ACCIDENT

Aircraft Type and Registration:	Socata TB10 Tobago, G-JURE
No & Type of Engines:	1 Lycoming O-360-A1AD piston engine
Year of Manufacture:	1986
Date & Time (UTC):	25 September 2006 at 2028 hrs
Location:	Delamere, near Chester, Cheshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passenger - None
Injuries:	Crew - 1 (Serious) Passenger - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence
Commander's Age:	52 years
Commander's Flying Experience:	300 hours (of which 25 were on type) Last 90 days - 4 hours Last 28 days - 0 hours
Information Source:	AAIB Field Investigation

Synopsis

Whilst in the approach phase of a night currency flight, the aircraft suffered a sustained loss of engine power that required the pilot to make a forced landing. In the darkness, the pilot was unable to locate a clear area in which to land and the aircraft flew into a tree, where it came to rest. Shortly afterwards the aircraft caught fire and the pilot, unable to open the aircraft's door, vacated the aircraft through a perspex window. He fell to the ground and was taken to hospital with serious burn injuries.

History of the flight

The pilot intended to perform a night currency flight, having not flown at night for nearly three months. When he arrived at Liverpool Airport the aircraft was parked on the general aviation apron. Having removed the aircraft's soft cover the pilot carried out the usual pre-flight inspection, which included a check for water contamination of the fuel. The start, taxi, power checks and takeoff were uneventful and he departed the Liverpool Control Zone at 1933 hrs, heading towards Chester.

The pilot flew to Llangollen between 2,000 and 2,500 ft amsl, and then headed back towards Oulton Park, the visual reporting point for his return to Liverpool Airport. At 1953 hrs, the pilot transmitted to Liverpool ATC that he was 'FOUR MILES SOUTH WEST OULTON PARK FOR REJOIN AT OULTON PARK' and then descended to 1,500 ft to comply with Liverpool Airport's special visual flight rules. He completed his rejoin checks, which included selecting carburettor heating which he

left selected for between 30 seconds and one minute. After levelling off at an airspeed of approximately 100 kt, the pilot recalled that the engine noise changed slightly but he was unable to identify why. As he began the turn towards Liverpool Airport from Oulton Park, the engine note changed significantly and there was a significant loss of power; he thought that the sound was mechanical rather than rough running. The pilot moved the throttle marginally backwards and then forwards and selected the mixture to fully rich, but neither action increased the engine power. At his stage he completed the engine restart checks which included setting the mixture to FULL RICH, the propeller to FULL FINE, full throttle and the carburettor heat to ON. He cannot recall any of the instrumentation at this stage but transmitted 'MAYDAY MAYDAY MAYDAY, G-JURE HAS AN ENGINE PARTIAL FAILURE AND IS DESCENDING CURRENTLY AT 800 FEET AND JUST THREE MILES TO THE NORTH WEST OF OULTON PARK'.

Liverpool ATC passed the surface wind to the pilot but nothing more was heard from the aircraft. The pilot, unable to maintain level flight, established the aircraft in a glide towards an area of darkness at 80 kt, with the wings level, and switched on the landing light in an attempt to identify a landing field. The light illuminated a canopy of trees and he then switched the light off to preserve his night vision. Shortly afterwards the aircraft impacted the tree canopy and rapidly came to rest in an upright position. The pilot's lap and diagonal restraint held him in his seat and he remained conscious throughout. Within a few seconds a fire started just forward of the cockpit and the pilot attempted to vacate the aircraft. Although he was unable to open the door as the latch positioned at the front of the door was now engulfed in the fire, he was able to undo his harness. He then positioned his back against the side plexiglass panel and, pushing with his feet, popped the panel out and then fell backwards through the opening, straight down to the forest floor. With some difficulty he moved away from directly beneath the burning wreckage towards a witness who was searching for survivors. The witness called the emergency services and, whilst they were waiting, another passer-by poured a bucket of water over the pilot as his clothing continued to emit smoke. The pilot was taken to hospital by the emergency services where he spent several weeks in intensive care with serious burn injuries.

