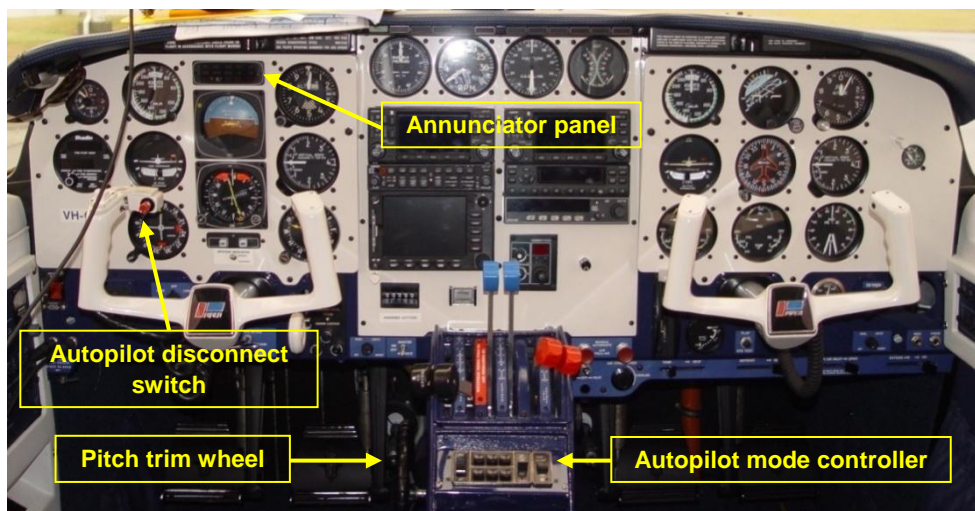
- a Bendix/King KFC 200 autoflight (autopilot) system, incorporating a pneumatically-powered attitude indicator/flight director and

electrically-powered horizontal situation indicator that were located on the left instrument panel, with yaw damper

- an electrically-powered attitude indicator and pneumatically-powered directional gyro that were located on the right instrument panel
- an electrically-powered turn and slip indicator
- a dual Garmin GNS 430 VHF NAV/COM/GPS
- a Bendix/King KR 87 ADF
- a Bendix/King RDR 2000 Weather radar
- a Garmin GTX327 Transponder.

The autopilot was operated through a mode controller that was located below the engine control quadrant (Figure 4). During a climb with the autopilot selected, a pilot would usually have the FD (flight director), AP (autopilot) and HDG (heading) or NAV (navigate) pushbuttons engaged, with corresponding symbology on the annunciator panel above the primary attitude indicator. Pitch attitude was controlled through pilot adjustment of a vertical trim wheel adjacent to the pushbuttons until the desired altitude was attained and the ALT (altitude) button pushed. To disconnect the autopilot, a pilot could push the red button on the left control column or deactivate the applicable circuit breakers. Overpowering the autopilot through the control column was possible but, if sustained in the pitch axis for more than 3 seconds, resulted in opposing autotrim.

**Figure 4: Aircraft cockpit**



During a single-pilot operation, the pilot would occupy the left seat, referring primarily to the left instrument panel. If any of those instruments were not functioning properly, the pilot would be able to refer to the corresponding instrument on the right instrument panel.

The Chieftain cockpit lighting system consisted of a number of different circuits; left instrument panel lighting, right instrument panel lighting, avionics back-lighting, overhead dome light and pilot/copilot map lights.

In addition to the wingtip landing lights, the aircraft's external lighting consisted of noseleg-mounted taxi/landing lights, wingtip strobe and navigation lights, and fin-mounted anti-collision light.

The Moorabbin refueller reported adding 370 L to fill the aircraft's fuel tanks prior to the aircraft departing for Bathurst. Based on an elapsed flight time of 2 hours and 5 minutes, the fuel consumed on the Moorabbin to Bathurst sector would have been about 350 L. Given the addition of 355 L at Bathurst, it is likely that the pilot again filled the fuel tanks.

With full fuel tanks on start-up at Bathurst, and an estimated passenger and baggage weight onboard of 355 kg, the aircraft gross weight was about 3,212 kg, 130 kg below the applicable maximum take-off weight at the time of the accident. It was at mid-range centre of gravity.

## **Aircraft maintenance**

The aircraft was maintained by a Moorabbin-based maintenance company under a Civil Aviation Safety Authority (CASA)-issued Certificate of Approval. The maintainer reported that the owner-pilot of the aircraft insisted on a high standard of aircraft maintenance and would not operate the aircraft with any defects.

A review of the aircraft logbooks and recent worksheets did not identify any indicators of an airworthiness-related factor in the accident.

The logbook statement for the aircraft specified that 50-, 100-, 500- and 1,000-hour inspections were to be carried out in accordance with the PA-31-350 maintenance manual. It also specified that Electrical, Instrument and Radio category inspections were to be carried out in accordance with the CASA maintenance schedule at 100-hour intervals.

