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ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2009-009
Final

# Collision with terrain 8 km NW of Donors Hill Station, Qld 24 February 2009

## Abstract

On 24 February 2009, at 1417 Eastern Standard Time, a Piper Aircraft PA28-180 Cherokee aircraft, registered VH-DAC, departed Normanton Airport, Qld on a visual flight rules private flight to Mount Isa with the pilot as the sole occupant. The aircraft did not arrive at Mount Isa as expected, and was later found to have impacted terrain at a location adjacent to the planned track. The aircraft was seriously damaged and the pilot was fatally injured.

Examination of the wreckage did not indicate any pre-existing technical fault that may have contributed to the accident.

The pilot was not qualified to fly in instrument meteorological conditions (IMC). He may have inadvertently entered IMC while attempting to avoid rain and cloud associated with a weather system that was moving over the intended route at the time.

## FACTUAL INFORMATION

### History of the flight

On 24 February 2009, at 1417 Eastern Standard Time[1], a Piper Aircraft PA28-180 Cherokee aircraft, registered VH-DAC (DAC), departed Normanton Airport, Qld on a visual flight rules (VFR) private flight to Mount Isa with the pilot as the sole occupant. The flight was the third of a series of business flights that morning; including previous flights from Mount Isa to Burketown and Burketown to Normanton, with short breaks at each landing point.

Before departing Normanton, the pilot informed his partner by telephone of his planned arrival time for Mount Isa. When the aircraft did not arrive as advised, it was reported missing by the partner. On the evening of 25 February 2009, a search and rescue helicopter located the wreckage of the aircraft at position 18.39.04S and 140.31.20E, which is about 8 km north-west of Donors Hill Station homestead, and 2.5 km east of the direct track from Normanton to Mount Isa. That area was located in a Designated Remote Area[2] as defined in the Aeronautical Information Publication (AIP) En Route Supplement Australia (ERSA).

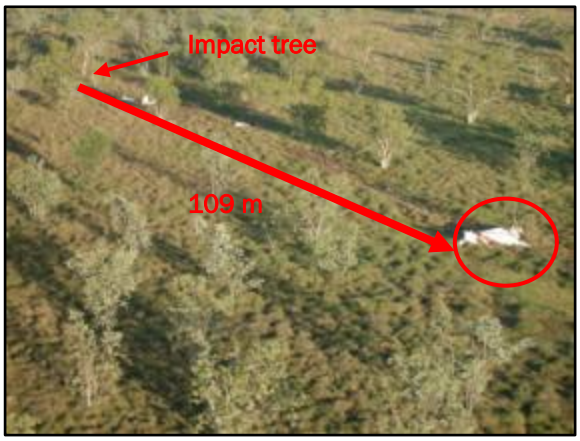
The crew of the helicopter confirmed that the pilot had received fatal injuries from the accident and that the aircraft was seriously damaged.

The wreckage trail extended about 109 m from the aircraft's initial impact with a tree to the main wreckage (Figure 1). The wreckage path was oriented on a track of approximately 085° M. The elevation of the wreckage site was 235 ft above mean sea level (AMSL).

1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time, as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

2 The requirements of operating in a Designated Remote Area include the carriage of an Emergency Locator Transmitter and survival equipment, as well as nomination of a search and rescue time (SARTIME) or lodgement of a flight note with a responsible person.

Figure 1: Aerial view of wreckage site[3]




## Wreckage examination

Examination of the wreckage indicated a high-speed, approximately 20º nose-down, right-bank collision with terrain. The examination indicated that, earlier in the accident sequence, the aircraft was nose-down and banked about 30° right wing-low when the right wing impacted a tree (Figure 1). The right wing had separated from the aircraft, outboard of the flap.

The cockpit and cabin area (Figure 2) sustained extensive, non-survivable impact damage.

The tail section had separated from the empennage and was retained only by the flight control cables. All flight control surfaces were accounted for near the impact site and continuity of all flight control cables was established. Both wing fuel tanks were disrupted, with some fuel remaining in the left wing fuel tank. Examination of the propeller blades and hub indicated significant engine power at the time of impact.

The wreckage examination did not indicate any pre-existing technical fault that may have contributed to the accident.

