

ACCIDENTS INVESTIGATION BRANCH
Department of Trade

Avions Pierre Robin DR 360, Robin
Knight G-AZOX
Report on the accident at Biggin Hill
Aerodrome, Kent on 21 July 1973

List of Civil Aircraft Accident Reports issued by AIB in 1974

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2/74	Piper PA-30 Twin Comanche G-AXRW at Shipdham Aerodrome, Norfolk, January 1973	April 1974
3/74	Slingsby T61A G-AYUO near Wycombe Air Park, Bucks., February 1973	May 1974
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5/74	Owl Racer 65-2 G-AYMS at Greenwich Reach, River Thames, London, May 1971	May 1974
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8/74	AA-1 Yankee G-AYHD at Beverley Nursery, near Uxbridge, Middlesex, April 1973	July 1974
9/74	Cessna F172H G-AYDC near Humphrey Head, Lancashire, December 1972	June 1974
10/74	Beagle A.61 Series 2 (Terrier) G-ARZT near Tonbridge, Kent, August 1973	July 1974
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12/74	Piper PA-30 Twin Comanche G-ASLD at Newchurch, Isle of Wight, May 1972	August 1974
13/74	Tiger Moth G-APVT and Rollason Beta G-ATLY at Nottingham Airport, September 1973	<i>(forthcoming)</i>
14/74	Cessna F172H G-AVHI in the sea 44 nm east of Wick, Scotland, December 1973	October 1974
15/74	AESL Airtourer T6/24 G-AYMF near Lands End, Cornwall, June 1972	September 1974
16/74	Piper PA 28-140 G-AVBM at Kingscote, near Dursley, Gloucestershire, August 1973	September 1974

Department of Trade
Accidents Investigation Branch
Shell Mex House
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6 August 1974

The Rt Honourable Peter Shore MP
Secretary of State for Trade

Sir,

I have the honour to submit the report by Mr R D Westlake, and Inspector of Accidents, on the circumstances of the accident to Avions Pierre Robin DR 360, Robin Knight G-AZOX which occurred at Biggin Hill Aerodrome, Kent on 21 July 1973.

I have the honour to be
Sir
Your obedient Servant

W H Tench
Chief Inspector of Accidents

Accidents Investigation Branch
Civil Aircraft Accident Report No 17/74
(EW/C457)

Aircraft: Avions Pierre Robin DR 360, Robin Knight
G-AZOX

Engine: Lycoming 0-320 D2A

Registered Owner: Mr A W Hobbs

Operator: Sportair Flying Club Limited

Pilot: Mr M H Jones – Killed

Passengers: Three – 1 Killed
– 2 Seriously injured

Place of Accident: Biggin Hill Aerodrome, Kent

Date and Time: 21 July 1973 at 1113 hrs

All times in this report are GMT

Summary

During the initial climb after take-off for a cross-country flight the aircraft's engine lost power at about 200 feet. The pilot attempted to turn back to the airfield and the aircraft stalled in the turn manoeuvre, entered a spin and crashed just inside the airfield boundary. The pilot and one passenger were killed; the other two passengers were seriously injured. The cause of the engine loss of power has not been determined.

1. Investigation

1.1 History of the flight

The pilot, who was a member of the Sportair Flying Club at Biggin Hill, booked out for a club authorised cross-country flight to Shobden, Herefordshire.

Shortly before 1100 hrs the three passengers boarded the aircraft and at the same time the pilot was seen walking around it presumably carrying out an external pre-flight check. At approximately 1105 hrs the pilot called Biggin Hill Tower by radio and requested taxi clearance for Shobden; the aircraft was later seen at the holding point for Runway 23 where power and pre-take-off checks are carried out. At 1111 hrs the pilot was given clearance to take-off.

The aircraft took-off on Runway 23 and climbed away normally to an estimated height of 200 feet just over the airfield boundary. Although the engine had sounded normal during the climb, evidence from witnesses indicated that at this point engine noise suddenly decreased and the propeller was seen to be turning slowly. The aircraft then appeared to level off for about 3 seconds followed immediately by a bank to the left of approximately 45°.

The aircraft turned through approximately 90°, still at the same height, after which the wings were momentarily levelled; the aircraft then banked steeply to the left and the nose dropped. The turn continued through a further 90° as the aircraft descended steeply towards the ground and crashed just inside the airfield boundary.

1.2 Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>
Fatal	1	1	—
Non-fatal	—	2	—
None	—	—	—

1.3 Damage to aircraft

The aircraft was destroyed by impact.

1.4 Other damage

No other damage was caused.

