

ACCIDENT

Aircraft Type and Registration:	Piper PA-28-140, G-ATVO	
No & Type of Engines:	1 Lycoming O-320-E2A piston engine	
Year of Manufacture:	1966 (Serial no: 28-22020)	
Date & Time (UTC):	30 March 2017 at 1450 hrs	
Location:	Shoreham-by-Sea, West Sussex	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Aircraft submerged in seawater	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	48 years	
Commander's Flying Experience:	8,303 hours (of which 4,000 were on type) Last 90 days - 8 hours Last 28 days - 5 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

Synopsis

On departure from Shoreham Airport, as the aircraft climbed through 450 ft, the engine abruptly stopped producing power and the aircraft was ditched a short distance from the beach at Shoreham-by-Sea. Despite a detailed examination of the aircraft, the cause of the abrupt power loss during the takeoff was not established.

History of the flight

The aircraft was being used for a training flight to convert a PPL(A) holder to the aircraft type. The accident flight was the first flight of the day. The aircraft had been refuelled the previous day to 'tabs'¹ on both the left and right wing fuel tanks and the aircraft contained sufficient fuel for more than three hours of flight. After being refuelled, the aircraft had been kept outside and the weather had been dry, with no rainfall. The PPL(A) holder conducted the daily check, including draining half of a sampling tube of fuel from both the left and right wing fuel tank drains and from the firewall gascolator. He stated that each of these three samples consisted of blue-coloured AVGAS, which he confirmed by smelling the samples. He also stated that none of the samples contained any visible water droplets or bulk water in the bottom of the sampling tube.

Footnote

¹ An internal metal 'tab' in the PA-28-series wing fuel tanks marks the fuel level at which each wing tank contains 17 US gal of fuel.

The PPL(A) holder, who was the handling pilot, was sitting in the left cockpit seat and the commander occupied the right seat. The commander stated that the left fuel tank was selected for engine start and for taxiing to the holding point for Runway 20, before the PPL(A) holder then switched to the right fuel tank for engine run-up and pre-takeoff checks. The engine run-up checks were completed without any abnormal magneto rpm drops on either magneto and with no evidence of carburettor ice during the carburettor heat check. As part of the pre-takeoff checks the electric fuel pump was switched ON and the fuel primer was locked closed.

As a demonstration to the PPL(A) holder, the commander requested that the aircraft be configured for a short-field takeoff, with two stages of flap selected. He stated that having lined up on Runway 20, full power was applied for five seconds and he noted the static propeller rpm was 2,400 prior to brake release, which was normal for this aircraft. The takeoff and initial climbout were normal, with the engine running smoothly and the flaps were retracted one stage as the aircraft climbed through approximately 350 ft. As the aircraft crossed the coast heading southwest, whilst climbing through 450 ft, the engine abruptly lost power although the propeller continued to windmill. The PPL(A) holder passed control of the aircraft to the commander, who lowered the nose to maintain best glide speed and turned the aircraft 150° to the left, towards the shoreline. During the descent the commander confirmed that the fuel was selected to the right tank, that the magneto switch was set to BOTH, the primer was locked closed and the electric fuel pump switch was ON. He 'pumped' the throttle to exercise the carburettor accelerator pump, but the engine did not respond.

As the engine continued to windmill without producing power, the commander realised that a ditching was inevitable so he turned the aircraft 60° right to track parallel to the shoreline and made a MAYDAY radio transmission to Shoreham ATC. He selected two stages of flap and opened the cabin door. The sea was calm with a slight swell and the aircraft ditched approximately 10 m from the shoreline. The aircraft remained upright and both crew were able to exit the aircraft without difficulty and swam to the shore. The aircraft subsequently sank, but was later recovered with no significant damage other than from being immersed in seawater.

Following the accident the airport operator confirmed that the fuel sample from the batch used to refuel G-ATVO had passed the normal fuel quality examination, and that no other aircraft receiving fuel from the same batch had reported any fuel-related problems.