## Radar and communications

There was no air traffic control radar coverage in the Class G airspace (below 24,000 ft) in which the flight was conducted.

A review of Airservices Australia recorded air traffic services automatic voice recording data found no record of any radio transmissions by the pilot during the flight.

Recorded radio broadcasts for takeoffs and landings at Normanton Airport confirmed the following radio transmissions by the pilot on the day of the accident:

- 1158:34; inbound for landing at Normanton
- 1414:26; preparing to take off from runway 32 at Normanton
- 1417:31; departure for Mount Isa.

## Pilot information

The pilot held a Private Pilot (Aeroplane) Licence that was issued by the Civil Aviation Safety Authority (CASA) on 21 December 2004, and a valid Class 2 medical certificate. His total flying experience was 420.5 hrs, and he was endorsed on the aircraft on 4 September 2004.[4]

The pilot was not qualified to fly in instrument meteorological conditions (IMC).

A review of the pilot's logbook indicated a total of 2.2 hrs instrument flying time, which was completed in October 2004. On 28 September 2008, he completed his most recent flight review. According to the logbook, his previous flight to Normanton was conducted on 16 June 2007.

According to witnesses, the pilot appeared well rested the night before the flight, and had eaten lunch while conducting business in Normanton.

## Aircraft information

The aircraft, serial number 28-7405190, was built in the US in 1974. It was of a low-wing, fixed-tricycle undercarriage design; with a four-cylinder, horizontally-opposed, 180 hp air-cooled piston engine; and was VFR flight-equipped only. On 13 September 1974, an initial Australian Certificate of Airworthiness was issued and, on 11 September 2006, a Certificate of Registration.

3 Photo courtesy of the Queensland Police Service.

4 The last entry in the pilot's logbook was dated 28 December 2008.

On 20 June 2008, at 6,623.2 hrs total time since new, a valid maintenance release was issued under the Air Work operational category. An annual inspection of the aircraft was performed at that time, with no significant maintenance items noted on the maintenance release.

A review of the maintenance logs indicated that the aircraft was maintained in accordance with the CASA Civil Aviation Regulation 1988 42B Schedule 5 maintenance schedule. For private operations in aircraft of less than 5,700 kg, Schedule 5 permitted periodic inspections on an annual basis irrespective of the hours flown.

The last major inspection and repair to the Lycoming model O-360-A4A engine was conducted on 21 April 2006.

## Meteorological information

For the purposes of issuing flight and other forecasts, the Bureau of Meteorology (BoM) divided Australia into a number of forecast areas. The flight from Normanton to Mount Isa was, for the most part, conducted in Area 43 (Figure 3). A number of area forecasts (ARFOR) affected the flight as discussed in the following paragraphs. In those reports, the heights of the bases and tops of any forecast clouds were given in feet AMSL.

### *ARFOR that was issued at 0112 on 24 February 2009*

The Area 43 ARFOR that was issued by the BoM at 0112 on 24 February 2009, and was valid from 0300 on 24 February 2009 to 1800 on 24 February 2009 included:

- isolated showers and thunderstorms, tending scattered north of Lake Nash, NT and Natal Downs, Qld
- after 1200, patchy rain areas north-east of Camooweal and Eglin Downs. Qld
- broken cloud from 2,000 to 5,000 ft in precipitation
- visibility 2,000 m in thunderstorms, 3,000 m in showers and rain, and 7,000 m in light rain.

### *ARFOR that was issued at 0647 on 24 February 2009*

A second Area 43 ARFOR that was issued by the BoM at 0647, and was valid from 0900 to 2100 included:

- scattered showers and thunderstorms throughout the area, patchy rain in the north
- broken cloud[5] from 2,000 to 5,000 ft in precipitation
- visibility 2,000 m in thundershowers and 3,000 m in showers and rain

**Figure 2: View of the wreckage**


5 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.

