ACCIDENT

Aircraft Type and Registration:	Piper PA-38-112 Tomahawk, G-RVRG
No & Type of Engines:	1 Lycoming O-235-L2C piston engine
Year of Manufacture:	1979
Date & Time (UTC):	23 July 2008 at 1055 hrs
Location:	City Airport Manchester, Barton, Eccles
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Serious) Passengers - None
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	37 years
Commander's Flying Experience:	Not known Last 90 days - Not known Last 28 days - 33 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft became airborne from a hump in the grass runway. The pilot continued the takeoff but the aircraft did not accelerate and climb, and stalled at about 50 feet above the aerodrome boundary.

History of the flight

The instructor was conducting an introductory flying lesson with the passenger, who had no previous experience of flying in light aircraft. While waiting for the aircraft to return from a previous detail the instructor showed the passenger another aircraft of similar type to explain its layout and the function of various cockpit controls. After boarding the accident aircraft the instructor conducted normal pre-start, engine and pre-takeoff checks and taxied the aircraft to a holding point at the beginning of the grass Runway 09R. Shortly afterwards, the aerodrome Flight Information Service Officer (FISO) transmitted the surface wind and indicated that takeoff was at the pilot's discretion.

Initially the takeoff was as the instructor expected, with normal acceleration to a point approximately 200 metres after the start of the takeoff roll but, shortly afterwards, at an indicated air speed of 53 kt, the aircraft became airborne unintentionally after passing over a hump in the runway. The instructor decided to continue the takeoff, expecting the aircraft to accelerate satisfactorily. He attempted to accelerate the aircraft close to the ground and, having some success, raised the nose again. As it approached the aerodrome boundary the aircraft had

reached approximately 50 feet and was observed to have a nose-high attitude. At that moment the pilot became concerned that the performance of the aircraft would be inadequate to pass safely over houses at the edge of the aerodrome, or a large viaduct several hundred metres beyond. He therefore decided to carry out a forced landing in open ground between the boundary fence and the houses. However, on passing the end of the runway the aircraft began to lose height and its right wing dropped. The aircraft rolled to the right and impacted the ground nose first.

First responders released the passenger and took her by road to hospital, where she was found to have no significant physical injuries. The aerodrome fire and rescue service (AFRS) released the pilot, who was taken to hospital by air ambulance.

Meteorological information

Meteorological conditions reported at the time of the accident included wind from 140° at 5 kt and air temperature of 22°C. The FISO on duty commented that the air was humid, there was no precipitation and the runway surface was dry.

Aircraft details

The aircraft had undergone a maintenance input between 11 July and 14 July 2008, during which a 150-hour scheduled inspection was carried out and the engine was replaced with a newly overhauled unit. The aircraft had completed one engineering flight, in order to conduct the engine 'bedding in' procedure as detailed in Lycoming Service Instruction 1427B, before being returned to normal service. Since the inspection and engine replacement, a total of 9 hours and 55 minutes had been flown prior to the accident flight. There were no reported defects with the engine or airframe during this period.

Following a flight earlier in the day, the aircraft was refuelled with 37 litres of Avgas 100LL to bring the total onboard to 78 litres at the commencement of this flight. The fuelling facility conducts routine daily sample checks of the fuel quality each morning and a further extra sample was taken immediately after the accident. Both of these samples were normal and no problems were reported by other aircraft that had received fuel from the same facility.

Examination of the wreckage

The wreckage was located in a slight hollow in an area of scrubland 108 metres past the upwind end and on the extended centreline of Runway 09R. The ground was soft and slightly boggy. The longitudinal axis of the main part of the aircraft fuselage was aligned on a heading of 210°(M), approximately 120° right of its original direction of travel. The damage to the aircraft indicated that it was in a 'nose low' and 'right wing low' attitude, and yawing to the right. The right wing tip impacted the ground, displacing the right wing. The left main gear was torn from its mounting and found next to the wreckage. The rear fuselage, aft of the cockpit area, was mostly detached and displaced to the left as a result of the right yaw on impact. One propeller blade was undamaged and the other was bent rearwards with some damage to its leading edge, indicating that it was rotating at low power. The nose landing gear was detached and located with the main wreckage and its mounting frame, the engine mount and lower cowling were distorted. There was no fire.

Examination of the engine controls and the primary flying controls found them all to be correctly connected and working as expected. The flap lever and the flaps were in the 'first detent' position and the elevator trim was set to a mid position. Both of these were consistent with normal operation. The airspeed indicator was

checked and found to be reading accurately and there were no apparent defects with the pitot-static system.

The engine was examined externally. The rocker covers were then removed to check valve gear operation whilst the engine was rotated by hand. The spark plugs were removed to allow a borescope inspection of the pistons, cylinders, valve heads and valve seats. No defects were noted and the condition of the components examined was consistent with normal operation and with the life of the engine.

