Australian Government
Australian Transport Safety Bureau

Fuel starvation and forced landing, involving PA31, VH-OFF

Near Aldinga ALA, South Australia, 29 January 2014

ATSB Transport Safety Report
Aviation Short Investigation
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Addendum

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Fuel starvation and forced landing, involving PA-31, VH-OFF

What happened

VH-OFF damage

Source: SA Police

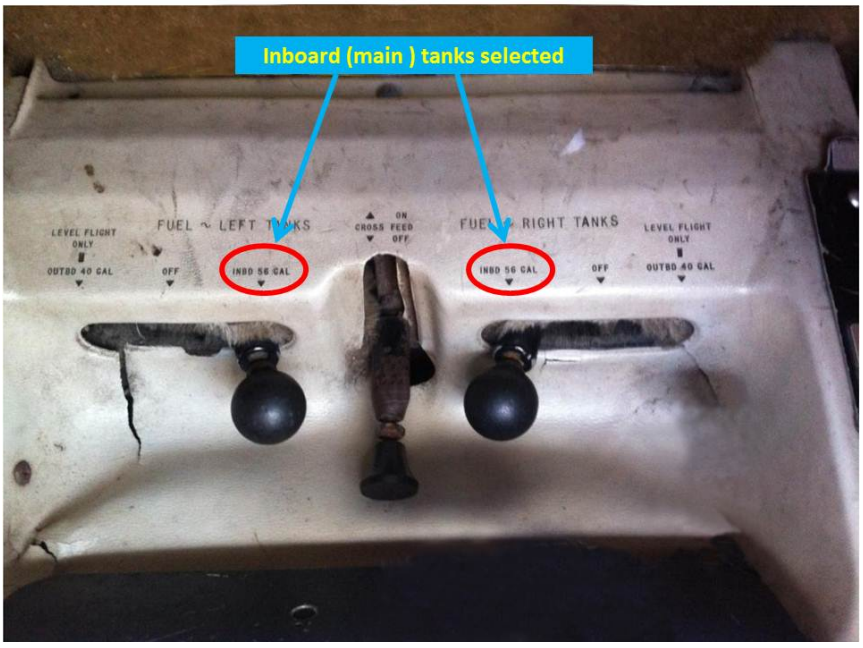
On 29 January 2014, at about 1100 Central Daylight-savings Time, the pilot prepared a Piper PA-31 aircraft, registered VH-OFF, for a private flight from Aldinga aeroplane landing area (ALA) to Kangaroo Island, South Australia.

To check fuel quantities, the pilot entered the cockpit, turned on the master switch and placed the left and right fuel selectors onto the main tank (inboard) position (Figure 1).The gauge for each tank showed just under half full. He then placed each fuel selector onto the auxiliary (outboard) tank position, where the gauge indicated the right and left auxiliary tanks were each about a quarter full. He did not return the selectors to the main tanks. He estimated that refuelling the main tanks would allow sufficient fuel for the flight with over an hour in reserve. He exited the aircraft while it was refuelled and continued preparing for the flight.

Once refuelling was completed, the pilot conducted a pre-flight inspection, and finished loading the aircraft. The pilot and passenger then boarded.

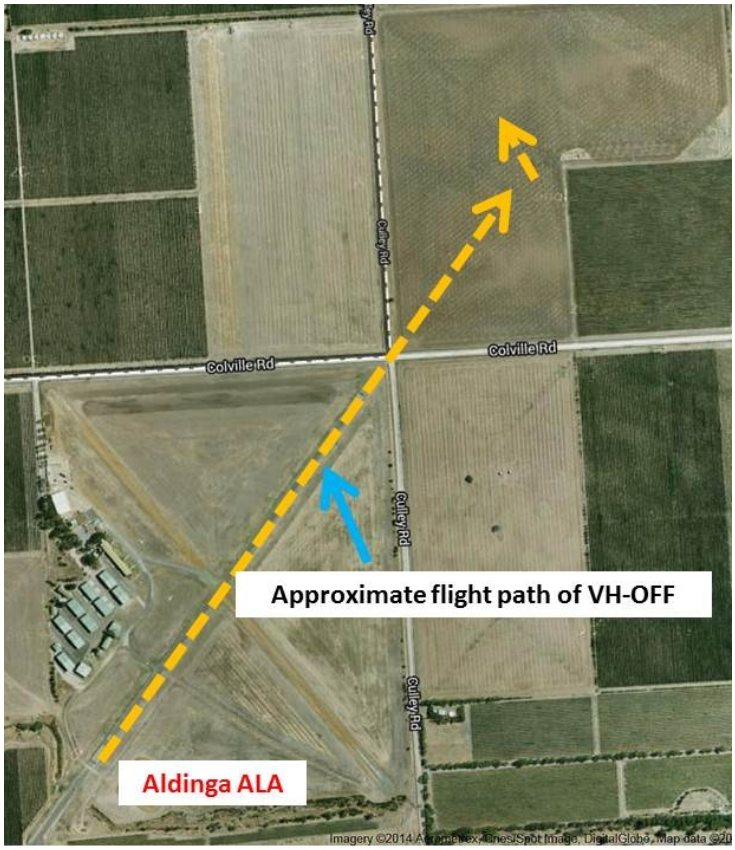
The pilot was familiar with Aldinga ALA (Figure 2), which is a non-controlled airport. At uncontrolled airports, unless a restriction or preference is listed for a certain runway in either the Airservices en route supplement Australia (ERSA), or other relevant publications, selection of the runway is the responsibility of the pilot. Operational considerations such as wind direction, other traffic, runway surface and length, performance requirements for the aircraft on that day, and suitable emergency landing areas in the event of an aircraft malfunction are all taken into consideration.