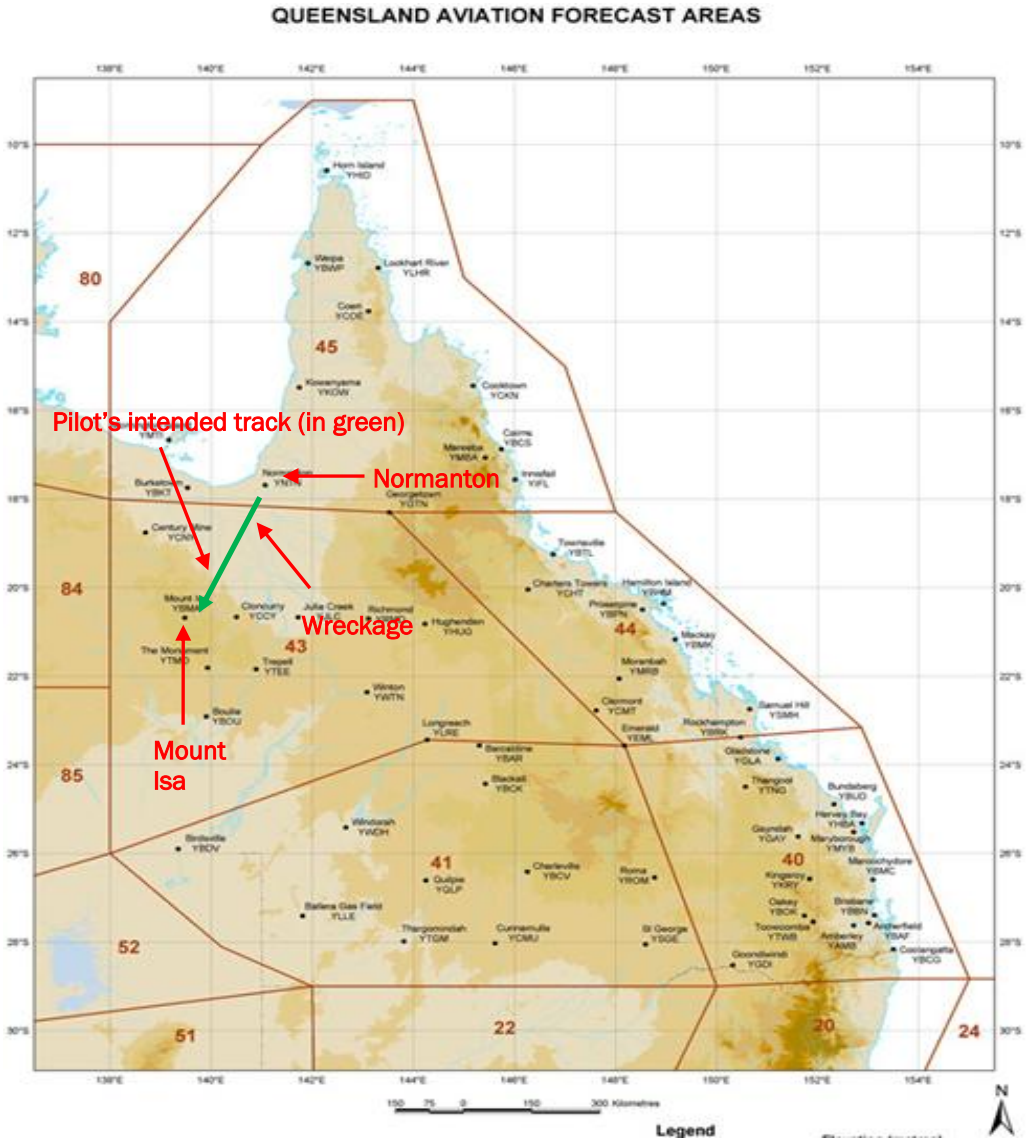
- a 15 to 20 kts easterly wind from 2,000 to 5,000 ft.

*Amended Area 43 ARFOR*

At 1229 on 24 February 2009, an amended ARFOR for the area (updating the 0647 ARFOR) was issued for the period 1300 on 24 February to 0300 on 25 February 2009. That forecast included:

- isolated showers and thunderstorms in the area, with patchy rain spreading southwards from the north, and patchy rain areas north-east of Camooweal (which was west of the flight track and north-west of Mount Isa)
- cloud unchanged from the 0647 area forecast
- a 15 kts north-easterly wind 2,000 to 5,000 ft.

