**ACCIDENT**

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| **Aircraft Type and Registration:** | Piper PA-28-161 Cherokee Warrior II, G-BYKR |
| **No & type of Engines:** | 1 Lycoming O-320-D3G piston engine |
| **Year of Manufacture:** | 1988 |
| **Date & Time (UTC):** | 30 August 2006 at 0810 hrs |
| **Location:** | Oxford Airport, Kidlington |
| **Type of Flight:** | Training |
| **Persons on Board:** | Crew - 2 Passengers - 1 |
| **Injuries:** | Crew - None Passengers - None |
| **Nature of Damage:** | Aircraft damaged beyond economic repair |
| **Commander's Licence:** | Commercial Pilot's Licence |
| **Commander's Age:** | 28 years |
| **Commander's Flying Experience:** | 1,019 hours (of which 800 were on type)<br>Last 90 days - 44 hours<br>Last 28 days - 25 hours |
| **Information Source:** | AAIB Field Investigation |

**Synopsis**

The aircraft suffered a loss of engine power shortly after takeoff but the instructor pilot was able to land back on the runway. However, there was insufficient distance available in which to stop and the aircraft overran the end of the paved surface and passed through the airport boundary fence, coming to rest inverted on a public road. Although it was substantially damaged and leaking fuel, there was no fire.

Examination and testing of the engine and other components did not identify any defects that could have accounted for the loss of engine power.

**History of the flight**

The aircraft was one of several operated by a flight training organisation based at Oxford Airport and the accident occurred on the first flight of the day. This was intended to be a training detail. There were three occupants: the instructor, a student and a passenger seated in the rear, who was also a student at the flying school.

The weather recorded by ATC at Oxford Airport at 0750 hrs was: CAVOK, temperature +9ºC, dewpoint +8ºC and wind 220º/5 kt. The temperature and dewpoint figures indicate a Relative Humidity (RH) of 88%.

Soon after startup, the instructor realised that the engine showed symptoms of carburettor icing, so the engine speed was set at between 1,300 rpm and 1,400 rpm,

instead of the recommended 800 rpm to 1,200 rpm, to warm it up more quickly. The aircraft was parked on the apron in front of the control tower and, with Runway 19 in use, this necessitated a relatively long taxi to the departure point of approximately 1,000 m. After taxiing, the power and before-takeoff checks were performed, with satisfactory results. Carburettor heat was re-applied for about 15 seconds at the holding point prior to takeoff; no signs of carburettor icing were noted.

After backtracking the active runway a short distance beyond the intersection with Runway 11/29, the student commenced the takeoff by applying full power. The engine temperature, pressure and speed indications appeared normal but, shortly after rotation, there was loss of power and the engine was heard to 'cough'. The instructor immediately took control and, after putting out a radio call, landed the aircraft back on the runway. He braked heavily but the aircraft overran the end of the paved surface and continued through the airport boundary fence and hedge. It then pitched over and came to rest, inverted, in Langford Lane, a public road bordering the southern end of the airport (Figure 1). The left wing had completely separated from the fuselage, the right wing almost so, which allowed a considerable quantity of fuel to leak from both wings, but there was no fire.

The occupants, who had been wearing lap straps and shoulder belts, were uninjured and exited the aircraft unaided, albeit with some difficulty, after turning off the battery master switch. The cabin door was partially obstructed and had to be kicked several times in order to make it open. The emergency services were in attendance within two to three minutes, by which time the occupants had already vacated the aircraft.

**Aircraft information**

The Piper PA-28-161 is a single-engined low-wing monoplane of all-metal construction. It is equipped with a 160-hp normally-aspirated, carburetted piston engine, incorporating dual, independent ignition systems. The aircraft has a total fuel capacity of 50 US gallons (190 litres), contained in two tanks, one in each wing. Each tank is equipped with a fuel sampling/drain valve. Fuel pressure to the carburettor is provided by a conventional engine-driven diaphragm pump and a supplementary electrically-driven pump. The engine is equipped with a conventional carburettor air heat system which, when selected, ducts unfiltered warm air, sourced from a heat exchanger around the exhaust manifolds, into the carburettor inlet.

The aircraft was not carrying any deferred defects relevant to the accident and no maintenance had been performed on the engine or fuel system immediately prior to the accident.

**Wreckage examination**

The aircraft wreckage was recovered to a hangar at Oxford Airport, where it was examined by the AAIB.

**Figure 1**

Photograph of aircraft wreckage

The wing spars had been severed at the wing root by the impact, disrupting the fuel pipes, and the fuselage, empennage and nose landing gear had also sustained severe damage.