Aircraft examination

The aircraft was recovered from the ditching site by the owner with the assistance of an aircraft recovery company and was dismantled prior to an examination by the AAIB. The aircraft's fuel system had been contaminated by the ingress of seawater and no reliable fuel samples were obtained. The fuel selector valve was found selected to the right wing tank. There was no evidence of a fuel leak and no obstructions were evident within the fuel system's tanks, vents, filters, fuel lines, gascolator and electric and mechanical fuel pumps. The carburettor was inspected and no defects were noted; the accelerator pump functioned normally when tested. The mechanical fuel pump was tested and found to function normally.

The aircraft's engine was inspected following its disassembly at an engine overhaul facility; the engine has accumulated 1,126 operating hours since its last overhaul. There were no failures evident that would account for an abrupt and complete loss of engine power, although it was noted that the camshaft lobes 2, 5 and 6 were significantly worn, Figure 1. The respective bearing faces of the tappet bodies were also heavily worn, with extensive surface spalling, Figure 2.



Figure 1

Worn camshaft removed from G-ATVO

Camshaft lobes 2 and 5 operate the inlet valves on the forward and aft pair of cylinders respectively. Camshaft lobe 6 operates the exhaust valve on the left rear cylinder.

The engine's oil filter had been removed from the engine during the aircraft's dismantling and had been lost, and therefore was not available for inspection. The aircraft owner confirmed that the contents of the oil filters removed during the previous three 50-hour maintenance checks, following his acquisition of the aircraft, had been examined for debris. He stated that apart from one instance where three small metal 'whiskers' were noted on the filter element, no other metallic debris had been visible during these examinations.

The engine's exhaust system was examined and no blockages or loose internal baffles were observed. The magnetos and ignition harness were not in a condition to be functionally tested due to seawater contamination.



Figure 2

Tappet bodies removed from G-ATVO, showing spalling of the tappet faces

Meteorology

The weather conditions reported at the time the accident occurred were no cloud below 5,000 ft and a visibility of more than 10 km. The wind was from 120°M at 10 kt, the temperature was 15 °C and the dew point was 10 °C. The carburettor icing chart published by the CAA² indicates the possibility of a serious risk of carburettor icing at all power settings, Figure 3.