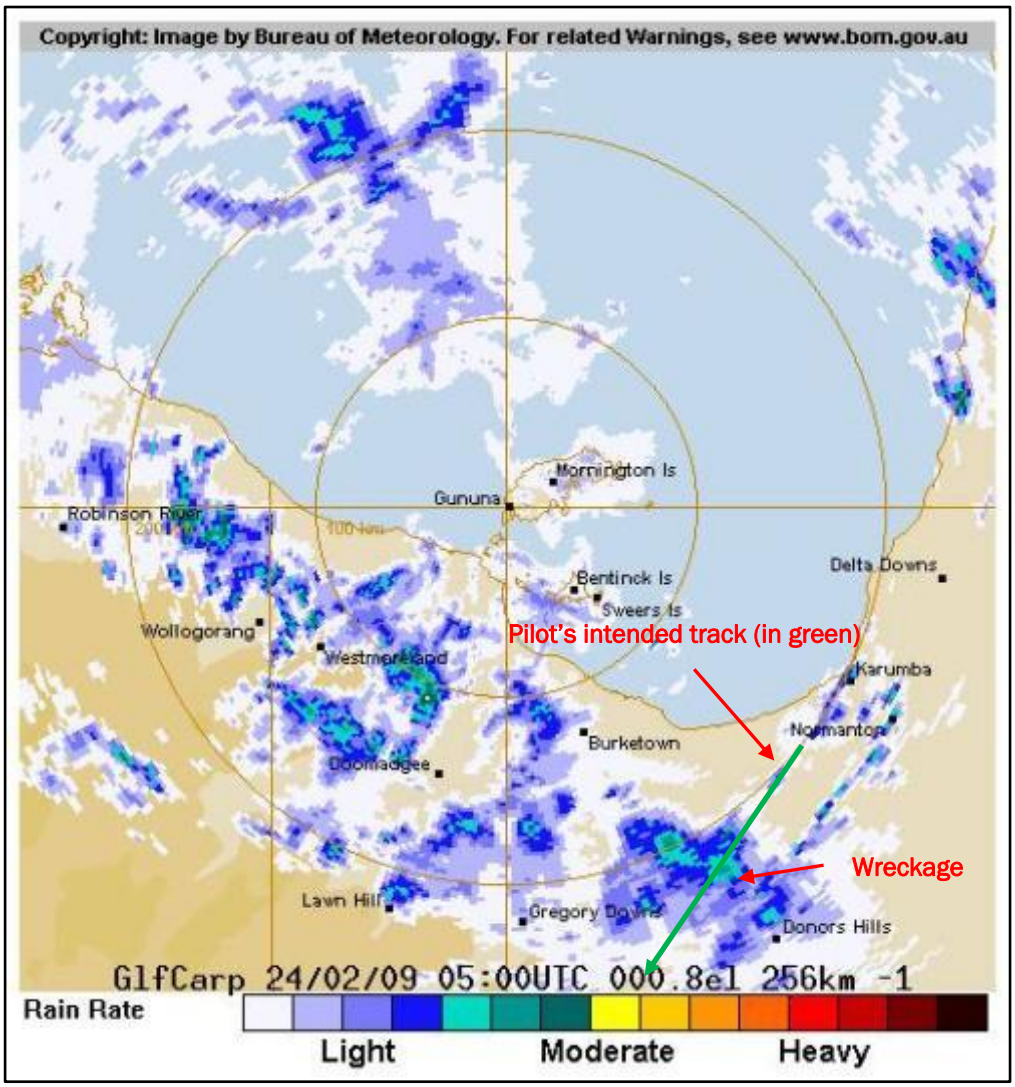
**Figure 3: Area 43 forecast map[6]**




6 Image courtesy of the Bureau of Meteorology.

Images from the BoM Mornington Island weather radar for 1500 on 24 February 2009 confirmed that there was precipitation in the area of the intended flight, and was consistent with the later witness estimates about the movement of the weather system (Figure 4).

