Australian Government
Australian Transport Safety Bureau

Publication Date: May 2010 ISBN 978-1-74251-054-5

ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2008-069
Final

Collision with terrain, VH-FXE Pilton Valley, Queensland 29 September 2008

Australian Transport Safety Bureau
PO Box 967, Civic Square ACT 2608
Australia

1800 020 616

+61 2 6257 4150 from overseas

www.atsb.gov.au

May/10ATSB83

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Abstract

At about 1440 Eastern Standard Time on 29 September 2008, the pilot of a Piper Aircraft PA36-375 Pawnee Brave, registered VH-FXE, was conducting aerial baiting operations in the Pilton Valley, Queensland when the aircraft collided with terrain. The aircraft was seriously damaged by impact forces and a post–impact, fuel and magnesium-fed fire. The pilot was fatally injured.

The pilot had flown the aircraft for about 3 hours that day, conducting baiting operations at a number of properties in the region.

The investigation found that the topography of the area in which the pilot was operating, and the strong gusty wind conditions at the time, probably resulted in turbulence that increased the hazardous nature of the low-level application task.

It is likely that the pilot lost control of the aircraft as a result of that turbulence, at a height from which recovery was not possible before the aircraft struck the ground.

FACTUAL INFORMATION

Sequence of events

At about 1440 Eastern Standard Time[1] on 29 September 2008, the pilot of a Piper Aircraft PA36-375 Pawnee Brave, registered VH-FXE (FXE), was conducting aerial baiting operations in the Pilton Valley, Queensland when the aircraft collided with terrain. The aircraft was seriously damaged[2] by impact forces and a post-impact, fuel and magnesium-fed fire. The pilot was fatally injured.

At the time, the region was experiencing a mouse plague that was damaging crops and the local landowners were keen to have the bait[3] applied as soon as possible. On the day of the accident, the pilot had planned to spread the bait over 10 properties with a combined total area of 760 hectares.

Preparation for the flight

The pilot left Toowoomba at about 0900 and drove to his private airstrip near Oakey, where the aircraft was based. The bait was loaded into the aircraft in preparation for the day's activities. While performing that task, the pilot received a bulk fuel delivery to replenish his fuel stocks. The driver of the delivery vehicle reported that the pilot was keen to commence operations and was cheerful. The driver observed the aircraft's departure and stated that the engine sounded normal and that the takeoff and climb appeared to be normal. He estimated that the time of departure was about 1040.

Recorded air traffic control (ATC) information at the Oakey Army Aviation Centre showed that the

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

2 The *Transport Safety Investigation Regulations 2003* definition of 'serious damage' includes the 'destruction of the transport vehicle'.

3 Grain that was impregnated with a zinc phosphide poison.

aircraft became airborne from the operator's airstrip at 1046.

At about 1330, the pilot landed at Clifton airstrip for a pre-arranged uplift of about 200 L of aviation gasoline. Witnesses observed the pilot fuelling the aircraft with the engine running; filling the right wing tank with an estimated 120 L, and adding about 80 L to the left wing tank. The witnesses observed the pilot clean the aircraft's windshield after refuelling and briefly spoke to the pilot. Witness reports indicated that 'he [the pilot] appeared to be content'.

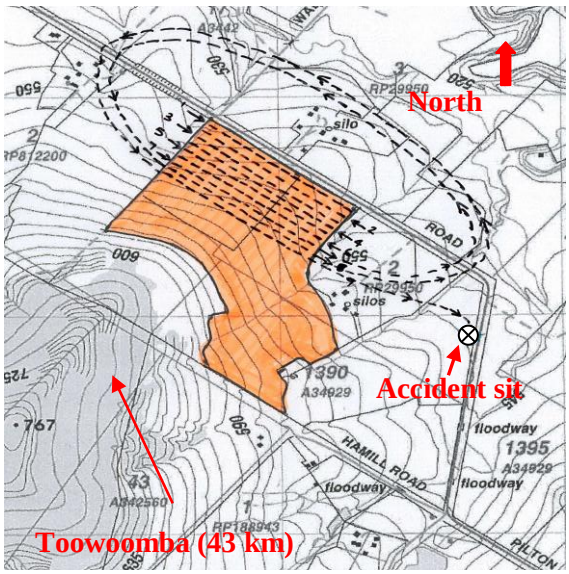
The witnesses at Clifton airstrip also saw the aircraft's departure and reported that the takeoff and subsequent climb appeared to be 'normal'. One witness estimated that the wind at that time was 20 to 25 kts from a direction of 280° magnetic (M), and that the temperature was about 32° C.

