Piper PA-28-140, G-AVLR

AAIB Bulletin No: 7/2002	**Ref: EW/C2001/8/4**	**Category: 1.3**
Aircraft Type and Registration:	Piper PA-28-140, G-AVLR	
No & Type of Engines:	1 Lycoming O-320-E2A piston engine	
Year of Manufacture:	1967	
Date & Time (UTC):	15 August at 0930 hrs	
Location:	Halesworth, Suffolk	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - Fatal	Passengers - N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence with IMC Rating	
Commander's Age:	58	
Commander's Flying Experience:	211 hours (of which 32 were on type)	
	Last 90 days - 6 hours	
	Last 28 days - 3 hours	
Information Source:	AAIB Field Investigation	

History of the flight

The pilot arranged to fly from Cambridge airport for a two hour flight in the area of Southwold. He was seen to carry out an external inspection of the aircraft and at 0848 hrs he called for taxi clearance. At 0858 hrs ATC cleared him for take off from Runway 23. At the time the weather conditions were good. The weather reported at Cambridge airport at 0920 hrs shortly after the pilot's departure gave a surface wind of 180°/ 8kt and CAVOK. The forecast wind at 2,000 feet was 190°/17 kt.

The tower controller observed the take-off but could not hear the sound of the engine due to soundproofing in the tower. Furthermore, even though the airfield was busy with other movements at the time of his departure, no other witnesses were identified who could comment on the sound of the engine. Shortly after take-off the pilot contacted the approach controller and advised him that he was leaving the circuit.

A radar recording of the transmissions from the aircraft's transponder showed that it turned left after departure and tracked directly towards Southwold. A witness, some 30 nm east of Cambridge at Walsham Le Willows, heard the aircraft pass overhead making an unusual rasping noise "as if the exhaust was detached or broken". The engine was not mis-firing, but was described as being "noisy for that size of aircraft". The witness estimated the altitude of the aircraft to be between 2,000 to 3,000 feet.

At 0928 hrs the Cambridge approach controller received a distress call from the pilot when he transmitted "PAN PAN PAN GOLF ALPHA VICTOR LIMA ROMEO LOSING POWER FIVE MILES WEST OF SOUTHWOLD". This was acknowledged by the controller and monitored by another aircraft on the frequency. A minute later the controller called the pilot who responded "LIMA ROMEO, LOOKING AT HALESWORTH AS A LANDING SITE".

Halesworth is a disused airfield 2.5 nm north-east of the local town. The main runway (disused) has agricultural buildings erected on its west side and there are straight metalled taxiways of sufficient length upon which to carry out a forced landing. A large flat open area is formed in the arc from 190°T to 250°T subtended between the two taxiways.

The controller attempted, on two further occasions, to contact the pilot to confirm his intended landing site but these transmissions were not acknowledged. A short unintelligible transmission however was received which could have possibly originated from the aircraft. At about this time a witness, 7.5 nm to the west of Southwold in the town of Halesworth, heard the aircraft engine running "roughly and then stop".

Occupants of a farm house, some 300 metres from the accident site, initially heard and then saw the aircraft approaching from the south with the wings level and at a height estimated to be 300 feet. They described the engine as making an irregular "put putting" noise as it passed overhead and out of sight. The aircraft's ground speed at this time, determined from the radar recording, was approximately 75 kt.

A further witness, who was a nurse, then saw the aircraft carry out a left turn at a low angle of bank with the aircraft yawed and skidding. This turn was later estimated to have been carried out with the aircraft still at a height of 300 feet agl. She also heard the unusual engine noise. Having turned left through approximately ninety degrees onto a westerly heading the aircraft descended with the wings level. It was described as being under control but obviously making a forced landing. Maintaining wings level and flying slowly the aircraft continued its descent and was eventually lost from sight behind trees.

There were two fields, containing a standing crops of peas approximately one metre high, between the aircraft and the perimeter of the disused airfield after the pilot completed his turn. Each field was 100 metres long in his direction of travel and 200 metres wide. They were separated by a row of low trees and bushes 12 to 14 feet high running from left to right across his track. The aircraft was estimated to be at 200 feet as it crossed the line of tall trees and bushes marking the eastern edge of the first field.

Concerned for the safety of the aircraft the nurse and the other witnesses set off in their cars to try to find it. It was eventually located by the farmer who approached the wreckage whilst his wife went to summon the assistance of a neighbour. The nurse and an off duty policeman also arrived on the scene and with those already present rendered medical assistance to the pilot until paramedics from the air ambulance arrived. A Search and Rescue Sea-King helicopter eventually evacuated the pilot to Ipswich hospital.

Medical Aspects

Evidence suggested that the pilot had had his 'lap and diagonal' restraint harness properly secured before he was released from his harness and removed from the aircraft. At some point during the impact however he had slipped sideways to the right, out of the upper body restraint, and struck his head on the instrument panel receiving a fatal injury . Post-mortem examination revealed no evidence of any pre-existing medical condition which might have caused or contributed to the accident.

Engineering investigation

The aircraft came to rest, erect, in the base of a 14 to 15 feet high hedge. As found, it was resting, upright, on top of its left wing, which had become separated from the aircraft at its root end and inverted. This wing had also broken structurally at the inboard end of the aileron cut-out. There was evidence that the aircraft had struck the hedge face with its upper surfaces before falling back into the position in which it was found. Although the rear fuselage and tail had been bent to the right and slightly downwards and the engine frame crushed rearwards, the cabin section had not been severely structurally distorted.