Figure 4: Radar image of the flight area




The BoM report compiled after the accident noted:

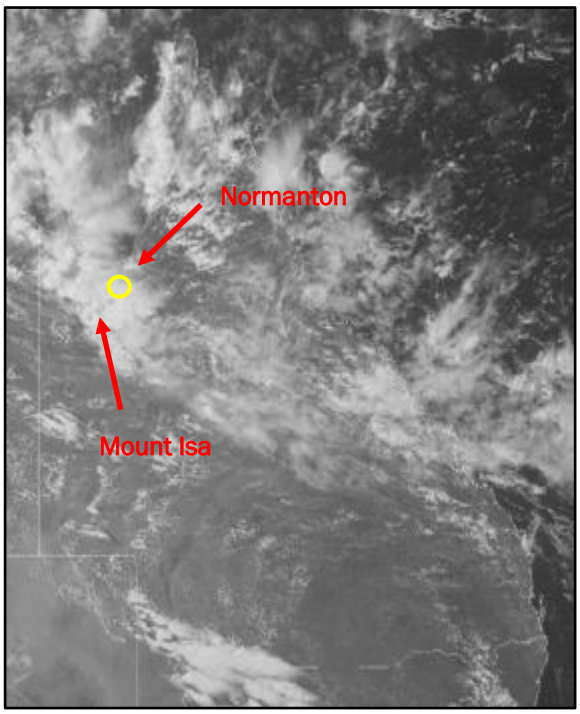
> The accident location is about 226 km from the Mornington Island radar and at this distance the radar is displaying rainfall echoes at approximately 22,000 ft above the ground. This indicates that convective showers and thunderstorms were present to a height of at least 22,000 ft. At this distance from the radar significant precipitation can go undetected by the radar due to the radar beam passing over the top of the precipitation. Path attenuation can also occur when the radar beam passes through precipitation closer to the radar. When this occurs the returned signal from further along the radar path can be reduced.

The Mount Isa and Cloncurry Aerodrome Forecast (TAF) predicted thunderstorms from 1200. The Normanton TAF included showers with associated low cloud and reduced visibility throughout the day and thunderstorms. Scattered cloud with a base of 2,000 ft and broken cloud base of 4,500 ft were also forecast.

At 1400, the actual conditions recorded at Normanton were; winds from the north-north-east at 7 kts with a temperature of 32° C. Cloud observations were not recorded.

Satellite images recorded at 1430 on 24 February 2009, indicated that showers and thunderstorms were present in the general area of the accident site (Figure 5).

**Figure 5: Satellite image of flight area (area of the accident circled in yellow)[7]**




## Witness reports of the weather

The ATSB contacted other pilots whose radio transmissions were recorded on the Normanton Airport frequency at around the time of the aircraft's departure for Mount Isa.

One pilot, who flew from Cloncurry to Karumba earlier in the day, reported that he initially planned to fly at 7,500 ft but, due to cloud and rain ahead, descended to 600 ft while on the Cloncurry to Karumba track, abeam the Burke and Wills Roadhouse (overhead the Cloncurry River).

In addition, the pilot reported that he had to divert to the west towards the Burke and Wills Roadhouse and then crossed the Burke and Wills Development road. From that position, he was then able to track direct to Karumba. The pilot further reported that there was a large rain front stretching from the Burke and Wills Development road to the Gulf of Carpentaria orientated in a south-west to north-east direction that was slowly moving to the south-east. He said that he was able to see through the rain ahead of him, and that he landed at Karumba at about 1210.

At about 1350, the same pilot departed Karumba,[8] climbed to 9,500 ft and remained visually on top of the cloud cover. He noted that the weather front he had observed to the west on the flight to Karumba earlier that day had moved, and was situated between Milgarra Station and Cowan Downs. He reported that the intensity of the rain was such that he could not see through it and that the rainfall was 'black'.

The pilot also reported that he would not fly low level in that area because '...on that track, you meet rising ground just prior to Donors Hill Station, and it goes from about sea level to 400 ft [AMSL].'

Another pilot reported that he departed Normanton direct to Mount Isa[9] in an aircraft that was equipped with weather radar[10]. He reported that the cloud base was 1,500 to 2,000 ft, and that he was forced to avoid thunderstorm cells and was in IMC for most of the flight. He further reported isolated thunderstorm cells at 10,000 ft to the left and right of his track, and that he entered an area of heavy rain and moderate turbulence about halfway along track.

A non-pilot witness, who reported meeting the pilot of DAC on his arrival at Normanton Airport at about 1145 that morning, advised that the weather was fine at that time, with sunshine. He said that at about 1500, a 'large rain shower' came through the Normanton area.