A 100-hour (including 50-hour) inspection was certified complete on 21 June 2008. Most of the recorded maintenance tasks were routine or scheduled with some minor rectification carried out. The maintenance release issued at that time was not found at the accident site, so the aircraft total time and defect endorsement status were not available.

The most recent maintenance recorded on the aircraft was a routine 50-hour inspection and re-weigh that were certified on 11 October 2008. The aircraft was only flown once between the 50-hourly inspection and the day of the accident. The pilot of that flight, who had flown the aircraft on a number of previous occasions, reported that the aircraft performed very well.

## **Meteorological information**

### **Bureau of Meteorology**

At the request of the investigation, the Bureau of Meteorology (BoM) conducted an analysis of the meteorological conditions at Bathurst at the time of the accident and provided copies of the associated forecasts, reports, charts and imagery. The following information is quoted or adapted from the BoM report.

On the day of the accident, a cold front extended over the western parts of NSW, producing cloud and rain over most of the state, including the accident site. Images from the Sydney weather radar (located about 182 km to the south-east of Bathurst)

show that, prior to and at about the time of the accident, a band of precipitation was passing through the Bathurst region (Figure 5).

**Figure 5: Weather radar image representing the conditions at 2030<sup>8</sup>**



The Bathurst aerodrome forecast that was valid for the time of the accident indicated deteriorating conditions from 1900 with rain and broken<sup>9</sup> cloud at 7,000 ft above aerodrome elevation, and moderate turbulence below 5,000 ft. Intermittent periods of visibility reduced to 4,000 m and broken cloud at 1,000 ft were also expected after 1900.

The automated aerodrome weather report for Bathurst Airport at about 25 minutes before the accident indicated that there was scattered cloud at 7,500 ft and an overcast layer of cloud at 8,800 ft above aerodrome elevation. Visibility detected by the automated sensor was 10 km or greater.

<sup>8</sup> Colours represent different levels of precipitation intensity.

<sup>9</sup> Cloud amounts are reported in oktas. An okta is a unit of sky area equal to one-eighth of total sky visible to the celestial horizon. Few = 1 to 2 oktas, scattered = 3 to 4 oktas, broken = 5 to 7 oktas and overcast = 8 oktas.

The 10-minute average data from the Bathurst Airport Automatic Weather Station is shown in Table 1.

**Table 1: Bathurst Airport surface observations on 7 November 2008**

Time (EDT)	Wind Direction (° T)	Wind Speed (kts)	Wind Gust (kts)	Temp (°C)	Dew Point (°C)	QNH (hPa)	Rainfall (mm)
2020	028	7	9	17.6	11.6	1011.1	0.0
2030	018	8	9	17.1	11.8	1011.4	0.0
2040	008	6	8	16.6	12.2	1011.6	0.2

Based on the available data, in all likelihood there was no thunderstorm or other significant weather phenomenon present in the area at the time of the accident. Moderate turbulence was likely to have been present.

### Other information sources

Some of the residents in the area of the accident site reported that there was overcast cloud and light rain and that it was dark with no significant weather in the area at the time.

The pilot of a light aircraft that arrived from Sydney about 30 minutes after the accident reported that, while inbound to Bathurst from the east at 6,500 ft, the weather allowed flight under the visual flight rules and that Bathurst was visible with about 75 km to run. In the circuit at Bathurst, the cloud was overcast at about 8,000 ft with rain showers to the north-east.

On the day of the accident, the end of civil twilight was 2000 and the end of nautical twilight was 2032.

### Airport-related information

Bathurst Airport was located about 7 km to the east of the Bathurst central business district and was 2,435 ft above mean sea level (AMSL). The area to the north of the airport was sparsely populated and was reputed to have a low level of ground lighting.

The main runway, 17/35 (runway aligned 354° M), had a bitumen surface and was 1,705 m long. The other runway, 08/26, which intersected the main runway, had a gravel surface and was 1,315 m long. A local traffic regulation specified right circuits to runway 35 between 2200 and first light.

Runway lighting was only provided for runway 17/35. That lighting could be selected ON through a series of specifically timed transmissions on the dedicated pilot activated aerodrome lighting (PAL) frequency of 120.6 MHz. The PAL lighting remained on for 30 minutes with continuous flashing of the wind indicator lights when the runway lights were about to extinguish.

The runway lighting was observed to be activated at 2014, which was after the occupants boarded the aircraft and before the aircraft taxied. The airport manager reported that when he attended the accident site soon after the accident, he observed that the runway lights were still illuminated.

There were two Avgas self-service bowser at Bathurst Airport, one of which was used by the pilot to refuel the aircraft. The quality of the fuel in the tanks at that bowser was checked the evening before and at 2230 on the day of the accident with nil water and sediment recorded. Samples of fuel from both tanks, taken after the accident, were examined and no anomalies were observed.