Fuel samples were taken from both the left and right tanks. Preliminary visual examination found them to be satisfactory and free of contamination. Sixty litres of fuel were recovered from the tanks.

Initial inspection by the Fire Service indicated the fuel selector valve was in the OFF position, but a later more detailed inspection confirmed the valve was selected to the LEFT position. The fuel selector is a rotary valve that has LEFT, RIGHT and OFF positions. To prevent inadvertent selection, a spring-loaded pawl needs to be moved away before OFF can be selected. The valve is located near the base of the firewall and is connected to the selector lever at the base of the centre instrument panel by an extension rod.

When interviewed afterwards, the passenger, perhaps as a result of the briefing she received from the instructor in a similar type aircraft, demonstrated a good understanding of the function and location of the various cockpit controls. She stated that she did not recall the fuel selector being moved by either occupant before or after the accident. The valve body may have been displaced in the impact which in turn displaced the selector lever, leading to the misleading indication.

Performance

A loadsheet produced after the accident indicated that the aircraft was within weight and balance limits, with a fuel load of 78 litres and a takeoff weight of 1,658 lb. The Pilot's Operating Handbook (POH), produced by the manufacturer, indicated that at the maximum takeoff weight of 1,670 lb the stall speed of the aircraft in standard atmospheric conditions would be 53 kt. At this weight, and in the conditions reported at the time of the accident, the takeoff run would be approximately 250 metres. The manufacturer notes that published data are based on flight tests of a new aircraft in standard configuration and do not allow for physical deterioration, pilot technique or runway surface. High humidity also has a detrimental effect on the performance of normally aspirated piston engines for which no consideration is made in the POH. Nevertheless, continued successful operation of this aircraft type at Barton indicates that it is capable of achieving satisfactory performance for takeoff from Runway 09R.

Aerodrome information

Barton Aerodrome (City Airport Manchester) is situated on the western edge of Manchester and bordered to the east by a contiguous built-up area. It has four licensed grass runways, two of which are aligned east-west. One of these, Runway 09R, has a takeoff run available of 621 metres. The aerodrome is susceptible to waterlogging and has several notable humps which are locally known to be sufficient to cause aircraft close to takeoff speed to become momentarily airborne. The aerodrome operator has an ongoing program of works that attempt to maintain the manoeuvring areas in satisfactory condition.

An accident[1] in which a similar aircraft failed to become airborne safely from Runway 09L at Barton was found to have resulted from an excessive nose-up pitch input and not from inadvertent launch from one of these humps. Aircraft routinely operate from Barton without incident and there is no evidence that the presence of such humps is unduly troublesome.

Aerodrome standards

Civil Aviation Publication (CAP) 168 – *'Licensing of Aerodromes'* gives guidance to licence holders on the procedures for the issue and continuation of or variation to an aerodrome licence and indicates the licensing requirements used for assessing a variation or application. The section relating to unpaved surfaces (including grass runways) states, in part:

> *'Natural surfaces of unpaved runways should be prepared or treated to remove irregularities which might adversely affect the directional control, braking or riding characteristics of an aeroplane.'*

and,

> *'A simple method of assessing the evenness of a natural surface is to drive over it in a Land Rover or similar vehicle at 30 mph. If the surface is acceptably even, this test should be accomplished without discomfort to the vehicle occupants.'*

Operator procedures

The instructor, who most frequently flew from the operator's base at Liverpool Airport, had been briefed on procedures for flying at Barton and had been assessed on his ability to follow them by the operator's Chief Flying Instructor. The aircraft operator has also issued written orders to its instructors concerning operation at Barton. In particular, it requires that aircraft contain no more than 78 litres of fuel prior to departure in order to restrict maximum takeoff weight and reminds pilots to ensure that 'rotate speed and climb speed' are achieved before allowing the aircraft to become airborne.

Discussion

Based on information published in the POH and the continued successful operation of the type at Barton, it is likely that the aircraft was capable of taking off from Runway 09R in the prevailing conditions. Despite containing undulations, which are known to cause aircraft to become airborne before intended by their pilots, there is no evidence that the surface of Runway 09R has caused similar accidents to this one. When an aircraft becomes airborne at its stall speed there is no performance margin and a change in flight path or control input may result in development of the stall. Aircraft of this type generally have insufficient power to accelerate away from the stall whilst climbing.

Conclusion

The aircraft was in an airworthy condition and operating normally immediately prior to the accident, which occurred when the aircraft failed to achieve the proper takeoff speed before becoming airborne and stalled during the attempted forced landing.

Footnote

1 AAIB reference EW/G2006/09/13 published in the Bulletin 2/2007