The manager of the Donors Hill Station advised that there were numerous 'large storms' in the area for most of the afternoon. He also mentioned that the station, which was about 8 km south of the accident site, had an airstrip that, in his opinion, would have been suitable for landing.

7 Source- Japan Meteorological Agency satellite MTSAT-1R.

8 The radio recordings indicated that at 1403 he was 53 km south of Normanton.

9 The recording indicated that he departed at 1404.

10 Airborne radar (less often, surface radar), the purpose of which is to indicate any weather along a planned track. The traditional output is a picture of heavy precipitation, but some modern radars have the capability to indicate severe turbulence (in meaningful colours), even if there is no precipitation.

## Operational information

### *Weight and balance*

The weight and balance of the aircraft was estimated to have been within limits.

### *Fuel*

The pilot added 92 L of fuel at Normanton but the total amount of fuel on board the aircraft at the time of departure could not be determined. There were no fuel quality problems reported by other pilots who had also refuelled from the same Normanton fuel source.

According to the engine operator's manual, the average flight fuel burn for the aircraft was about 40 L per hour.[11] Based on the distance from Normanton to Mount Isa of 373 km, and an average cruise speed of 127 kts, the investigation estimated a fuel burn of 65 L for the Normanton to Mount Isa flight. In that case, the pilot could have anticipated at least 27 L of fuel remaining for his arrival at Mount Isa.

### *Weather*

The AIP ENROUTE (ENR) 1.2 Visual Flight Rules, paragraph 1.1.1 contained the specific requirements for VFR flight, including that it may only be conducted in visual meteorological conditions (VMC). The aircraft VMC requirements applicable for flight in Non-Controlled Airspace (Class G) below 3,000 ft AMSL or 1,000 ft above ground level (whichever is higher) were:

- minimum visibility of 5,000 m
- clear of cloud and in sight of the ground or water
- the carriage and use of a radio was required in those conditions.

The VMC requirements applicable for flight in Class G airspace above 3,000 ft and below 10,000 ft AMSL were:

- minimum visibility of 5,000 m
- 1,500 m horizontal and 1,000 ft vertical clearance from cloud.

11 At performance cruise (75% rated engine power).

The investigation could not establish what altitude the pilot intended to climb to, or actually climbed to after departing Normanton. The AIP required that:[12]

> Before beginning a flight, a pilot in command must study all available information appropriate to the intended operation…

and that:

> …in the case of flights away from the vicinity of an aerodrome…[that included] a careful study of:
>
> a. current weather reports and forecasts for the route to be flown and the aerodromes to be used;

Further, ENR 1.10 Flight Planning paragraphs 1.2.5 and 1.2.8 stated that:

> A pilot in command must ensure that the forecasts cover the period of the flight and that the aerodrome forecasts for the destination and alternate aerodromes, to be nominated in the flight plan, are valid for a period of not less than 30 minutes before and 60 minutes after the planned ETA [estimated time of arrival].
>
> and:
>
> When preflight briefing is obtained more than one hour prior to ETD [estimated time of departure], pilots should obtain an update before each departure to ensure that the latest information available can be used for the flight. The update should be obtained by NAIPS [National Aeronautical Information Processing System[13]] pilot access, telephone, or, when this is impracticable, by radio.

The pilot had a valid NAIPS user identification that permitted access to the system. A search of recorded NAIPS data using the pilot's user identification, confirmed that the system was accessed at 0614 and 0621 on the day of the accident. However, the investigation was unable to establish whether the pilot accessed weather and operational data at some later time during the morning by other means including via telephone, by radio or by a third party.

12 ENR 1.10 Flight Planning, paragraph 1.1.

13 The Airservices Australia NAIPS is a multi-function, computerised, aeronautical information system. The services available via electronic medium include pre-flight briefing, area briefing, general meteorological forecasts and flight notification.

### *Flight notification*

The AIP ENR 1.10 Flight Planning, paragraph 2.11, required the pilot to have submitted a search and rescue time (SARTIME)[14] or to have left a flight note with a responsible person for the flight through the Designated Remote Area. The pilot had left a flight note with a responsible person.

## Medical and pathological information

A post-mortem examination of the pilot was completed by the relevant state authorities. That examination indicated the pilot succumbed to impact-related injuries.