## Accident site and wreckage information

The aircraft collided with terrain on a rural property that was located about 3 km to the north of Bathurst Airport, at about the same elevation as the airport (Figure 6). The initial impact point was on a grassy area that sloped upwards for about 50 m before slightly sloping down. The wreckage trail was generally linear, orientated on a bearing of 165° M and extended for about 300 m. The length of the wreckage trail and damage to the aircraft was consistent with a high speed collision with terrain. There was evidence of fire along the wreckage trail.

Below the likely aircraft flight path, between 20 and 35 m down-slope of the initial impact point, was a cluster of trees about 12 m high. There was no apparent gap for a Chieftain to fly through, and no apparent damage to, the trees, indicating that the aircraft passed over the trees at a descent angle greater than about 20°.

**Figure 6: Accident site (dotted line indicates wreckage trail orientation)**

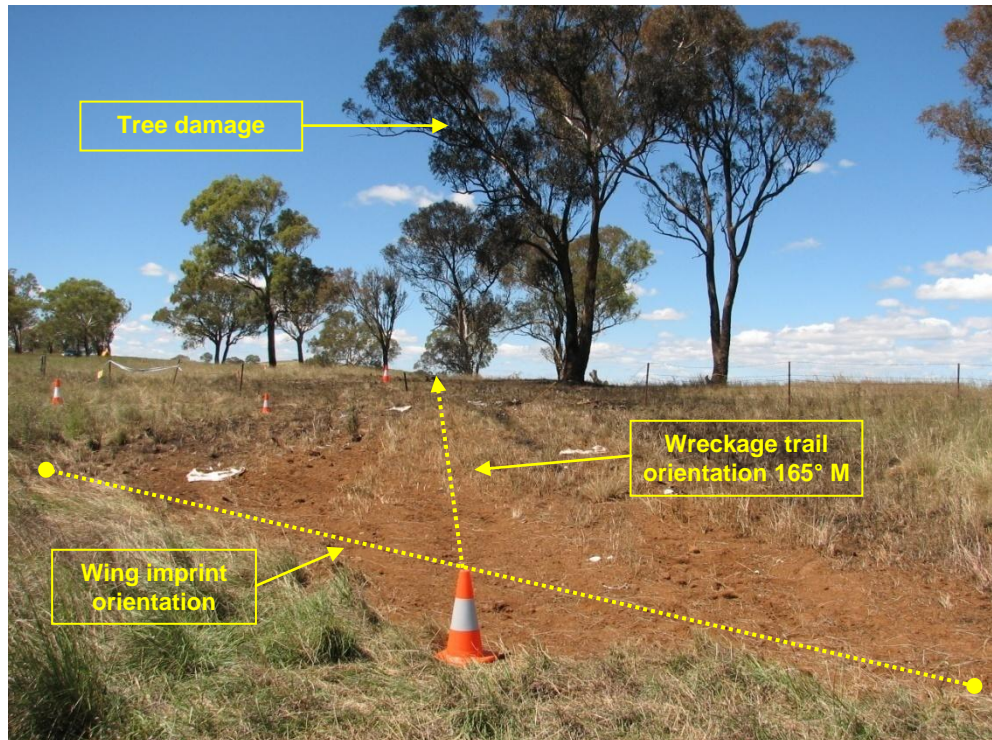


The ground marks and debris at the initial impact site (Figure 7) indicated that the aircraft was generally upright at the point of impact. The first sign of aircraft contact was a blade tip from the right propeller that was embedded in the ground, closely followed by ground disturbance consistent with wing impact. The

orientation of the wing impact line was consistent with a slightly right wing-low attitude at impact. The ground marks and aircraft damage indicated that the aircraft attitude at impact was shallower than the minimum descent angle over the trees that was derived by the investigation.

Drag marks extended for about 50 m from the initial impact point, including through a fence. A tree located about 50 m into the wreckage trail sustained upper branch damage. Drag marks restarted about 110 m into the trail and continued up to the main wreckage. Aircraft wreckage was distributed along the accident site.

**Figure 7: Initial impact site (looking in direction of travel)**



The main wreckage, comprising the majority of the fuselage, tail and inboard section of the right wing, was located about 200 m along the wreckage trail (Figure 8). The left engine assembly was 13 m further on and the right engine core was 35 m further on from the main wreckage. The right engine turbocharger assembly, found at about 300 m from the initial impact point, was at the extremity of the wreckage trail.

**Figure 8: Main wreckage (looking back along the direction of approach – initial impact site circled)**



All of the aircraft extremities and major components were accounted for at the accident site. All of the observable damage was impact and/or post-impact fire-related.

To the extent possible, pre-impact flight control system continuity and surface attachment was verified. The rudder trim tab was the only one of the three trim tabs that remained fully attached, and was deflected in a nose-right direction, close to the limit of normal travel. The control cables wrapped on the elevator trim and aileron trim drums that were recovered from the cockpit area, indicated mid-range trim tab positions. All of the trim information was not necessarily reflective of the tab positions at the time of impact due to the extensive disruption to the control cables.