Technical examination

After coming to rest suspended in trees the aircraft suffered an intensive post-crash fire, which destroyed the fuselage immediately aft of the engine firewall. The fuel tanks were damaged in the impact and although no fuel was recovered there was significant evidence of fuel spillage at the accident site. A detailed examination of the wreckage was carried out after recovery of the aircraft from the accident site. All the instrumentation had been destroyed together with the fuel lines and selector valve in the fuselage. The propeller, engine, control cables and the fire wall were the subject of a detailed examination by the AAIB.

Although one blade had been bent backwards, the propeller was relatively undamaged and there were no witness marks to indicate that it was rotating with significant speed as it passed through the trees. Measurement of the exposed 'inners' of the engine control cable indicated that the engine controls were in the following positions: throttle 80% fully open, mixture 75% toward the RICH position and the carburettor heat had been selected. There was no evidence to suggest that the position of these cables had been disturbed during the recovery process and given that the surrounding structure had been destroyed prior to the recovery it is considered that they represent their approximate positions immediately after the impact. Moreover, since the

carburettor control knob must be pulled towards the pilot to select the carburettor heat it is considered unlikely that impact forces would have moved it into this position.

It was not possible to test the carburettor and the magnetos because of fire and impact damage and the position of the carburettor air intake valve at the time of impact could not be verified. The spark plugs showed no evidence of oil fouling and examination of the cylinder bores confirmed that there was no evidence of scoring or other abnormalities to the liners and pistons. No other mechanical abnormalities were identified.

Aircraft records

A review of the aircraft's records showed that at the time of the last annual inspection in December 2005 the engine was suffering from low compression and all of the cylinders were removed and overhauled. After a further seven hours of operation the number two cylinder was again removed for 'rework' to rectify an oil fouling problem. After reinstallation of the cylinder, the engine operated for a further 54 hours without any reported defects prior to the accident.

Carburettor icing

The Liverpool Airport weather, observed at 2001 hrs, reported a surface wind from 310º at 5 kt, scattered cloud at 2,500 ft amsl and a temperature of +16ºC with a dew point of +12ºC.

Examination of carburettor icing charts, using the prevailing atmospheric conditions for the altitude of the aircraft, suggests that the aircraft would experience moderate levels of carburettor icing at cruise power settings and serious icing during a descent (Figure 1). The presence of carburettor icing would lead to the engine losing power and running roughly. The application of carburettor heat would then result in an increase in the rough running and further power loss until all the ice had dissipated. The periodic application of carburettor heat for short periods of time during cruise checks may not have been sufficient to remove completely any accumulated ice. Whilst running roughly at low power the effectiveness of carburettor heat quickly diminishes as the engine exhaust manifold rapidly cools. In the event of a significant build-up of ice, it could take a considerable amount of time to clear all the ice and regain full engine power.

The dangers of carburettor icing are discussed in detail in the CAA General Aviation Safety Sense Leaflets 03, (*Winter Flying*) and 14b (*Piston Engine Icing*).

Analysis

The engine had operated for 54 hours following its last significant maintenance without any reported defects prior to the accident. There was no evidence of a mechanical failure within the engine and the spark plugs and cylinders confirmed that the engine had not suffered from oil fouling immediately prior to the accident. Evidence from the crash site and the intensity of the post crash fire confirm that the aircraft had fuel in its tanks at the time of the crash. It was not possible to test the fuel and ignitions systems because of damage and they cannot therefore be eliminated as a possible cause of the loss of engine power and rough running.

The possibility remains that despite the occasional use of carburettor heating, the conditions in which the aircraft was operated resulted in a build-up of carburettor ice causing a loss of engine power. This power could not be recovered by the use of carburettor heat before the aircraft crashed into the trees.

The weather was suitable for the flight, the pilot was familiar with the area and the planning of the flight appears