1.5 Crew information

Commander:	Mr Malcolm Harvey Jones, aged 35.
Licence:	Private Pilot's Licence, valid to 15 May 1977.
Ratings:	Aircraft, Group 'A'.
Last medical examination:	20 January 1973, assessed fit.
Total pilot hours:	184.
Total hours in command of Robin DR 360 and DR 400 aircraft:	About 61. (Note, the DR 400 is a more powerful version of the DR 360).
Last flight on G-AZOX:	17 June 1973.

Mr Jones was considered by his club management to be an extremely thorough and reliable person, in illustration of which the club used him at times to position aircraft and as a safety pilot. He received training at Biggin Hill which included the procedure to adopt in the event of an engine failure shortly after take-off, during which training the following points were stressed:

- (i) Lower the nose to maintain gliding speed.
- (ii) Land as nearly as possible straight ahead.
- (iii) Tighten harness and switch off fuel and ignition.

1.6 Aircraft information

The aircraft was built by Avions Pierre Robin, Dijon, France in 1972 and issued with a United Kingdom Certificate of Airworthiness in the General Purpose Category on 12 May 1972. The engine, a Lycoming O-320-D2A was manufactured in 1971 and was fitted with a Sensenich fixed pitched metal propeller.

Both the airframe and the engine had been maintained in accordance with an approved maintenance schedule.

Airframe and engine flying hours since the issue of the Certificate of Airworthiness: 511.

Airframe and engine flying hours since last inspection, a Check 2: 19.

At take-off the aircraft's weight and centre of gravity were within the prescribed limits and the fuel tanks contained 34 gallons of 100/130 Avgas (petrol). The aircraft was filled with four fuel tanks: one in each wing each with a capacity of 8.8 gallons, a main fuselage tank with a capacity of 16.5 gallons and an auxiliary fuselage tank with a capacity of 11 gallons. The auxiliary tank feeds into the main fuselage tank via a separate on/off cock controlled from the cockpit. During the investigation it was established that the two wing tanks and the main fuselage tank had been topped up to full the evening before the accident flight; the auxiliary fuselage tank was not filled. The aircraft had not flown since that refuelling was carried out. Each tank, including the auxiliary, is equipped with an individual electrical contents gauge positioned on the cockpit instrument panel. Although it is possible to make a pre-flight visual check of the fuel contents of the two wing tanks via the tank filler neck, this is not possible for the two fuselage tanks whose filler necks curve through 90°.

1.7 Meteorological information

A weather observation taken at Biggin Hill at the time of the accident was as follows:

Surface wind:	240°/10 knots.
Visibility:	10 kilometres.
Cloud:	6/8 at 2,500 feet.
Temperature:	+18°C.
Relative humidity:	69 per cent.
QNH:	1005.

The weather is not considered pertinent to the accident.

1.8 Aids to navigation

Not applicable.

1.9 Communications

VHF radio communication between the aircraft and Biggin Hill Tower was normal. The final message was an acknowledgement by the pilot of his clearance to take-off.

1.10 Aerodrome and ground facilities

Biggin Hill Aerodrome, near Westerham, Kent is at an elevation of 600 feet. The tarmac Runway 23, from which the aircraft took-off, has a length of 837 m. From the end of the runway the ground falls away in a south-westerly direction, over a distance of approximately one mile, into a valley which has an elevation of about 400 feet. The area is relatively unobstructed and consists of crop and pasture land.

1.11 Flight recorder

No flight recorder was required or fitted.

1.12 Wreckage

The aircraft struck the ground just inside the airfield boundary in a steep left bank nose-down attitude, port wing first followed immediately by the nose. It came to rest on the southwest corner of the southern taxiway 60 m from the point of initial impact. Severe impact damage was caused to the port wing, to the engine and propeller and to the cockpit of the fuselage.

Examination of the wreckage showed that the aircraft had been structurally complete at the time of impact and that the flying controls had been functioning correctly. The flaps were extended although their exact position could not be determined because of crash damage; the flap selector lever in the cockpit was selected to the full flap position. The damage to the propeller indicated that it had not been rotating under power when it struck the ground.

The engine had received substantial crash damage mainly localised to the No 2 cylinder assembly, however it was possible to make an extensive strip examination and to check all engine components with the exception of the carburettor. This detailed examination revealed no evidence of mechanical or electrical failure which could have caused or contributed to a loss of engine power. No evidence of faulty maintenance was found and lubrication throughout was satisfactory.

The carburettor, which is on the underside of the engine, received very extensive crash damage, the various parts being widely scattered at the wreckage site. Because of its disintegrated and damaged state it could not be tested and it has not been possible to establish whether or not this component was functioning correctly at the relevant time.