The landing gear was retracted or damaged in a way that was consistent with it having been retracted at the time of impact. One of the wing flap screw-jack actuating mechanisms was found in the retracted position.

A number of aircraft components and assemblies were retained by the Australian Transport Safety Bureau (ATSB) for further examination.

## **Further wreckage examination**

The left and right engines were disassembled and examined at a CASA-approved engine overhaul facility. No pre-impact defects likely to have contributed to the accident were found.

One of the left engine exhaust pipes was fractured at its sleeve joint end (Figure 9). Specialist examination showed that the pipe material, weakened during elevated-temperature service, was probably fractured during the impact sequence.

The investigation was unable to establish the service history of the fractured exhaust pipe.

**Figure 9: Fractured exhaust pipe as found on site**



Some areas of the left engine assembly, between the rear of the engine core and the turbocharger, exhibited localised severe burning. There was no intense grass fire leading up to, and where the engine came to rest (Figure 10), that may have been the source of the localised severe burn damage (Figure 10). As such, the investigation used an exemplar aircraft to correlate those burnt areas with possible sources of intense heat, and found that the pattern of burning was not consistent with an in-flight fire.

**Figure 10: Left engine assembly as found on site**



Examination of the left and right propellers did not identify any pre-impact defects. The bending and twisting of the left and right propeller blades was comparable, and was consistent with a high level of rotational energy associated with significant engine power at the time of impact (Figure 11).

**Figure 11: A left propeller blade (on left) and a right propeller blade (on right) with corresponding damage**



The investigation was only able to recover a limited number of components from the aircraft's autopilot system. Those parts were fire and/or impact damaged and, in the case of some servo components, their specific role in the system was not identifiable. The parts were examined at a CASA-approved avionics repair facility with the only anomaly found being the excessive wear of the servo motor commutator. It was not clear what the effect of the commutator wear would be on autopilot operation, but it was not considered likely to be a significant threat. Examination of the annunciator panel globes showed that the autopilot was probably not engaged at impact, but it was not possible to determine if the autopilot was engaged at some time during the departure from Bathurst.

One of the two pneumatically-powered gyros in the aircraft was recovered, having been found separated from its instrument housing. It was difficult to positively identify the gyro, but it was more likely to have been from the secondary directional gyro than the primary attitude indicator. Evidence of rotational scoring was found on the inside of the gyro casing, gyro rotor and gyro casing end cap. The two engine-driven pneumatic pumps were disassembled and examined. They both exhibited evidence of rotation at impact, with no apparent faults. However, there was no way for the investigation to determine if the gyroscopes were rotating at the correct speed to provide reliable indications at that time. In addition, it was not possible to assess the other components of the aircraft pneumatic system for normal operation at the time of the accident.

The electrically-powered remote gyro that provided data to the horizontal situation indicator was disassembled and examined. Evidence of rotational scoring was found on the inside of the gyro casing and on the gyro rotor.

The incandescent globes that provided switch backlighting for the autopilot mode controller, displayed filament stretch, an indication of globe illumination at the time of impact. Those globes were probably<sup>10</sup> on a different electrical circuit to the flight instrument lighting. Given that the instrument lighting filaments were unable to be recovered, there was no information available about the functionality of that lighting.

A hand tool was found about halfway along the wreckage trail (Figure 12). It was established that the tool was probably last used to tighten the engine cowl fasteners during the recent 50-hour inspection. However, it was not clear how the tool came to be in the aircraft, or what its location was in the aircraft, at the time of the accident. The ATSB examined the tool and found it in good condition except for some scrape marks with associated corrosion. The investigation was unable to determine how those marks were made.

**Figure 12: Hand tool as found at accident site**



Shortly after the accident occurred, a small torch, still emitting light, was found near the main wreckage. The light source was two light emitting diodes (LED), which do not have filaments and were therefore not suitable for light bulb analysis. The ownership of the torch and whether it was on the aircraft at the time of the accident could not be verified. The ATSB examined the torch and found it in good condition with minor damage to the rubber cover of the push-button on/off switch. The investigation was unable to establish if that damage was the result of an impact that activated the torch during the accident sequence.

## **Recorded information**

The investigation reviewed a copy of the recorded radar data applicable to the aircraft's two flight sectors on the day of the accident. Other than a minor deviation

---

<sup>10</sup> Electrical wiring is subject to modification and/or replacement during an aircraft's life, which can make it difficult to be certain about a particular aircraft's wiring circuits.

in track between Moorabbin and Bathurst, there were no anomalies. During the descent into Bathurst, at 1926 and at about 4,400 ft, the aircraft descended below radar coverage.

The radar data did not contain any further radar tracks or plots of the aircraft during the departure from Bathurst Airport.