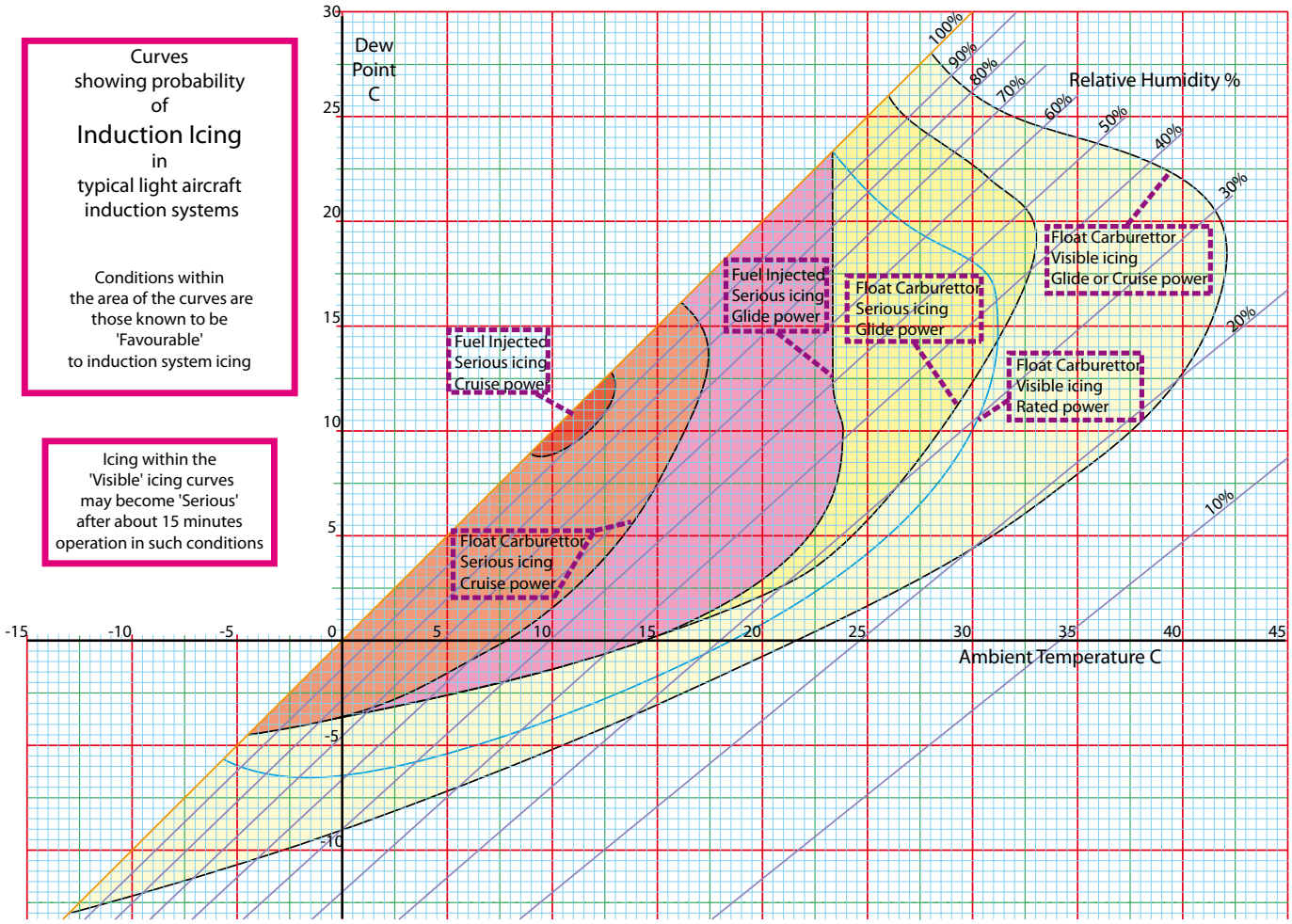

Figure 1

well considered. Regardless of the reasons behind the power failure, the pilot was required to attempt a forced landing at night, away from an illuminated airfield. This is always likely to be a hazardous manoeuvre and anything that can be done to mitigate the risk should be considered. Although the CAA does not offer any specific guidance on night forced landings, flying schools recommend looking to land into wind in 'dark' areas which are less likely to have obstructions, although as in this accident, these maybe areas of woodland. They also consider that any form of ground illumination should be maintained in order to give the pilot the optimum opportunity to avoid obstructions. The pilot's emergency call included position information, which assumes a greater significance since a night accident is less likely to be observed by ground witnesses.

A further consideration is the use of an aircraft ballistic recovery system. These whole aircraft parachute systems can be fitted to a variety of light aircraft and potentially offer a reduced risk option in the event of an engine failure at night on a single-engine aircraft.