Figure 1: PA 31 fuel selectors on inboard (main) tanks



Source: Max Velge

Figure 2: Approximate flight path of VH-OFF



Source: Google maps

On this day, the pilot assessed the wind to be favouring runway 14, which already had an aircraft in the circuit intending to land. However, he decided to use runway 03 due to the availability of a landing area in case of an emergency. He then completed a full run-up check of the engines, propellers and magnetos prior to lining up for departure. The pilot reported that all of the pre-take-off checks were normal.

Once the aircraft landing on runway 14 was clear of the runway, the pilot went through his usual memory checklist prior to take-off. He scanned and crosschecked the flight and panel instruments, power quadrant settings and trims, but did not complete his usual final check, which was to reach down with his right hand and confirm that the fuel selector levers were on the main tanks.

After broadcasting on the common traffic advisory frequency (CTAF) he commenced the take-off. At the appropriate speed, he rotated the aircraft as it passed the intersection of the 14 and 03 runways. Almost immediately both engines began surging, there was a loss of power, the power gauges fluctuated and the aircraft yawed from side to side. Due to the surging, fluctuating gauges and aircraft yaw, the pilot found it difficult to identify what he thought was a non-performing engine. He reported there were no warning lights so he retracted the landing gear, with the intent of getting the aircraft to attain a positive rate of climb, so he could trouble shoot further at a safe altitude.

When a little over 50 ft above ground level (AGL), he realised the aircraft was not performing sufficiently, so he selected a suitable landing area. He focussed on maintaining a safe airspeed and landed straight ahead.

The aircraft touched down and slid about another 75-100 metres before coming to rest. The impact marks of the propellers suggest the aircraft touched the ground facing north-easterly and rotated to the north-west prior to stopping.

The pilot turned off the master switch and both he and the passenger exited the aircraft. After a few minutes he re-entered the cockpit and completed the shutdown. Police and fire service attended shortly after the accident.

PA31 Aircraft

The PA31 Navajo fuel system consists of four flexible fuel cells, two in each wing. Two electric fuel quantity gauges are mounted in the overhead switch pane. The right fuel quantity gauge indicates the quantity of fuel in the selected right fuel system tank (right main or right auxiliary), and the left fuel quantity gauge indicates the quantity of fuel in the selected left fuel system tanks. There are also engine-driven fuel pumps, and emergency fuel pumps. Emergency fuel pumps are installed to provide fuel pressure in the event an engine driven pump fails. These pumps are also used under normal conditions for priming the engines, take-off, and landing. The fuel selectors are required to be set on the main tanks for take-off.

Pilot comments

The pilot stated that the large mental workload of running a business may have taken some of his attention from an intended routine flight to a known destination on a clear day. This most likely contributed to his not reselecting the main tanks prior to start up, and also not completing his usual memory checks of physically reaching and checking the selector position during the pre- take-off checks.

The pilot recalled that the time from the initial engines malfunctioned to landing was a matter of seconds, which left him little time to troubleshoot the issue. He had hoped that by retracting the landing gear and lessening the drag, the aircraft would obtain a positive rate of climb and give him longer to assess the situation.

He feels that his clear decision not to persevere with the underperforming aircraft and put it on the ground probably saved both his and his passenger's lives; there was not even time to broadcast a mayday call.

Over time he had developed a mental checklist for pre-take-off and other checks, which had worked well up until this accident. In the future, he intends to revert to a manual checklist for every flight.