The aircraft had approached the accident location on a track of about 300°M, over gently falling ground which became level over the last 50 metres of the flight path. The left wingtip made first contact with the ground as it scythed through the 3 feet high crop, cutting a rapidly widening swathe for about 8 metres, along track. The ground-marks indicated that, at this point, the left outer wing had failed structurally at about 2/3 semi-span, had separated from the fuselage at the root end joint and the nose landing gear and engine had struck the ground. The nose landing gear had broken off, but there were no marks to indicate that either of the main landing gear wheels or the right wing had struck the ground in this area. There was no evidence of the aircraft sliding on the ground between the point of the engine contact and the hedge.

The condition of the propeller showed no evidence of significant power being developed by the engine at impact. Examination of the engine in situ revealed no obvious signs of mechanical failure. There was no significant oil spillage either within the engine bay, or anywhere between the point at which the engine had first struck the ground and where it came to rest. There was however an oily patina along the whole underside of the fuselage and tailplane.

The characteristics of the accident site were consistent with the aircraft having stalled and dropped its left wing whilst flying close to the ground. The aircraft then pitched into a steep nose down attitude and yawed to the left striking the ground before bouncing to strike the hedge top first, with the fuselage angled about 45° nose down and to the left.

A more detailed examination of the wreckage, at the AAIB, revealed that, before impact, the aircraft had been in a clean configuration, the controls were in a serviceable condition and the elevator trim was at a mid range setting. No evidence was found to suggest any malfunction or

failure of the airframe before impact. The pilot's harness was examined and the condition of both the lap strap and diagonal belt were found to be sound; neither showed significant evidence of being subjected to high loading during the impact.

Examination of the engine, however, revealed a massive internal mechanical failure consistent with there being a very rapid loss of oil contents or pressure. The big ends of the forward two connecting rods (No. 1 and 2) had both failed in tensile rupture. They had become so hot that their strength had reduced to the point where it was insufficient to sustain the inertial forces resulting from piston reversal at the top of the stroke. The associated No. 1 and 2 crankpins were extremely heavily scored. The big end bearing of the No. 3 rod had run sufficiently hot that the big end showed evidence of severe heat distress and the crankpin was also heavily scored. No. 4 big end showed some distress of the bearing surface and its crankpin exhibited light scoring and discoloration. By contrast, all the crankshaft main bearings were in good condition, as were all other lubricated surfaces within the engine. None of the debris generated by these failures had penetrated the crankcase and examination of the other internal components of the engine revealed no evidence of any other failure.

Examination of the ancillary equipment related to the oil lubrication system also revealed no evidence of any pre-impact failure or misassembly which could have resulted in a significant loss of engine oil or oil pressure. Examination of the engine compartment showed that, even following the impact, there was no significant oil wetting of any of the cowling interior surfaces nor of the firewall bulkhead. There was some evidence however of light oil mist wetting near the top of the nose landing gear leg. There was, also, evidence of relatively light oil wetting of the underside of the fuselage which had run obliquely aft, following the swirl pattern from the propeller wash.

There was no evidence of oil leakage through failed or displaced engine casings or seals. The only evidence of oil escape from the engine appeared to be associated with the crankcase breather and no evidence to support a logical explanation for this could be found.

Maintenance

The aircraft's records showed that it was properly certificated and had been regularly maintained to the appropriate schedule. The last maintenance performed had been a Star Annual inspection for the renewal of the aircraft's Certificate of Airworthiness. Additionally, during the inspection, two cylinders (No. 1 and 3) had been removed for overhaul and refitted. The associated new piston rings had been correctly installed on their pistons. Following reassembly, the engine had been filled with 8 quarts (7.5 litres) of an appropriate oil for bedding in the new rings.

The aircraft oil consumption after maintenance had been normal. One litre of oil had been added after 24 hours flying to bring the contents to 'full'. In the 6 hours flown since that time no further oil had been added. The pilot who had flown the aircraft for 35 minutes before the accident flight stated that the sump appeared to be full when he checked to 'dip stick'.

Discussion

Following the loss of engine power the pilot declared his intention to land at Halesworth He appears to have positioned his aircraft downwind for a left hand circuit to land on the airfield but which area he intended to land on is not known. There was sufficient distance available however to land on both the metalled and cultivated surfaces. The weather was good and both the surface wind and that at 2,000 feet were favourable. During the forced landing pattern however the pilot found

himself turning onto a base leg much lower than the recommended height for this manoeuvre of 1,000 feet. He had not selected any flap and was approximately 300 feet agl, with a ground speed of 75 kt and an estimated airspeed of 65 kt, as he commenced the skidding turn. The stalling speed for the aircraft in this configuration is 56 kts.

Having completed his turn he was faced with two fields between him and the airfield. He did not have sufficient distance to touch down in the first field without striking the line of trees and bushes which separated it from the second. The second field was also too small and both fields were cultivated with standing crops approximately one metre high. The aircraft ultimately stalled, albeit from a low height, and struck the ground short of the airfield in a pitched down attitude.

It is considered that the pilot may have allowed the airspeed to reduce to the stall either:

1. Inadvertently, whilst attempting to preserve as much height as possible by 'stretching the glide' to make the airfield from what had developed into a far from ideal position.

2. Intentionally, to minimise the effect of the crop pitching the aircraft forward as it came into contact with the landing gear.

3. Subsequently, as he attempted to pull up to 'balloon' over trees and bushes ahead of him.

It was not possible to positively identify which of the three possibilities had occurred. It was however considered that the yawing left turn combined with an attempt to pull up and balloon over the trees or an involuntary aft control input to avoid them was the most likely cause of the left wing drop.

The structure of the aircraft cabin was not severely distorted in the impact and the pilot's harness was secured and showed no sign of high loading. The fact that the pilot suffered a fatal injury to the head must therefore be considered to be as a result of the dynamic forces generated during impact forcing his upper body to slide sideways and out of the upper restraint. Lap and diagonal style harnesses can be relatively less effective in accident situations where the retarding forces are not along the aircraft's longitudinal axis.