Analysis of the recorded tracks of other aircraft operating in the Bathurst area before and after the accident, showed that aircraft were within radar coverage above altitudes that varied between 4,200 and 4,600 ft. Based on that information and the non-appearance of the aircraft on radar, the aircraft altitude probably did not exceed 4,600 ft following its departure from Bathurst.

The investigation reviewed a copy of the automatic voice recording of the air traffic control frequencies applicable to the two flights. The pilot's radio transmissions were routine with no indication by the pilot of any aircraft abnormality or pilot impairment. Similarly, the radio transmissions by the pilot on the Bathurst Common Traffic Advisory Frequency were also routine.

Mobile phone records indicate that the last phone call made from or received by the pilot's mobile phone, was a call to a family member at about 1703, which was prior to the pilot's departure from Moorabbin Airport. The recipient of the call reported that it was from the pilot, and that there was nothing significant communicated during that call.

The first recorded call to the 000 emergency phone number was received at 20:24:51. Based on the elapsed time between the pilot's first radio call indicating his departure from Bathurst, and the time of the first 000 call, the aircraft was airborne for about 2 ½ minutes.

## **Flight planning and departure procedures**

The pilot submitted an IFR flight plan for the Moorabbin to Bathurst and Bathurst to Port Macquarie sectors. Both flights were planned at a true airspeed (TAS) of 185 kts and altitude of 9,000 ft. The elapsed time for the Moorabbin to Bathurst sector was within 2 minutes of the flight planned time.

The flight plan for the Bathurst to Port Macquarie sector was via waypoints Singleton and Taree (Figure 1). The departure track was 046° M with an expected elapsed time of 1 hour and 13 minutes. The initial route lowest safe altitude (LSALT)<sup>11</sup> was 6,600 ft and the minimum sector altitude (MSA)<sup>12</sup> within 10 NM (18.5 km) of Bathurst Airport was 5,400 ft.

The ATO who conducted the pilot's recent IFR renewals advised that the terrain reflected in the high route LSALT and Bathurst MSA, would prohibit a departure on track in instrument meteorological conditions. Instead, a pilot could turn left or right after takeoff from runway 35 and orbit south towards the NDB while climbing the aircraft. Approaching 5,400 ft over the airport, the pilot would be able to

---

<sup>11</sup> The lowest altitude that will provide safe terrain clearance at a given place.

<sup>12</sup> The lowest altitude that will provide a minimum of 1,000 ft clearance within a defined area or sector within that area. The area or sector is generally based on a radio navigation aid or, if there is no aid, on the airfield reference point.

intercept the outbound track. The ATO advised that the pilot regularly flew between Moorabbin and Mt Hotham, Vic. and had a high level of terrain awareness.

The ATO advised that during IFR renewals, the pilot would use the autopilot in the cruise and hand-fly the aircraft during the other phases of the flight. The investigation was unable to establish the pilot's normal practice in the use of the autopilot during a night departure.

## **Flight path derivation**

The investigation did not have any direct evidence of the aircraft's actual flight path immediately preceding the accident. However, the investigation was able to derive some possible aircraft flight path parameters from the timing and content of the pilot's radio transmissions, the wreckage trail orientation and the investigation's understanding of the pilot's standard departure procedures (Figure 13). For simplicity, wind was not factored into the calculations and aircraft speed was taken to be 120 kts.