The flight time between the Clifton airstrip and the Pilton Valley property was estimated to be about 10 minutes.

Conduct of the flight

Witnesses reported that the pilot commenced the flight with seven baiting runs in a north-west to south-east direction, with a procedure turn at the completion of each run to reverse direction. The pilot was reported to have then completed two runs in an anticlockwise racetrack pattern. The last run positioned the aircraft in a direction towards the south-east, about half way across the property (Figure 1).

Figure 1: Baiting runs[4]



Several witnesses at various locations near the property observed the aircraft in flight. They all stated that the aircraft sounded normal (operations by crop spraying aircraft were a common occurrence in the area). They also stated that it was very windy with stronger gusts coming around and over the mountain range and along the valley.

Witnesses who were situated on elevated terrain to the south-west of the application area observed the last baiting run. They reported watching the aircraft travel from left to right in a south-easterly heading and in a downhill direction, turning towards them at about treetop height near the property's boundary fence. They described seeing the aircraft skidding to the left with the wings rocking and the aircraft in a nose-down, right wing-low attitude. They lost sight of the aircraft behind a slight rise in the terrain just prior to impact.

Pilot information

The pilot held an Air Transport Pilot (Aeroplane) Licence (issued on 10 June 1992) and had a current Command Instrument Rating (multi-engine aeroplanes) and an Agricultural Rating Grade 2. The pilot was endorsed to fly a significant number of high and low capacity passenger transport and

4 As recalled by one of the witnesses to the baiting runs.

other aircraft, including the Pawnee Brave, and had several special design feature endorsements, including:

- variable pitch propeller
- retractable landing gear
- tailwheel landing gear.

The pilot had a valid Class 1 Medical Certificate with no restrictions and was reported to have been well rested prior to the flight.

At the time of the accident, the pilot had accumulated about 11,500 total flying hours. The majority of that flying was in commercial air transport operations, including international airline flying and, more recently, corporate jet charter.

In April 2005, the pilot qualified for an Agricultural Rating Grade 2 and did not log any further agricultural flying until August 2007, when he undertook 4 hours of agricultural flying training to comply with currency requirements for agricultural flying operations. At about that time, the pilot bought a small agricultural business and commenced flying under the supervision of an experienced agricultural pilot.

On 10 December 2007, the pilot was certified as having completed the required 110 hours of direct and indirect supervision of agricultural operations.[5] In the 90 days prior to the accident, the pilot accumulated 98.2 total flying hours, of which 73.9 hours were in agricultural aircraft. Of those, 57.5 hours were in FXE.

At the time of the accident, the pilot had accumulated a total of 425.2 agricultural flying hours.

Aircraft information

The last recorded aircraft maintenance was on 20 March 2008 at a Civil Aviation Safety Authority (CASA)-approved maintenance facility. At that time, the aircraft had a total time in service of about 4,980 hours, and the engine had recorded 1,370 hours since the last overhaul.

During the March 2008 maintenance inspection: a repair was performed on the left of the fuselage and on the landing gear truss assembly; a new propeller was fitted; the dual magneto was serviced with new ignition points; the propeller constant speed unit was overhauled and reinstalled; the engine fuel nozzles were serviced; and the engine inlet and exhaust valves were serviced.

The aircraft maintenance records showed that the aircraft was issued with a current maintenance release and that the aircraft was being maintained under the CASA schedule 5 maintenance program.

Meteorological information

Although possible, there was no evidence that the pilot accessed the available aviation meteorological data prior to the flight.

Air traffic control at the Oakey Army Aviation Centre, which was about 60 km to the north-west of the accident site, reported that at around the time of the accident, the weather conditions had deteriorated due to a front moving in from the south-west. The relevant recorded observations included at:

- 1400, wind 260° M at 15 kts, dust devils[6] in the terminal area, temperature 33° C
- 1423, wind 260° M at 21 kts, dust devils in the terminal area, temperature 33° C
- 1431, wind 260° M at 21 kts gusting to 31 kts, dust devils in the terminal area, temperature 33° C. A hazardous weather warning was declared due to a wind speed of greater than 30 kts.

