Australian Government
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# Partial power loss and collision with terrain – De Havilland Aircraft Pty Ltd DH-82A, VH-GVA

Maryborough Airport, Victoria | 27 January 2012


Investigation

**ATSB Transport Safety Report**
Aviation Occurrence Investigation
AO-2012-017
Final

Australian Government

Australian Transport Safety Bureau

**ATSB TRANSPORT SAFETY REPORT**

Aviation Occurrence Investigation
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# Partial power loss and collision with terrain Maryborough Airport, Victoria 27 January 2012

# VH-GVA

# De Havilland Aircraft Pty Ltd DH-82A

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# SAFETY SUMMARY

## What happened

At about 1710 on 27 January 2012, a De Havilland Aircraft Pty Ltd DH-82A Tiger Moth aircraft, registered VH-GVA, took off from Maryborough Airport, Victoria, with two people on board.

Immediately after lift-off, the aircraft was observed to have a partial, intermittent power loss. The pilot continued the flight with the aircraft maintaining altitude or climbing slightly. At the upwind end of the runway, the aircraft made a climbing left turn before stalling and descending. The aircraft impacted the ground and the occupants received fatal injuries.

The aircraft was seriously damaged by the accident forces and post-impact fire.

## What the ATSB found

The partial engine power loss was probably a result of a partial blockage of the aircraft's fuel cock. Although sufficient runway remained ahead to allow a safe landing, the flight was continued under limited power without gaining sufficient height to clear trees beyond the runway. Approaching the trees the aircraft climbed, lost airspeed, stalled and collided with terrain. There would have been a safer outcome had the pilot immediately landed the aircraft straight ahead.

## Safety message

This accident illustrates several of the points made in the ATSB's research report AR-2010-055, *Managing partial power loss after takeoff in single-engine aircraft* (see http://www.atsb.gov.au/publications/2010/ar2010055.aspx). In particular, pilots are reminded that continued power in such circumstances is unpredictable and risk can be reduced by conducting a controlled landing at the earliest opportunity.

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**Acknowledgements**

Figure 2: Courtesy of Google Earth

# 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's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

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

**Purpose of safety investigations**

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

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

**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 initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of 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 to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept 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.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes appropriate, or to raise general awareness of important safety information in the industry. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

# 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, current risk controls and organisational influences.

**Contributing safety factor:** a safety factor that, had it not occurred or existed at the time of an occurrence, 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 in the interests of improved transport safety.

**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.

**Risk level:** the ATSB's assessment of the risk level associated with a safety issue is noted in the Findings section of the investigation report. It reflects the risk level as it existed at the time of the occurrence. That risk level may subsequently have been reduced as a result of safety actions taken by individuals or organisations during the course of an investigation.

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

- **Critical** safety issue: associated with an intolerable level of risk and generally leading to the immediate issue of a safety recommendation unless corrective safety action has already been taken.
- **Significant** safety issue: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable. The ATSB may issue a safety recommendation or a safety advisory notice if it assesses that further safety action may be practicable.
- **Minor** safety issue: associated with a broadly acceptable level of risk, although the ATSB may sometimes issue a safety advisory notice.

**Safety action:** the steps taken or proposed to be taken by a person, organisation or agency in response to a safety issue.

# FACTUAL INFORMATION

## Sequence of events

At about 1710 Eastern Daylight-saving Time[1] on 27 January 2012, witnesses observed a De Havilland Aircraft Pty Ltd DH-82A aircraft, registration VH-GVA, take off from runway 35 at Maryborough Airport, Victoria. On board were a pilot and a passenger in a tandem seating arrangement. The passenger was in the front seat, which was the normal passenger seating position, and was familiar with the use and operation of the aircraft.

Witnesses reported that the aircraft experienced an intermittent partial power loss immediately after lift-off. The aircraft was observed to continue flying at a low height until obscured by rising terrain as it approached the departure end of the runway. At about the departure end of the runway, where open terrain changed into a wooded area, the aircraft returned to view in a climbing left turn. The witnesses described the aircraft descending before it impacted the terrain.