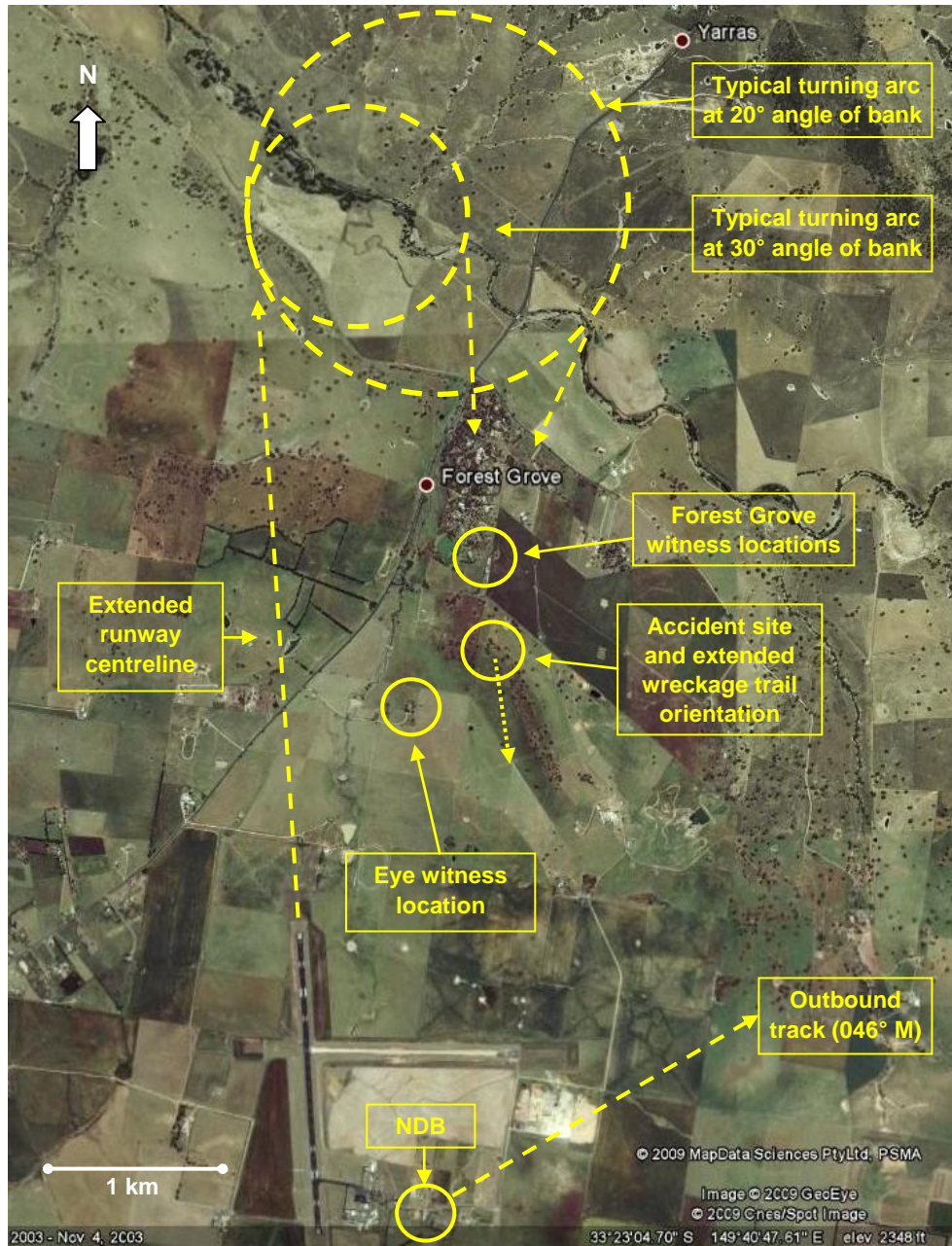
The investigation had no direct evidence of the direction or radius of turn. However, the displacement of the accident site to the east of the runway centreline, made a right turn the more likely. A turn to the right at an average  $20^\circ$  angle of bank would have displaced the aircraft to the east of the accident site and at some point required some manoeuvring to align the aircraft along the wreckage trail orientation of  $165^\circ$  M.

A steeper turn, at an average  $30^\circ$  angle of bank, would have allowed the pilot to roll out on the reciprocal heading and align the aircraft with the wreckage trail orientation. Continuation on a track of  $165^\circ$  would have put the aircraft over the witnesses at Forest Grove and on to the impact point. That track was also aligned with the wreckage orientation of  $165^\circ$ .

There was no direct evidence of the altitude or rate of climb of the aircraft throughout the flight. However, with an average climb rate of say 1,000 ft/min, the aircraft could have climbed about 1,500 ft in the 1 minute 22 seconds between the two radio transmissions associated with the departure. Given that the last radio transmission sounded routine, the aircraft probably descended after that point.

The only information regarding the descent profile was the minimum descent angle of  $20^\circ$  over the trees. If a descent angle of  $20^\circ$  was applied to the likely track of the aircraft, the aircraft would have been about 600 ft above the witnesses at the southern end of Forest Grove, 450 m from the accident site. The suddenness of the noise heard by those witnesses supports a steep descent profile.

Figure 13: Representation of derived track parameter information



## Human factors information

In this event, spatial disorientation and pilot incapacitation were potential contributing factors. A brief description of those human factors follows.

### Spatial disorientation

Spatial disorientation can be defined as the inability of a pilot to correctly interpret aircraft attitude, altitude or airspeed in relation to the Earth or other points of reference. More simply, it is the inability to tell which way is up.

Spatial disorientation occurs when the brain receives conflicting or ambiguous information from the visual (eyes), vestibular (inner ear) and proprioceptive (skin, muscles, joints, tendons) sensory systems. There is a higher risk of this occurring when a pilot flying visually encounters cloud or an area of reduced visibility and no visible horizon. The resulting state of confusion is dangerous for the pilot, as it can lead to incorrect control inputs and a resultant loss of aircraft control.

The Chieftain Information Manual specified a placard for the pilot's side window moulding (when fuselage red strobes were installed) with the following wording:

Warning

To avoid optical illusion and severe vertigo, turn anti-collision lights off upon entering clouds, fog or haze

More information about spatial disorientation can be found in the ATSB aviation research and analysis report B2007/0063, *An overview of spatial disorientation as a factor in aviation accidents and incidents* (available at [www.atsb.gov.au](http://www.atsb.gov.au)).