Chord-wise scrape marks on the propeller blades and circumferential scoring of the spinner indicated that the propeller was turning when the aircraft struck the boundary fence, but the lack of any distortion of the propeller blades suggested that the engine had been running at low power.

The engine contained sufficient oil and had not seized, and mechanical continuity of the valve train was confirmed. The engine controls operated correctly, with the exception of the mixture control. This was extremely stiff to operate due to the operating cable becoming trapped by nose landing gear support structure, which had been badly distorted in the impact. The spark plugs were found to be in good condition and their leads were securely attached. Both magnetos appeared to be in good condition and were securely mounted. The fuel selector handle was found set to the right-hand tank and the fuel primer was in the locked position.

The disruption to the fuel tanks and fuel pipes in the wings was such that the contents of the tanks had completely drained out following the accident. However, small quantities of fuel were found in the gascolator, electric fuel pump and the fuel hoses in the engine bay, and these samples were collected and subjected to quality testing.

**Engine testing**

The engine, including the carburettor, had suffered only minor damage in the accident, so it was decided to install it as a complete unit in an engine test facility, without making any adjustments, and assess its performance. As it had not been possible to recover sufficient fuel from the aircraft, an alternative supply of Avgas 100LL was used.

The engine started easily and, once warmed up, high power runs were completed satisfactorily. The engine showed no signs of hesitation at any power setting or during rapid throttle advancements. At full throttle, measurements confirmed that the engine was developing close to the nominal rated power quoted by the engine manufacturer.

**Component testing/examination**

The fuel tank vent pipes and the fuel lines between the tanks and the engine were found to be free from obstruction. The gascolator was clean and its filter was free of debris. The electric fuel pump and the ignition switch were also tested and found to be satisfactory. Bench tests of the carburettor confirmed that this was correctly adjusted and, when stripped for internal examination, it was found to be in good condition and free of debris. Both fuel tank filler caps were in good condition.

**Fuelling records**

Fuelling records showed that G-BYKR was refuelled from Bowser AV3 twice on the day before the accident, uplifting a total of 62 litres of Avgas 100LL. The times of refuelling were not established as this information is not recorded by the fuel provider.

The daily inspection sheet for Bowser AV3 for 29 August 2006 shows that a fuel quality check was carried out at 0720 hrs, prior to the first refuelling of the day. Further quality checks were performed at 1330 hrs following replenishment of the bowser and after the first subsequent refuelling of an aircraft. The results of these checks were recorded as satisfactory. The records show that the bowser had refuelled about 40 aircraft

that day and the AAIB is not aware of any reports of engine problems with any of these aircraft, other than G-BYKR.

A sample of fuel was taken from the bowser after the accident and provided to the AAIB for testing.

**Fuel sample testing**

The small samples of fuel recovered from the aircraft were found to be free of water and exhibited the characteristic blue colour of Avgas 100LL. Tests showed that they were very similar to both a known good reference sample of Avgas and the sample of fuel taken from Bowser AV3. Tests on this sample confirmed that it met the specification for Avgas 100LL.

**Discussion**

As large quantities of fuel were seen leaking from both wings after the accident, it is therefore reasonable to conclude that the aircraft did not run out of fuel.

Examination and testing of the fuel system and the engine did not identify any technical defects that could account for the loss of engine power after takeoff. An intermittent ignition problem could not be ruled out but this seems unlikely, given that the engine is equipped with two independent ignition systems and the fact that the engine performed satisfactorily during test runs.

No evidence of debris or blockage was found in the fuel system but the possibility of water contamination of the fuel must be considered. It is unlikely that the fuel from Bowser AV3 was contaminated, given that numerous other aircraft were refuelled from the bowser on the same day with no reports of subsequent engine problems. Condensation inside an aircraft's fuel tanks may cause significant quantities of water to accumulate over a period of time, but this is unlikely on flying school aircraft which have a high utilisation, as these are frequently refuelled and regularly sampled during the pre-flight checks. Another potential source of water ingress into fuel tanks is poorly sealing fuel filler caps. However, this could be ruled out on G-BYKR as both cap seals were found to be in good condition.

A potential cause of loss of engine power is carburettor icing. With a relative humidity of 88% and a temperature of +9ºC, the conditions at the time of the accident were highly conducive to carburettor icing at any power setting, and this is supported by the fact that such icing occurred soon after the engine was started. The subsequent long taxi at a low power setting would probably have increased the likelihood of ice re-forming in the carburettor. Although the crew carried out carburettor heat checks at the holding point, in accordance with recommended practice, it is possible that, on this occasion, this was not completely effective in removing all the ice that may have accumulated within the carburettor. Alternatively, ice may have been forming in the time taken to taxi from the holding point until shortly after takeoff, when the loss of power occurred.