The application area was in a valley adjacent to the Great Dividing Range. A number of peaks of up to 800 m (2,600 ft) above mean sea level (AMSL) lay immediately to the south-west (Figure 2).

A Bureau of Meteorology (BoM) post-occurrence report stated that, at the time of the accident, the estimated surface winds across the general area would most likely have been from the west-south-west at about 15 to 20 kts, with gusts of between

5 Civil Aviation Order Section 40.6, *Agricultural pilot (aeroplane) rating and agricultural pilot (helicopter)* rating sub-section 7.2(1).

6 Small local whirlwind that could be dangerous to light aircraft.

25 and 30 kts. The BoM report also stated that:

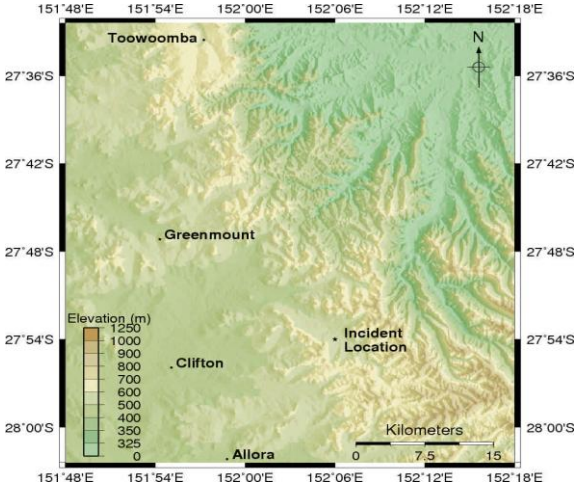
> Based on the available meteorological information and the terrain at the incident location, terrain induced wind flows (waves or down slope winds) or turbulence may have been present at the time of the accident.

and that:

> The incident location lies within a valley, it is possible that mountain waves may have occurred, including breaking waves, and also down slope winds in the vicinity. It is also reasonable to expect that the likelihood of encountering these phenomena would have been significantly greater at low altitude and close to the terrain.

Anemometer[7] equipment was located at the property that was being baited, and the property owner reported advising the pilot via ultra high frequency (UHF) radio that the indicated wind speed at the time was about 30 kts. However, he believed that the pilot may have misunderstood the intent of that information, relating it to the potential adverse effect on the application, rather than to flying safety.

Figure 2: Topographical map of the area



An experienced agricultural pilot, who was familiar with the location, stated that he would not have attempted aerial baiting in the reported weather conditions.

Communications

The pilot was operating in Class G airspace[8] between Clifton airstrip and the Pilton Valley area, wherein the carriage and use of radio was not mandatory. In addition to a UHF radio, the aircraft was also fitted with a very high frequency (VHF) radio that was capable of communicating on aeronautical frequencies.

The pilot could have been monitoring either Brisbane or Oakey ATC VHF radio frequencies for weather updates, although the reported usual practice at low level was to monitor the relevant common traffic advisory frequency (CTAF)[9]. The investigation was unable to determine if the pilot had sought or received updated weather forecasts during the conduct of the day's operation.

The property owner reported that, when the aircraft was overhead the property, the pilot discussed the local weather conditions with him using the aircraft's UHF radio.

Wreckage and impact information

Wreckage examination

The on-site examination of the wreckage established that the aircraft's right wing made the initial impact with terrain. That was evident by a depression in the soil that contained fragments of green-coloured glass, consistent with the right wing's navigation light lens.

Further along the wreckage trail, there were four consecutive slash marks, consistent with the propeller contacting the ground while rotating. Given a nominal engine operating speed of 2,500 RPM, from the spacing of those slash marks, it was estimated that the aircraft's speed at impact was about 88 kts (Figure 3).[10]

7 An instrument for indicating wind velocity.

8 Non-controlled airspace, in which visual flight rules flights received an if-requested flight information service.

9 CTAF. A designated frequency on which pilots make positional broadcasts when operating in the vicinity of an aerodrome.

10 A number of variables can affect the derivation of an aircraft's impact speed using this methodology, including; the engine's operating RPM at the time, the effect of any head or tail wind, and the angle of impact with the ground.

