

ACCIDENT

Aircraft Type and Registration:	Piper L18C Super Cub, G-AXLZ	
No & Type of Engines:	1 Continental Motors Corp C90-8F piston engine	
Year of Manufacture:	1952 (Serial no: 18-2052)	
Date & Time (UTC):	18 July 2016 at 1007 hrs	
Location:	Shoreham Airport, West Sussex	
Type of Flight:	Training	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Minor)	Passengers - None
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	61 years	
Commander's Flying Experience:	19,162 hours (of which 30 were on type) Last 90 days - 38 hours Last 28 days - 22 hours	
Information Source:	AAIB Field Investigation	

Synopsis

During takeoff the aircraft encountered a wake vortex system from a helicopter which had hover-taxed across the runway approximately two minutes earlier. The pilot was unable to correct the roll, induced by the vortex system, before the aircraft struck the ground.

History of the flight

The flight had been planned as a training flight from Shoreham. After completing the pre-flight briefing and checks, the flying instructor, with the broadcast wind information as "variable at 03 kt", decided to take off from Runway 24, the longest of Shoreham's grass runways. The flying instructor was to carry out the takeoff. No abnormalities were identified during the pre-takeoff power checks and, after lining up on Runway 24, the pilot received clearance for takeoff and the updated wind conditions of "150 at 07 kt".

The pilot stated that the takeoff was initially normal, with the aircraft accelerating as usual, but reported that the runway surface was very uneven and "bouncy". The aircraft became airborne before reaching its normal takeoff speed; the pilot did not recall the actual speed. Its left wing dropped and this was corrected by the pilot. The aircraft remained level for a brief period. The right wing then dropped but, despite the use of full corrective aileron, the pilot was unable to prevent the right wing from striking the ground. The aircraft's fuselage then struck the ground and the aircraft rotated 180° before coming to rest. The pilot and passenger received minor injuries. The aircraft was destroyed.

Approximately two minutes prior G-AXLZ's takeoff a Robinson 44 helicopter had hover-taxed from the northern side of Runway 24 to the fuel installation on the south of Runway 24.

Aircraft operation on grass runways

When operating from uneven or bumpy grass surfaces aircraft can become airborne at lower than the normal takeoff speed. In these cases, if the aircraft has sufficient airspeed, it may be possible for the pilot to correct any tendency for 'wing drop' by using the ailerons. However, the use of aileron to correct roll at airspeeds close to the aircraft's stall speed can induce a stall of the 'high' wing. For example: the use of aileron to correct a left wing down roll will cause the right wing to descend. The downward movement of the right wing increases its relative angle of attack to the airflow which, at speeds close to the stall speed, can result in the right wing stalling.

Wake vortex

All aircraft generate vortices at their wing tips as a consequence of generating lift. The strength and duration of these vortices is generally a function of the weight, size and speed of the aircraft. In stable air conditions the wake vortex produced by an aircraft will tend to move downwind. The rate of dissipation of a wake vortex is dependent on the local wind speed; in high wind conditions wake vortices dissipate rapidly but in low wind conditions the wake vortex can remain active for a prolonged period.

The CAA commissioned a study by the University of Liverpool¹ to investigate the specific effects of helicopter wake encounters which was published on 17 March 2015. The introduction to the study (Chapter 1, page 1) states:

'There are clear definitions of the separation time or distance for the wake encounter between fixed-wing aircraft. However, for the wake encounter between helicopter wake and an encountering light aircraft, the separation distance is not clearly defined and lacks of details. There is, however, some guidance for helicopter wake encounters, for example, the three-rotor-diameter separation distance described the CAP 493, Manual of Traffic Services. Serious and fatal accidents have happened in the UK when a light aircraft has been caught in a helicopter wake and the pilots have subsequently lost control. The wake generated by a helicopter is different to that of a fixed-wing aircraft. The helicopter wake vortices maybe more intense with different wake structure, duration and decay. The wake vortices are also dependant on the type of the helicopter (weight, size, configuration) and its operating conditions (altitude, speed). Helicopter wake encounter accidents have often happened around airports where helicopters are in hover or hover taxiing and the light aircraft is either landing or departing. Both the helicopter and aircraft are at low altitudes and low speeds and hence this type of wake encounter scenario has its own

Footnote

¹ Helicopter Wake Encounter Study, Version 1.0, University of Liverpool, March 17 2015.
https://www.liverpool.ac.uk/media/livacuk/flightscience/projects/cfd/wakeencounter/caa_helicopter_report.pdf

distinct features. When a helicopter is flying at low altitude, ground effect can distort its wake vortices, while the low forward speed causes a large wake skew angle.'