Engineering report

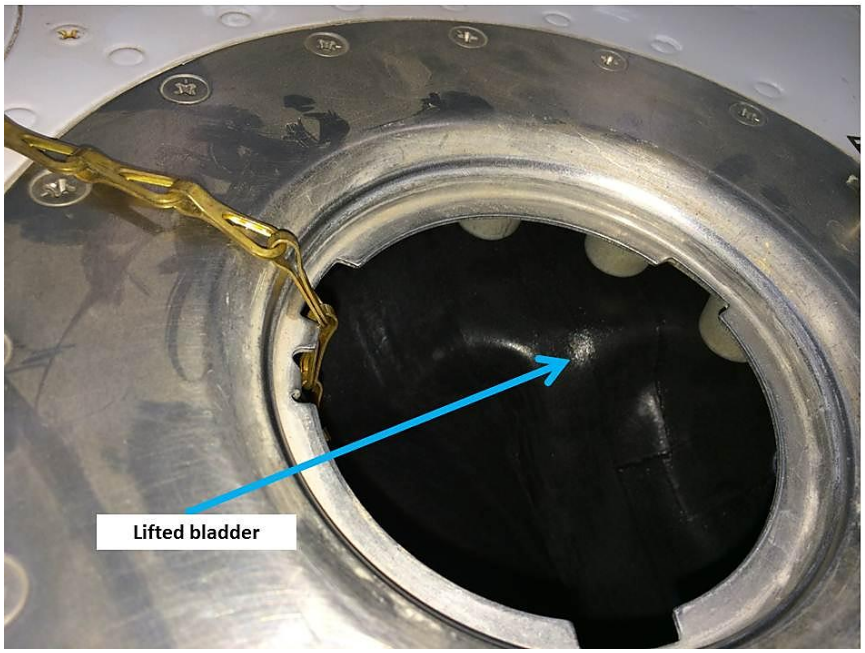
A post-accident engineering report found all four fuel tanks were operational. When selected, the auxiliary tanks were almost empty. The left and right auxiliary tank fuel samples indicated about 0.5 ml of water was present. The left auxiliary fuel tank bladder was found to be lifted inside the tank (Figure 3). The engineer noted that in its extremities, the bladder can lift the fuel sender float, which gives a false indication that there is more fuel in the tank than available. Fuel pressure was tested and was normal.

ATSB comment

Other occurrences of fuel starvation due to tank selection issues have been investigated by the ATSB. One example is noted below.

In 2003 a Piper Chieftain departed Albury, NSW on a charter flight with a pilot and six passengers on board. The flight had been delayed about two hours due to fog, and the pilot had rewarmed the engines prior to departure. To conserve fuel, he conducted this warm up with the auxiliary tanks selected. About five minutes into the flight, while the aircraft was climbing through about 5000 ft, the right fuel flow light illuminated. The pilot moved the right engine mixture control lever to full rich and commenced a return to Albury. Although he was aware of minimal fuel in the auxiliary tanks, the pilot reported selecting them to see if the aircraft performance would improve.

Figure 3: Lifted bladder, VH-OFF left auxiliary tank



Source: Engineer

A short time later the right engine commenced surging. Soon after, the left engine also began to surge. The aircraft was unable to maintain speed or altitude, so the pilot made an emergency landing in an open field near Holbrook, NSW. Although not conclusively proven, the loss of engine power and the subsequent engine surging were consistent with fuel starvation.

The full report is available on the ATSB website at:

www.atsb.gov.au/publications/safety-investigation reports.aspx?mode=Aviation&q=200303599

Safety message

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns has its focus on Genera Aviation operations, including pilot's experiencing a loss of awareness of fuel supply status. Further reading on this topic is available on the ATSB website at:

www.atsb.gov.au/safetywatch/ga-pilots.aspx

On average, the ATSB received around 21 reports of fuel exhaustion or starvation occurrences each year. Research conducted by the ATSB indicates that fuel mismanagement was three times more likely to involve fuel starvation than exhaustion, and was more likely to occur in private and charter operations.

Further reading is available from the ATSB Avoidable Accident series: *Starved and exhausted: Fuel management aviation accidents:* www.atsb.gov.au/publications/2012/avoidable-5-ar-2011-112.aspx

General details

Occurrence details

Date and time:	29 January 2014 –1132 CDT	
Occurrence category:	Accident	
Primary occurrence type:	Fuel starvation	
Location:	Near Aldinga ALA, South Australia	
	Latitude: 35° 17.33' S	Longitude: 138° 29.60' E

Aircraft details

Manufacturer and model:	Piper Aircraft Corporation	
Registration:	VH-OFF	
Serial number:	31-7812064	
Type of operation:	Private	
Persons on board:	Crew –1	Passengers – 1
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB 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; and 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.

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.

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

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.