The two aircraft occupants received fatal injuries during the accident sequence and the aircraft was seriously damaged[2] by the impact forces and a post-impact, fuel-fed fire. Bushland surrounding the accident site was burnt by the fire.

## Pilot information

The pilot held a Private Pilot (Aeroplane) Licence (PPL) issued in March 1994 with a tailwheel endorsement issued in July 1994. The pilot held a valid Class 2 Medical Certificate with a restriction requiring reading correction to be available while exercising the privileges of the PPL.

The aircraft was first flown by the pilot in July 1994 when the pilot had a total aeronautical experience of about 180 flight hours, and the pilot had flown the same aircraft almost exclusively since that time. The pilot's total aeronautical experience was 980.3 flight hours.

The pilot's post-mortem report stated that there were no issues relating to general medical conditions or evidence or issues relating to general pilot incapacitation.

## Aircraft information

### General

The aircraft was a single piston-engine, propeller-driven acrobatic two-seat biplane. A control column could be installed in the passenger's cockpit. Although the control column was not installed in the passenger's cockpit for the flight, the rudder pedals were still connected.

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1 Eastern Daylight-saving Time (EDT) was Coordinated Universal Time (UTC) + 11 hours.

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

The aircraft, serial number 1014, was manufactured in Australia in 1942, and was powered by an inverted in-line Gipsy Major engine. The aircraft was recorded as having flown 4,153 hours and the engine had flown 653 hours since overhaul.

The aircraft had been maintained in accordance with an approved maintenance schedule and no mechanical defects were recorded or identified that could have affected the airworthiness of the aircraft. The aircraft maintenance records indicated that in June 2005, 200 flight hours before the accident, a broken fuel filler cap cork gasket had been replaced.

### Fuel system

The aircraft was equipped with a fuel tank mounted between the upper wings with a capacity of 86 L and an auxiliary fuel tank in front of the passenger seat with a capacity of 46 L. Fuel was gravity fed to the engine from the main tank, and a fuel cock was mounted at the tank outlet (Figure 1). Fuel was fed to a carburettor that contained a varnish-coated cork float for controlling fuel flow.

**Figure 1: Main fuel tank (inverted) and fuel cock**


Refuelling records showed that the aircraft was fuelled with 108 L five days before the flight. It was reported that the aircraft had not flown in the intervening period.

## Operational information

There was no weather station at Maryborough. The nearest weather station was an Automatic Weather Station (AWS) at Bendigo, 65 km north-east of the accident site. This AWS reported a light north-east wind and a temperature of 33 °C and dew point of 12 °C. There was low humidity at the time. Witnesses at the accident site reported similar weather conditions.

Maryborough Airport is located about 3 km to the north-west of Maryborough township at an elevation of 766 ft (233 m). The main runway, runway 17/35[3] was 1,040 m long with a sealed surface. The terrain beyond the aerodrome was not conducive to a safe forced landing.

## Wreckage and impact information

The wreckage was located in low bushland about 220 m beyond the departure end of runway 35 and 85 m to the left of the extended runway centreline (Figure 2).

**Figure 2: Accident location**


On-site examination of the wreckage found no anomalies with the aircraft's flight control systems. The aircraft impacted the ground in a nose-low attitude in a left bank, with a low forward speed (Figure 3). There was no evidence of any piece of the aircraft separating in flight.

The main fuel tank had separated from the upper wing during the impact sequence. Damage to the propeller indicated the engine was producing little or no power when the aircraft collided with the ground.

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3 The runway direction was 162/342 °(M).

**Figure 3: Aircraft accident site**

The aircraft was consumed by a post-impact fire. The extent of the fire damage was consistent with the fuel tanks being full or nearly full at the time of the collision. A fire-damaged piece of organic material was found in the main tank fuel cock and, on examination, was identified as being similar to that used in the fuel filler cap cork gasket.

The aircraft's engine was removed from the accident site and transported to a specialist workshop for further examination under supervision of the Australian Transport Safety Bureau (ATSB). This examination found the varnish coating on the carburettor float was darker than normal and had blistered away from the float, allowing the blister to contact the float bowl and interfere with the free movement of the float.