The CAA have published a number of Aeronautical Information Circulars (AIC) providing guidance and advice relating to Wake Turbulence for ATC personnel. The current AIC, P001/2015, was published on 22 January 2015 and states:

'5.2 When hovering, or whilst air taxiing, a helicopter directs a forceful blast of air downwards that then rolls outwards in all directions. This can create problems on the apron, in parking areas and to light aircraft movement on taxiways and runways. In particular there is a risk of damage to fixed-wing control runs and surfaces caused by helicopter downwash driving unlocked control surfaces forcibly against their stops. The risk of damage from this form of turbulence and from wake turbulence encounters may be reduced if the guidelines below are followed:

- (a) wherever possible and/or practicable segregate helicopter movements from fixed wing movements;*
- (b) whenever possible, ground taxi rather than air taxi;*

Note: Ground taxiing uses less fuel than air taxiing and minimises air turbulence. Hovering helicopter downwash turbulence, when produced in ground effect, has an increased horizontal flow; this increases proportionally with larger and heavier helicopters.

- (c) if it is necessary to air taxi, ensure that as wide a clearance as possible is maintained from other aircraft or loose ground equipment;*
- (d) when air taxiing, avoid flying over parked aircraft or vehicles;*
- (e) when helicopters and fixed wing aircraft must use common areas such as aprons, it is recommended that helicopters follow standard taxi routes in those areas. This will facilitate any following aircraft to visualise avoidance areas or areas of increased likelihood of wake turbulence encounter.....*

5.6 Controllers and pilots should consider wake vortices generated when helicopters hover taxi across active runways and apply the appropriate wake turbulence separation minima. Caution should be exercised when a helicopter or fixed-wing aircraft of lower weight category is cleared to land on a runway immediately after a helicopter of higher weight category has taken off from that runway's threshold. Additionally it should be borne in mind that the downwash and associated turbulence generated by a hovering helicopter can drift a substantial distance downwind and may therefore affect an adjacent runway.

5.7 In cruise flight, light fixed-wing aircraft should allow a substantial horizontal distance when passing behind and below helicopters.'

In addition the CAA provide guidance of pilots regarding wake vortex in CAA Safety Sense leaflet 15c. This states:

'HELICOPTERS

- a) *The AIC specifies minimum spacing between light aircraft and large helicopters. However, it is considered that any helicopter in forward flight generates more intense vortices than a fixed-wing aircraft of a similar weight. For example, the S76 is characterised as 'light', so no minimum spacing is recommended for another 'light' aircraft, but such a light aircraft has been turned over by an S76 vortex. When following a helicopter, pilots of light aircraft should consider allowing a greater spacing than they would behind a fixed-wing aircraft of similar size, especially if the helicopter has been hovering.*
- b) *Helicopters with rotors turning create a blast of air outwards in all directions, the strongest effect being downwind. This effect is not so significant when the helicopter with rotors turning is on the ground. It is most severe during hovering and hover taxiing, when the rotors are generating enough lift to support the full weight of the helicopter, and this creates the greatest downwash, out to a distance of approximately three times the rotor diameter.'*

Analysis

Given the pilot's report regarding the nature of the runway surface, it is considered probable that the uneven surface resulted in his aircraft becoming airborne before reaching its normal takeoff speed. The fact that the pilot was able to correct the initial wing drop and return the aircraft to wings level showed that the aircraft's speed, whilst lower than normal, was sufficient to allow roll control using the ailerons.

The light wind conditions prevalent during the takeoff would have prevented the rapid decay of the wake vortex produced by the hover-taxiing helicopter which had crossed the runway prior to G-AXLZ's takeoff. These conditions would also have caused the vortex system to progress across and along Runway 24. The presence of a wake vortex system over the runway could introduce significant aerodynamic effects on the PA18 during its takeoff. The inability of the pilot to correct the subsequent wing drop is consistent with the aircraft having been subject to such effects.

Conclusion

In view of the facts established during the investigation, it is considered that the most probable cause of the accident was a wake vortex encounter at low airspeed which resulted in an uncontrollable wing drop and subsequent contact with the ground.