## **Pilot incapacitation**

Pilot incapacitation is a physiological event that renders a pilot unable to fly or to safely operate the aircraft. It may be due to the effects of a pre-existing medical condition manifesting itself in flight, or the development of an acute medical condition during a flight.

In January 2007, the ATSB published a report titled *Analysis of Medical Conditions Affecting Pilots Involved in Accidents and Incidents: 1 January 1975 to 31 March 2006* (also available on the ATSB web site). The results of this study demonstrate that the risk of a pilot suffering from an in-flight medical condition or incapacitation event is low. The majority of the 98 events identified during the study were due to acute gastrointestinal illness (usually food poisoning), followed by incapacitating events involving toxic smoke and fumes. Heart attack increased the risk of a fatal accident occurring.

The majority of pilot incapacitation events recorded by the ATSB during the period 1 January 1975 to 31 March 2006 did not involve a chronic or pre-existing medical condition.

---

# ANALYSIS

---

## Introduction

The steep angle of descent of the aircraft just prior to the impact with the ground was consistent with uncontrolled flight into terrain. Analysis of the factors that contributed to this accident was limited by a lack of information about the sequence of events after takeoff, and by the serious damage to the aircraft by the impact and post-impact fire. An analysis of the potential contributing factors follows.

## Airworthiness

There were no indicators of an aircraft malfunction prior to the accident. The flight from Moorabbin to Bathurst appears to have been normal and the aircraft departure from Bathurst appears normal up to and including the last radio transmission that was made by the pilot about 1½ minutes after takeoff. The maintenance history of the aircraft did not reveal any potential airworthiness factors. The aircraft had been extensively refurbished and modified and then been operated for about 7 years without significant problems. A witness account of abnormal engine noise was the only report of an engine anomaly and, by itself, was not a reliable indicator of engine malfunction.

Extensive examination of the accident site and aircraft wreckage did not identify any aircraft-related problem. The bending of the propellers indicated that, at the point of impact, the engines were operating at high power. Disassembly of the engines and propellers did not reveal any pre-impact defects. That information was consistent with the high aircraft velocity indicated by the aircraft damage and the length of the wreckage trail.

Given the aircraft's steep angle of descent over the trees, the elevator control system (controlling aircraft pitch attitude) was of particular interest. The elevators, including the trim tab, were accounted for at the accident site with no evidence of any pre-impact defect in those parts of the control cable system that were able to be inspected. The finding of the hand-tool on the accident site raised the possibility of interference in a flight control system. However, based on the location of the tool at the accident site, and on the report of it last being used on the engine cowl fasteners, it was unlikely that the tool was in a location on the aircraft that allowed interference with the aircraft's flight controls.

The autopilot and electric elevator trim system both had potential influence on the elevator system and pitch attitude of the aircraft, but there was no evidence found in the recovered components of a pre-impact defect. In any event, the pilot had readily accessible means to momentarily override any spurious inputs and to disconnect those systems from control of the aircraft.

In the dark-night and possibly cloudy conditions, failure of the primary flight instruments or cockpit lighting had the potential to adversely affect the pilot's ability to control the aircraft. There was no evidence of flight instrument malfunction and there was duplicate flight information presented on the right instrument panel. The finding of the activated torch at the accident site suggests that the pilot might have been using it after failure of instrument lighting. Although

there was no information available about left or right instrument panel lighting, that lighting was on different circuits, and there were other sources of cockpit lighting available. With regard to electrical power, the witness observation of external aircraft lighting, and evidence of avionics backlighting, shows that electrical power was generally available.

The possibility of a fire in an engine or some other part of the aircraft was evaluated, but was considered unlikely because there was no physical evidence of an in-flight fire, no radio transmission from the pilot to that effect, and there were no reports of fire in the night sky from any witnesses.

Extensive impact and fire damage rendered the investigation findings regarding aircraft airworthiness generally inconclusive. However, based on the available information, an airworthiness factor was considered unlikely.

## **Operational considerations**

The likely scenario of a right turn some time after takeoff and tracking to the south, might have been the initial manoeuvring to keep the aircraft within the circling area so that climb could be effected to a safe altitude before the departure track was intercepted. That would have been consistent with the pilot's training and previously demonstrated terrain awareness, and aligns with the pilot's last radio transmission of 'standby for departure'.

An alternate explanation for a right turn and southerly track was manoeuvring to return for a landing in response to an event or condition involving the aircraft or an occupant. If that was the case, the lack of a radio call for traffic alerting purposes or declaration of an emergency was somewhat unusual.