The left wing fuel tank, which had been torn off and flattened during the wing disintegration, still contained about one pint of fuel; there was also evidence of fuel spillage in the left wing crash area. The right wing fuel tank was torn open but still contained approximately 3½ gallons of fuel. The main fuselage tank received crash damage to its left front bottom corner and to the filler neck from which the cap had been torn off; it contained no fuel when it was examined some hours after the accident. The tank was found lying on its left side at a very steep angle, consequently any fuel which had been in the tank could have drained out via the filler neck and/or the damaged corner. However there was evidence of 'bulging' of the tank consistent with inertia loading of fuel and therefore it is considered that at the moment of impact the tank had contained a substantial quantity of fuel. The auxiliary fuselage tank was undamaged and contained a small amount of residual fuel; its on/off valve was in the close position. There was a considerable amount of spilt fuel on the ground in the general area of the left side of the cockpit and also below the right wing; this was hosed down by the fire service when they arrived a

few minutes after the time of the accident. The four fuel tank gauges were strip examined in a laboratory. The two wing tank and the main fuselage tank gauges showed smear/scrape marks made by the needles on the faces of the instruments corresponding to a full tank reading in each case. The auxiliary fuselage tank gauge indication was inconclusive but probably reading empty. The rod linkage which connects the cockpit tank selector handle to the selector valve was broken in two places but the selector valve itself was fully selected to the right wing tank.

1.13 Medical and pathological information

A full post mortem examination and toxicological analysis of the two persons killed did not reveal any medical cause for or contribution to the accident. The cause of death of the pilot, who was in the front left hand seat, was multiple injuries; the cause of death of the female passenger, who was seated in the rear right hand seat, was a fracture dislocation of the neck.

The passenger in the front right hand seat; a young lady of slight build, suffered severe multiple injuries; she was discharged from hospital on 26 October 1973.

The passenger in the rear left hand seat, a young boy aged 8 years, suffered a head injury with fractured skull and fractured zygome; he was discharged from hospital on 4 August 1973.

The lady passenger has no recollections of any of the events on the day of the accident whilst the boy can recall events up to and including the take-off ground roll but nothing after this point. Because he was sitting behind the pilot he was unable to provide any material evidence concerning the pilot's pre take-off cockpit actions.

1.14 Fire

There was no fire.

1.15 Survival aspects

A number of flying club pilots arrived at the crash scene immediately. After moving the aircraft, which was lying on its left side, to a more level position they attempted to extricate the occupants; however some delay was experienced as those first at the wreckage were unfamiliar with the buckle of the lap-straps, a side latch and flap type, that all four occupants were wearing. One and a half minutes after the accident the situation was remedied with the arrival of the airfield crash crew who were familiar with the buckle, and all occupants were carried from the wreckage and given first aid. Ambulances arrived at 1133 hrs and took the victims to hospital.

There is no apparent pattern in the fact that the pilot and one passenger seated in the front left hand and rear right seats respectively were killed, whereas the two other passengers who were seated in the front right and rear left seats, were seriously injured.

1.16 Tests and research

There was no evidence to explain the apparent power failure and therefore a most detailed examination of the fuel system was made together with some tests to determine the consequences of a possible mis-selection of the fuel selector valve. Laboratory tests made on samples of the residual fuel proved it to be satisfactory.

Fuel from the two wing tanks and the main fuselage tank feeds to a selector valve operated by a control handle in the cockpit. From this valve it feeds via a filter, an electric booster pump and an engine driven mechanical pump to the carburettor. The control handle has four clearly marked and positive detents viz:

12 o'clock (forward):	'off'.
9 o'clock:	left wing tank.
6 o'clock:	main fuselage tank.
4 o'clock:	right wing tank.

Movement of the control handle and valve is limited to the 270° sector from the 12 o'clock position anticlockwise round to the 3 o'clock position and vice-versa. A certain amount of force is necessary to move the handle out of each detent.

Tests of the fuel system of a similar aircraft to G-AZOX were made. With the aircraft stationary it was found that at full throttle the engine would continue to run with the fuel selector at any intermediate position between tanks. The engine would lose power only when the fuel selector was placed to 'off'; under this condition, after approximately 17 seconds, the engine would falter but would regain full power immediately the fuel selector was moved to a tank 'on' position. A static test was made of a simulated take-off in which the fuel selector was turned 'off' during the pre-take-off checks followed by a simulated immediate taxi onto the runway at taxiing rev/min and a full throttle simulated take-off. A time of between 22 and 25 seconds was used at taxiing rev/min and the engine cut at full throttle between 36 and 40 seconds after turning the fuel selector 'off'.