The examining pathologist advised that toxicological testing was unable to be performed due to the lack of a suitable sample for testing.

## Aircraft equipment

Since 1995, the carriage in aircraft of an emergency locator transmitter (ELT) has been mandatory in Australia. More recently, the carriage of a portable ELT was permitted in lieu of a fixed ELT. The aircraft was not fitted with a fixed ELT; however, the pilot carried a portable 406 MHz frequency ELT. A fixed ELT is intended to activate upon impact, whereas, a portable ELT must be manually activated. The pilot's portable ELT was found during the on-site wreckage examination, and was observed to be in the OFF position.

It was reported that the pilot also carried a satellite phone but no phone was found at the accident site.

The pilot also reportedly carried a Global Positioning System (GPS) portable aviation receiver that included a moving map display. Damaged portions of a GPS unit were recovered from the wreckage, but did not provide any information to assist the investigation.

## Additional information

### *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'.

According to the ATSB aviation research and analysis report B2007/0063, *An overview of spatial disorientation as a factor in aviation accidents and incidents,*[15] 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. The report noted that there was a higher risk of this occurring when a VFR pilot encounters cloud or an area of reduced visibility and no visible horizon; conditions typical of IMC. The resulting state of confusion can be dangerous for the pilot, as it can lead to incorrect control inputs and a resultant loss of aircraft control.

### *VFR into IMC occurrences*

In June 2004, the ATSB published aviation research paper ***General Aviation Fatal Accidents: How do they happen? A review of general aviation accidents 1991 to 2000***. The data in that paper noted that there were 163 fatal aircraft accidents in the 10-year period examined, of which 22 (or 13.5%) were identified as involving VFR flight into IMC. Those 22 accidents resulted in 52 fatalities, which corresponded to 15.7% of the 331 fatalities in that period.

Of concern, VFR flight into IMC and spatial disorientation occurrences continue to occur. On 17 November 2007, the owner-pilot of a Cessna Aircraft Company C337G (Skymaster), registered VH-CHU, was conducting a private VFR flight from Moorabbin Airport, Vic. to Merimbula, NSW. The aircraft did not arrive at Merimbula and wreckage was later found on the beach and offshore. There were no survivors.

14 The time nominated by a pilot for the initiation of SAR action if a report has not been received by the nominated unit.

15 Available at http://www.atsb.gov.au/publications/2007/b20070063.aspx .

The investigation found that, while manoeuvring over water at low level and in conditions of reduced visibility, the pilot probably became spatially disorientated and inadvertently descended into the water. A contributing factor was the pilot's lack of an instrument flying qualification and minimal instrument flying training and experience. Further information on the risks associated with VFR flight into IMC can be found on the ATSB website at www.atsb.gov.au (refer to report number AO-2007-061).

In 2005, the ATSB published an aviation research investigation report that discussed weather-related aviation accidents.[16] The report, in part, considered different pilot responses to adverse weather, discussed pilot decision making and highlighted the well-known dangers associated with VFR flight into IMC. It noted:

> A VFR pilot may exhibit a range of behaviours when faced with adverse weather. For example, at the first hint that conditions are deteriorating, a pilot may decide that discretion is the better part of valour and immediately return to their point of departure and recount their brush with danger to an instructor or to fellow pilots in the clubrooms. At the other extreme, a pilot may 'press on' into deteriorating weather, either unable or unwilling to see the increasing danger of their actions, until the aircraft suddenly enters IMC and they have only minutes to rue their reckless behaviour before the flight ends in disaster. A more typical scenario might involve a pilot who, in response to deteriorating conditions, initially continues the flight as planned, but subsequently decides to return, divert, or perhaps even carry out a precautionary landing.
>
> However, whatever the pilot's response to deteriorating weather, the final outcome of a safety-related occurrence will depend on a myriad of factors, and in the final analysis chance can play a significant part.
>
> This research reinforces the significant dangers associated with VFR flight into IMC – 76% of VFR into IMC accidents involved a fatality. The chances of a VFR into IMC encounter increased as the flight progressed until they reached a maximum during the final 20% of the flight distance. This result highlights the danger of pilots 'pressing on' to reach their destination.
>
> The results emphasise that a safe pilot is a proactive pilot and that dealing with adverse weather is not a one-off decision but a continually evolving process.