Irrespective of the pilot's intentions regarding the departure, the aircraft descended at a steep angle and impacted terrain on a track of 165° in the minute or so after the pilot's last radio transmission. With the landing gear and wing flap retracted and the high impact speed, there was no apparent pilot intention to attempt a landing in the vicinity of the accident site. The attitude of the aircraft at impact being significantly less than the minimum descent angle over trees, suggests that the aircraft was in the process of being levelled when it impacted the ground. That could mean that the pilot or other occupant was trying to recover the situation when the aircraft impacted terrain. Given the overall circumstances, pilot spatial disorientation and pilot incapacitation were potential factors.

Spatial disorientation is an ever-present risk in night and instrument flying and by definition is difficult for an affected pilot to detect. The dark-night environment to the north of Bathurst Airport was generally conducive to disorientation and the pilot would have needed to refer to the primary flight instruments or use the autopilot to maintain control. In a right turn away from runway heading, the pilot would have had limited visual cues until the aircraft was heading to the south where airport and urban lighting was in the background. Given the environmental conditions, the prominence of that lighting at the time of the accident is difficult to ascertain. It is possible that the pilot unexpectedly encountered low cloud during the turn. If that was the case, use of the anti-collision lighting might have increased the risk of disorientation.

With regard to the pilot's ability to manage the environmental conditions, the pilot was qualified to operate the aircraft at night in instrument meteorological conditions

and had accumulated night and instrument flight experience, including in VH-OPC, over a number of years. In addition, the pilot had demonstrated competence in navigating in areas of high terrain with challenging seasonal weather patterns. The pilot's last known night and instrument flight time was during the instrument rating renewal about 4 months prior to the accident. If the pilot had not conducted any instrument flying since the renewal, he would not have met the stipulated recency requirements and been exposed to a higher risk of disorientation. Human factors such as rest, nutrition, hydration and the effect of quinine were considered for influence on the pilot's ability to avoid spatial disorientation, with no clear evidence to support a finding.

Although there was no evidence of any airworthiness factors in the incident, the existence of an aircraft anomaly with the potential to contribute to spatial disorientation could not be discounted. In the environmental context, a subtle failure of an instrument might have resulted in undetected divergence from the intended flight path, or an overt aircraft malfunction might have been a distraction that allowed an aircraft divergence to remain undetected. Another possibility is the activation of the autopilot without pitch mode.

There was no direct evidence of pilot spatial disorientation and, other than the environmental conditions, no evidence of any common preconditions or aggravating factors such as a lack of instrument flying qualifications or high pilot workload. However, due to the lack of information about the aircraft flight path and the pilot's situation, the investigation was unable to discount pilot spatial disorientation as a factor.

Pilot incapacitation, although not a common event, is an inherent risk to single-pilot operations. In this event, there was no indication of pilot impairment or incapacitation prior to the accident. The pilot held a Class 1 aviation medical certificate and there were no reports of any illness or condition likely to significantly increase the risk of impairment or incapacitation. Post-mortem examination did not identify any preconditions for, or existence of, pilot impairment or incapacitation. The lack of an emergency radio call could be interpreted as a symptom of a physiological factor that rendered the pilot unable to operate the aircraft, but was not of itself strong evidence of incapacitation.

Although there were no clear indications of pilot impairment or incapacitation, the investigation was mindful of the ATSB research findings that the majority of pilot incapacitation events do not involve a chronic or pre-existing medical condition. In that context, the investigation was unable to discount pilot incapacitation as a contributing factor.

Overall, there was no clear evidence for an operational factor in this occurrence, but given the circumstances of the accident, pilot spatial disorientation and pilot incapacitation could not be discounted.



---

## **FINDINGS**

---

From the evidence available, the following findings are made with respect to the collision with terrain involving Piper Aircraft Corp. PA-31-35 Chieftain, registered VH-OPC, 3 km north of Bathurst Airport on 7 November 2008 and should not be read as apportioning blame or liability to any particular organisation or individual.

### **Contributing safety factors**

- The aircraft descended at a steep angle before impacting the ground at high speed, consistent with uncontrolled flight into terrain.

### **Other key findings**

- Based on analysis of the available information, an airworthiness issue was considered unlikely to be a contributing factor to this accident.
- The investigation was unable to establish why the aircraft collided with terrain; however, pilot spatial disorientation or pilot incapacitation could not be discounted.



---

## APPENDIX A: SOURCES AND SUBMISSIONS

---

### Sources of information

The sources of information for the investigation included:

- a number of witnesses
- the aircraft maintainers
- the NSW Police
- the NSW State Coroner
- the Bureau of Meteorology
- the Civil Aviation Safety Authority (CASA)
- the aircraft manufacturer
- the engine manufacturer.

### Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to: a number of aircraft maintainers that had maintained the aircraft; the Approved Testing Officer (ATO); the aircraft, engine and propeller manufacturers; the National Transportation Safety Board and CASA.

Submissions were received from the ATO, one of the aircraft maintainers and CASA. Those submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.



Collision with terrain - VH-OPC, Piper Aircraft Corp PA-31-350,  
3 km N Bathurst Airport, NSW, 7 November 2008