Figure 3: Propeller slash marks

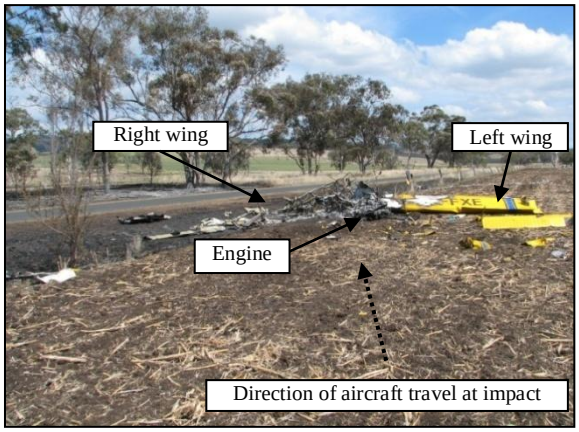
A section of propeller blade tip was located adjacent to those ground marks. That section of propeller blade was bent and curled in the direction of propeller rotation and exhibited chordwise scoring across both faces. The fracture, bending and scoring of the propeller were consistent with high rotational energy at impact (Figure 4).

Figure 4: Section of propeller tip

The aircraft came to rest upright and facing in the opposite direction of travel about 20 m from the initial impact point, with the left main wheel lodged under the fuselage. The fuselage, wings and engine sustained significant post-impact fire damage. The engine had separated from the airframe as a result of impact forces, and was located ahead of the airframe.

The left wing had rotated around the main spar, and was inverted and facing in the opposite direction. The left wing fuel tank had ruptured and was burnt at the wing root. The right wing was similarly oriented, and had also sustained significant fire damage (Figure 5).

Figure 5: Aircraft wreckage



Both wing fuel tank caps were found secured in the locked position. However, any fuel remaining at impact would have leaked from the ruptured tanks and been consumed by the post-impact fire.

A large amount of bait from the ruptured hopper was present in the wreckage. However, the actual quantity that was in the hopper at the time of impact could not be determined.

All of the aircraft's instruments, electrical system and radios were significantly damaged in the post-impact fire. The investigation was unable to obtain any valid information from those items.

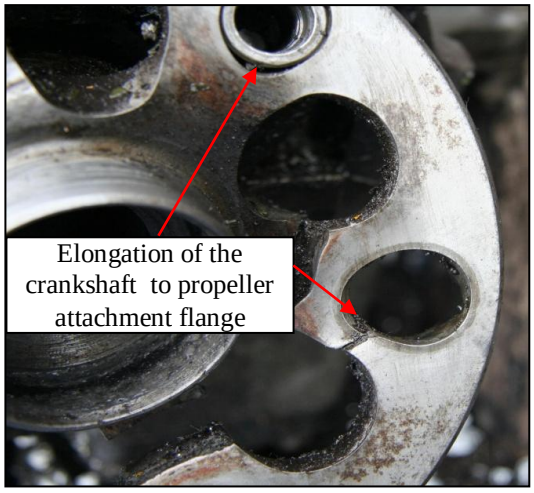
All of the primary and secondary flight controls were located in or around the wreckage with no evidence of pre-impact failure. System continuity of the flight controls, including the cabling, was established. Damage to the control cables was consistent with the impact and post-impact fire.

Engine examination

The engine was examined at the accident site. As found with the airframe wreckage, sections of the engine exhibited post-impact fire damage.

The majority of the propeller remained attached to the engine crankshaft flange. Once the propeller was removed from the flange, elongation of the propeller attachment spigot holes was identified (Figure 6). This damage was consistent with the production of torque by the engine at impact. In addition, a section of the flange had failed in ductile overload at an angle of about 40° to the propeller's plane of rotation. That was consistent with the final phase of the impact with the ground, and the aircraft pivoting on the propeller.

Figure 6: Engine crankshaft flange



The engine's fuel system was disrupted by the impact and post-impact fire. The engine fuel control unit control linkages were found connected and intact. The throttle lever was at the full power setting. The position of the engine fuel control unit control linkage, and damage to the propeller attachment spigot holes, were consistent with the production of high engine power at that time.

Medical and pathological information

The autopsy and toxicological examinations of the pilot did not reveal any evidence that physiological aspects were a factor.

The risk and effects of pilot incapacitation during single-pilot operations were most recently discussed in the Australian Transport Safety Bureau's (ATSB) transport safety report AO-2008-076.[11] That report included advice that 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.

Fire

The fire damage was consistent with a post-impact, fuel-fed fire. There was no evidence of an in-flight fire.

Survivability

At the time of the accident, the pilot's seat belt was secured and he was wearing leather boots and flying gloves, and a flying helmet. Based on the nature of the impact, the destruction of the aircraft, and of the post-impact fire, the accident was considered not survivable.