16 *General Aviation Pilot Behaviours in the Face of Adverse Weather*- ATSB Aviation Research Investigation Report B2005/0127.

## ANALYSIS

The investigation could not conclusively determine the reason for the collision with terrain. The aircraft wreckage trail indicated a heading away from Mount Isa, the reverse of the planned track, and was located 2.5 km to the east of the direct track from Normanton to Mount Isa. Given the likely adverse weather in the area at the time, it was possible that the pilot had turned back to Normanton in an attempt to avoid that weather, or for some other unknown reason.

Wreckage examination did not reveal any pre-existing technical fault that would have caused the pilot to turn back, necessitated an emergency landing, or contributed to the accident. Indications were that the engine was developing significant power, and the aircraft was not configured for a landing at the time of impact. The aircraft's approximately 20° nose-down, and right bank attitude at the time of impact indicated that the aircraft was not in a state of controlled flight at that time.

The lack of any apparent technical problems supported the conclusion that the pilot most likely manoeuvred the aircraft for operational reasons, such as in the case of inclement weather.

The lack of any pilot reports of problems with the Normanton fuel supply, evidence of significant engine power at the time of impact, and the addition by the pilot at Normanton of more fuel than was estimated to be required for the flight, meant that the fuel quality and quantity was not a factor in the occurrence.

The pilot accessed the Area 43 forecast before departing from Mount Isa on the first flight that morning. That forecast indicated the weather was suitable for visual flight rules (VFR) flight below 2,000 ft above mean sea level, subject to avoiding areas of reduced visibility in thunderstorms, rain and showers. The investigation concluded that the pilot probably planned the flight at or near that altitude.

The investigation was unable to locate any record of the pilot reviewing the amended Area 43 forecast before departing from Normanton. If the

pilot had not accessed the most recent forecast, he would not have been aware of any increased risk associated with any significant change in the forecast since earlier that morning. However, in this case, the investigation considered that the amended forecast would not have caused the pilot to change his decision to conduct the flight as, at all times, he had the option to return to Normanton, or to divert elsewhere to remain in visual meteorological conditions (VMC).

The weather conditions that were reported by other pilots in the area at the time of the flight suggested an increased risk of the pilot experiencing difficulty maintaining VFR. The pilot was not qualified for instrument flight, and was relatively inexperienced at flying in instrument meteorological conditions (IMC). That represented a number of the risk factors in the development of spatial disorientation. If the pilot inadvertently entered IMC while attempting to avoid the weather in the area, and manoeuvred at low level in those conditions in an effort to regain VMC, he may have either:

- experienced spatial disorientation and then lost control of the aircraft, or
- inadvertently descended into terrain.

Although carrying a portable 406 MHz frequency emergency locator transmitter (ELT) satisfied the regulatory requirements, the unit was not utilised as the pilot did not survive the impact. The carriage of a portable ELT may also have limitations in the event of a survivable but disabling impact.

# FINDINGS

From the evidence available, the following findings are made with respect to the collision with terrain involving Piper Cherokee aircraft, registered VH-DAC that occurred about 8 km north-west of Donors Hill Station, Qld on 24 February 2009 and should not be read as apportioning blame or liability to any particular organisation or individual.

## Contributing safety factors

- The reported weather conditions at the time of the flight increased the risk of the pilot having difficulty maintaining flight under the Visual Flight Rules.

## Other safety factors

- The pilot was not qualified for instrument flight.
- The pilot probably did not obtain the most recent weather forecast.

## Other key findings

- The pilot had informed a responsible person of his expected arrival time, which lead to the timely discovery of the aircraft wreckage.

# SOURCES AND SUBMISSIONS

## Sources

The main sources of information during the investigation included:

- wreckage examination
- the aircraft documentation
- the Queensland Police Service
- the Bureau of Meteorology (BoM)
- Airservices Australia
- pilots and other witnesses.

## 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 Executive Director about the draft report.

A draft of this report was provided to the Civil Aviation Safety Authority, the BoM and the aircraft maintainer. A submission was received from the BoM. That submission was reviewed and, where considered appropriate, the text of the draft report was amended accordingly.