Inquiries were made with the Civil Aviation Safety Authority (CASA) and the engine type certificate holder to determine the reason for the varnish discolouration and blistering. Neither was aware of a history of this type of deterioration during normal operational use leading to power failure. A number of service difficulty reports have been submitted to CASA notifying of the deterioration of carburettor float varnish in Gipsy-engined aircraft that have used motor vehicle fuel. It is not known whether this aircraft had previously been operated using motor fuel and, while an approved varnish is specified for float maintenance, the sole supplier of the varnish went out of business a long time ago. At the time of writing this report, no approved alternate coating had been identified.

Examination of several exemplar floats found differences in coating appearance and application, indicating that some floats had been reworked with unapproved coatings. Tests on these floats found that the coating blistered when exposed to elevated temperatures, which may have been similar to temperatures inside the carburettor during the post-impact fire.

No other anomalies were identified in the engine that could have initiated the reported partial power loss. However, some parts of the engine were so damaged as to prevent a conclusive determination.

## Managing partial power loss after takeoff in single-engine aircraft

ATSB research report AR-2010-055, *Managing partial power loss after takeoff in single-engine aircraft* analysed reported partial power loss occurrences over a 10-year period. The report identified that the risk associated with a partial power loss during or immediately after takeoff in a single-engine aircraft is reduced if the pilot makes an immediate commitment to land. In contrast, risk is increased if the airspeed is allowed to reduce until the aircraft stalls or cannot be landed safely with the remaining airspeed.

# ANALYSIS

At the time the engine was reported to have first lost power, there was sufficient runway remaining in front of the aircraft to enable the pilot to land safely. Consistent with the principles outlined in Australian Transport Safety Bureau research report AR-2010-055, *Managing partial power loss after takeoff in single-engine aircraft*, the nature of the power loss and surrounding terrain suggested that a circuit and landing represented more risk than to land ahead.

A circuit could not have been achieved without sufficient power to enable the aircraft to climb and fly at a safe circuit height. The aircraft was reported to have remained at a very low height until it approached the trees beyond the end of the runway.

At this point, an immediate safe landing was no longer possible and it was necessary to climb to avoid the trees. The aircraft's reported climbing attitude at a low airspeed and its subsequent descent was consistent with an aerodynamic stall. A stalled aircraft is more difficult to control until the angle of attack is reduced. This generally requires forward control column movement to put the aircraft's nose down and results in height loss. In this instance, the aircraft stalled at an altitude from which there was insufficient height for the pilot to recover before impacting terrain.

In assessing possible causes of the partial power loss, the Australian Transport Safety Bureau could not determine whether the observed discolouration and blistering on the carburettor float existed before the power loss, or happened as a consequence of the post-impact fire. However, it is likely that any obstruction to carburettor float movement would have become evident at an earlier stage in the flight.

The lodgement of an obstruction in the fuel cock, such as fuel filler cap gasket material, would have reduced the fuel supply to the engine. This would explain the partial power loss as reported by witnesses. However, the separation of the fuel tank from the wing during the impact sequence, which left the fuel cock open to the environment and post-impact fire, prevented a definitive conclusion as to the origin of the gasket material, or whether it lodged in the fuel cock prior to the accident.

# FINDINGS

From the evidence available, the following findings are made with respect to the collision with terrain that occurred at Maryborough Airport, Victoria on 27 January 2012 and involved De Havilland Aircraft Pty Ltd DH-82A aircraft, registration VH-GVA, and should not be read as apportioning blame or liability to any particular organisation or individual.

## Contributing safety factors

- The pilot did not land on the available runway remaining following a partial power loss immediately after lift-off.
- The aircraft stalled at a height from which the pilot was unable to recover before impacting terrain.
- The partial power loss was probably a result of a partial blockage in the fuel cock, such as by a piece of the fuel filler cap gasket material.

# SOURCES AND SUBMISSIONS

## Sources of Information

The sources of information during the investigation included the:

- individuals associated with the operation of the aircraft
- aircraft maintainer
- witnesses to the accident.

## Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), 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 Civil Aviation Safety Authority, the aircraft maintainer and witnesses.

Submissions were received from the Civil Aviation Safety Authority and the aircraft maintainer. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

**Australian Transport Safety Bureau**

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Investigation

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