2. Analysis and Conclusions

2.1 Analysis

Eyewitness evidence and the circumstances of the accident suggest strongly that the aircraft's engine lost power at a critical time during its initial climb after take-off but it has not been possible to establish a reason for this power loss. A detailed examination of the engine did not reveal any evidence of mechanical failure or malfunction. The airframe and flying controls were also examined, but these too showed no evidence of pre-crash failure or malfunction and are not considered to have had any bearing on the accident. The only engine feature which has not been eliminated is the possibility of some form of carburettor malfunction; the carburettor had suffered such extensive damage at ground impact that it is not possible to assess its pre-crash serviceability.

The circumstances of the power loss are strongly suggestive of fuel starvation. There was no evidence to suggest any compelling reason for the pilot to have deliberately closed the throttle at such a critical stage of flight and then kept it closed. It is equally unlikely that the power loss was due to carburettor icing. Any icing which might have built up during part throttle taxiing would be unlikely to further increase at the full throttle setting used during take-off and would have shown up as reduced power during the take-off roll rather than as an abrupt and total power loss at about 200 feet.

If the fuel selector handle had been mistakenly positioned to 'off' just before take-off then, as shown by tests, it is possible that the aircraft could have reached about 200 feet before a power loss. However the selector valve itself was found fully open to the right wing tank, ie the full 270° travel from the 'off' position. It is remotely possible, but unlikely, that random cockpit disruption or impact forces could produce the necessary 270° of movement from 'off' to the right wing tank selection; this implies that the selector was out of the 'off' position before the time of impact.

It was established beyond all reasonable doubt that there had been adequate fuel in all three main tanks. It was also established that, except for the 'off' position, continuous full engine power could be achieved with any fuel selector position including intermediate ones. Therefore, even if the selector had been at 'off' during take-off, power should have been restored the instant it was moved out of the 'off' position. In these circumstances, and also because of the pilot's reputation as a reliable and thorough individual, a fuel

mis-selection is not considered to be a tenable hypothesis and it appears that fuel was available as far as the carburettor. As previously noted it is not possible to offer any conclusions as to carburettor serviceability nor, therefore, any conclusions as to the cause of the power loss.

Although it has not been possible to establish a reason for the loss of engine power it is apparent that the basic cause of the accident was an attempt by the pilot to return to the airfield from which he had just departed. Witnesses evidence shows that whilst turning back towards the airfield the aircraft stalled and the left wing and nose dropped. Wreckage examination indicates that the pilot had probably extended full flap at some time after the engine lost power and in this configuration a left wing drop has been experienced by pilots during stalling exercises on this type of aircraft.

For many years flying training has emphasised the procedure to follow in the event of engine failure after take-off. Fundamental advice is to carry on ahead, make gentle turns to avoid obstacles and put the aircraft into the best open space available. Although, exceptionally, it may be advisable to revise this conventional drill where the periphery of the airfield is totally unsuitable ground for forced landing because of built-up areas etc, the basic tenet 'do not turn back', is generally recognised as being the safest course to adopt. In this accident the ground ahead of the aircraft, at the time of the engine loss of power, was quite suitable for a forced landing; furthermore, the pilot had received training on engine failure after take-off over this very same area and had been instructed to continue straight ahead and choose a suitable field in the valley which bordered the western boundary of the airfield. The investigation has not revealed any compelling circumstances which may have influenced the pilot to attempt to return; consequently it must be assumed that he was attempting to save the aircraft from possible damage, and believed he had sufficient speed and height safely to carry out a 180° turn followed by a landing. The accident that followed this manoeuvre illustrates the probable result when a pilot of average experience attempts to take action counter to well established procedures.

2.2 Conclusions

(a) Findings

- (i) The documentation of the aircraft was in order, it had been properly maintained and its weight and centre of gravity were within authorised limits.
- (ii) The pilot was properly licensed and experienced and had received training on the action to take in the event of an engine failure on take-off.
- (iii) The aircraft suffered a loss of engine power at about 200 feet during the initial climb after take-off.

- (iv) The cause of the loss of engine power has not been determined.
- (v) The terrain ahead of the aircraft was relatively unobstructed and suitable for a forced landing.
- (vi) The pilot attempted to return to the airfield from which he had just departed.
- (vii) During the turn back the aircraft stalled, entered a spin and crashed just inside the airfield boundary.

(b) *Cause*

The accident resulted from a stall at too low a height to permit recovery during an attempt to turn back following a loss of engine power soon after take-off.

R D Westlake
Inspector of Accidents

Accidents Investigation Branch
Department of Trade

August 1974