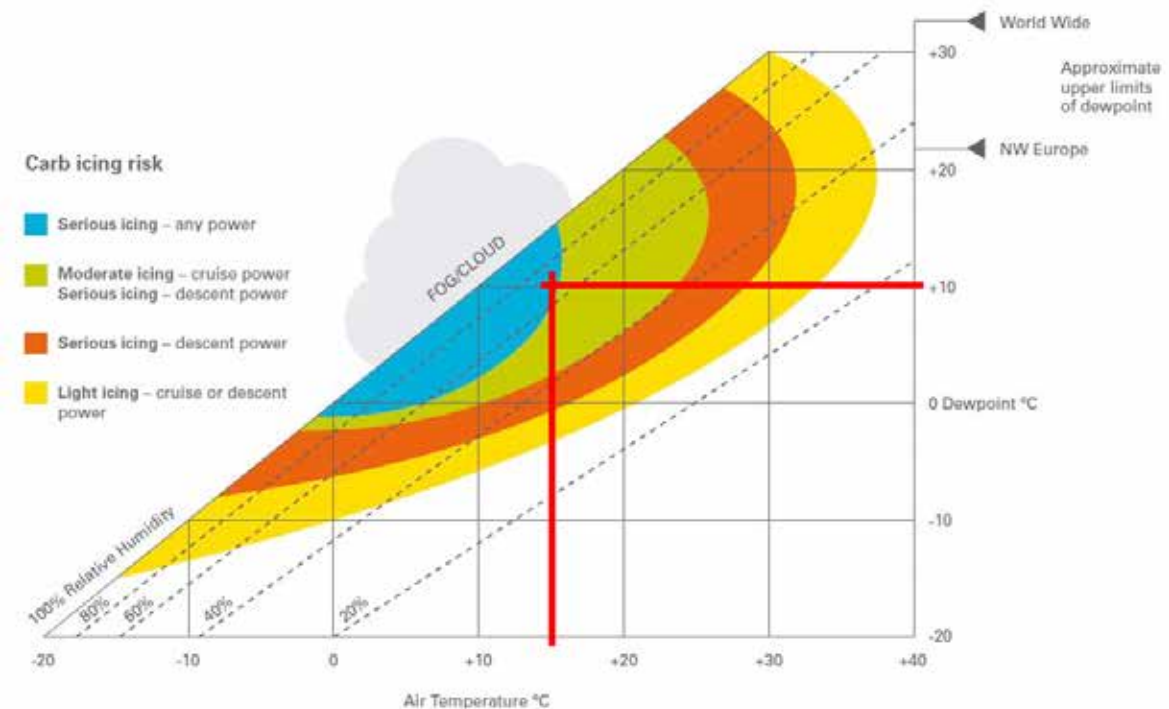


Figure 3

CAA carburettor icing chart

Footnote

² <http://www.caa.co.uk/General-aviation/Safety-information/The-Skyway-Code/>

Tests and research

A ground test was conducted by the AAIB using a PA-28-161 Warrior, which has a marginally more powerful Lycoming O-320 engine than that fitted to G-ATVO. Whilst the engine was running, the fuel selector valve was moved to the OFF position and the engine continued to run for 44 seconds before stopping due to fuel starvation. During this period the normal engine run-up and pre-takeoff checks were completed before the engine was then run at full power until it stopped.

The volume of fuel in the fuel line between the fuel selector valve and the right wing tank was estimated by measuring the length and internal diameter of the fuel line. This volume was calculated to be 0.136 litre, sufficient for the engine to run at full power for a further 16 seconds. Therefore should contaminated fuel be drawn into the fuel system from the right tank, following its selection, a period of approximately one minute may elapse before the contaminated fuel can reach the engine causing a sudden power loss.

Analysis

The absence of any engine rough-running immediately before the abrupt power loss indicates that the cause was probably not due to a fault with the dual-independent ignition systems. The commander described carrying out a carburettor icing check as part of the engine run-up checks prior to departure, with no carburettor ice detected. Given the ambient weather conditions, carburettor icing was more likely to form at low power settings rather than the wide-open throttle setting used for takeoff. Therefore if carburettor icing had occurred, it would probably have been detected after the period of ground taxiing to the Runway 20 holding point rather than during takeoff, which itself occurred shortly after carburettor heating had been applied as part of the carburettor icing check.

The worn camshaft lobes would cause a loss of engine power output due to reduced inlet valve travel on all four cylinders and changes in valve timing. However, despite the level of camshaft lobe wear, the engine continued to run smoothly and produced sufficient power to allow the aircraft to take off and climb to 450 ft prior to the loss of power. When the engine was disassembled, no mechanical failures were apparent that could account for a sudden power loss.

It is possible that the power loss may have been caused either by contaminated fuel being drawn into the engine from the right fuel tank, or by a restriction in fuel flow by an unidentified obstruction within the fuel system. Tests conducted by the AAIB showed that once the right tank had been selected, if contaminated fuel was present in the right tank the engine could have run for approximately one minute prior to engine stoppage. The PPL(A) holder who conducted the daily fuel drain check did not report finding any contamination in the samples drained from fuel tanks, and it was not possible to later determine whether any fuel contamination had occurred due to seawater ingress into the fuel system after the aircraft had ditched. The cause of the engine power loss was therefore not established.

Conclusion

On departure from Shoreham Airport, as the aircraft climbed through 450 ft, the engine abruptly stopped producing power and the aircraft was ditched a short distance from the beach at Shoreham-by-Sea. The cause of the abrupt power loss during the takeoff was not established.