Additional information

In the recent ATSB investigation report titled *In-flight breakup – Clonbinane, Vic.* (AO-2007-029),[12] the ATSB reissued the safety publication *Mountain wave and associated turbulence.* That publication described the pre-requisites for the development of mountain waves, and explained a number of hazards associated with mountain wave activity. Flight risks resulting from the presence of any rotors and breaking waves included:

- the possibility of extreme turbulence, which could lead to a loss of aircraft control or to structural failure
- in general aviation aircraft, insufficient performance to overcome the effects of a severe downdraft generated by a mountain wave, or by the turbulence or windshear generated by a rotor.

ANALYSIS

The damage to the aircraft was consistent with high energy impact forces as a result of the collision with terrain. Examination of the engine indicated that it was producing significant power at the time of impact. There were no other technical anomalies of the aircraft or its systems identified that would have contributed to the accident.

Similarly, the witness reports as to the pilot's apparent health and well being prior to the flight, and the results of the post mortem, suggested a low risk that pilot impairment or incapacitation was a factor. However, given that the majority of pilot incapacitation events do not involve a chronic or pre-existing medical condition, the investigation was unable to discount that pilot incapacitation may have been a contributing factor.

Although no clear precursor to the collision with terrain was evident, this analysis examines the

11 Available at www.atsb.gov.au.

12 Available at http://www.atsb.gov.au/publications/2005/mountain_wave_turbulence.aspx

operational factors with the potential to have contributed to the development of the accident.

Operational factors

The pilot was an experienced pilot with extensive experience on a variety of large jet and air transport category aircraft types. In contrast, his agricultural flying experience was relatively limited, although he had carried out regular, recent agricultural operations.

The investigation was unable to establish the extent to which the pilot's relatively limited agricultural flying experience was a factor. While it could be expected that he was well aware of the risks associated with mountain wave activity and other turbulence events at higher altitudes, he may not have previously experienced the potential impact on low-level operations such as aerial baiting.

It was also possible that the pilot may have been concerned with the urgency of completing the baiting task irrespective of the increased risk due to the conditions. That preoccupation could have influenced his decision to continue operations in the adverse conditions.

Weather

The investigation was unable to determine if the pilot had obtained a forecast or updated his weather information at any stage during the day. Whereas the pilot commenced the day's flying in wind conditions that might have permitted the safe completion of the planned tasks, the wind strength increased throughout the day.

The wind gusts that were reported by the witnesses were consistent with the report of a weather front moving through the area that would generate wind gusts of up to 30 kts. Gusts of that magnitude were measured by a local property owner in the Pilton Valley, and in the vicinity of the accident site. Those observations reinforced the Bureau of Meteorology observation that mountain and breaking waves might have occurred in the area. The presence of those phenomena could have precipitated and compounded any aircraft control difficulties experienced by the pilot.

Aircraft control

The risk of losing aircraft control increases with the onset of turbulence, and the pilot's decision to continue the low-level baiting operation despite the turbulent conditions, increased that risk. The witness reports of the aircraft skidding in the turns, coincident with the rocking of the wings and otherwise changing aircraft attitude, was consistent with the pilot having difficulty controlling the aircraft in the turbulence. The altitude required for the baiting operation meant that any tendency to depart from controlled flight left the pilot little or no room to recover.

FINDINGS

From the evidence available, the following findings are made with respect to the collision with terrain that occurred on 29 September 2008 and involved Piper Aircraft PA36-375 Pawnee Brave aircraft, registered VH-FXE, and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The pilot elected to continue baiting operations in turbulent conditions. It is likely that the pilot subsequently experienced a loss of control at a height above ground that was insufficient for recovery.

Other key findings

- The pilot received a wind strength report from the property owner but may have only considered the effect of that wind on the application of the product, and not on the safety of flight.
- The investigation could not discount the possibility of pilot incapacitation.

SOURCES AND SUBMISSIONS

Sources of Information

The sources of information during the investigation included:

- witness statements and interviews
- the Bureau of Meteorology (BoM)
- Queensland Police

- Civil Aviation Safety Authority (CASA).

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003*, the Australian Transport Safety Bureau (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 the aircraft owner and maintenance provider, the Australian Defence Force, the Bureau of Meteorology and the Civil Aviation Safety Authority.

No submissions were received from those parties.