

ACCIDENTS INVESTIGATION BRANCH
Department of Trade and Industry

Piper PA 23-250 Aztec G-APXN
Report on the accident at Gleneagles, near
Auchterarder, Perthshire, on 23 June 1971

List of Civil Aircraft Accident Reports issued by AIB in 1972

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Department of Trade and Industry
Accidents Investigation Branch
Shell Mex House
Strand
London WC2

25 January 1972

The Rt. Honourable John Davies MBE MP
Secretary of State for Trade and Industry

Sir,

I have the honour to submit the report by Mr R C Warren, an Inspector of Accidents, on the circumstances of the accident to Piper PA 23-250 Aztec G-APXN which occurred at Gleneagles, near Auchterarder, Perthshire on 23 June 1971.

I have the honour to be
Sir,
Your obedient Servant,

V A M Hunt
Chief Inspector of Accidents

Accidents Investigation Branch
Civil Accident Report No EW/C387

Aircraft: Piper PA 23-250 Aztec G-APXN
Engines: Two Lycoming 0-540-AID 5
Owner: Cirrus Aviation Ltd
Operator: Cirrus Aviation Ltd
Pilot: Mr D G D Roberts – killed
Passengers: One – seriously injured
Place of Accident: Gleneagles, near Auchterarder, Perthshire
Date and Time: 23 June 1971 at 2323 hrs

All times in this report are GMT

Summary

The aircraft was returning to its base at Auchterarder (Strathallan) at night after a flight to the Isle of Barra and Glasgow.

When approximately 3 miles out from the airfield, the aircraft hit the tops of fir trees near the Gleneagles Golf Course where the ground is 600 feet above mean sea level (amsl). The pilot was killed and the passenger seriously injured. The weather in the area was generally overcast with patches of stratus between 500 and 1,000 feet covering high ground. The report concludes that although the cause of the accident could not be established with certainty, it appears likely that it was due to the pilot descending prematurely when he had not positively established his position to be clear of high ground.

1. Investigation

1.1 History of the flight

The aircraft, which was based at Auchterarder (Strathallan) airfield in Perthshire, had left there earlier in the day for a private flight to the Isle of Barra and Glasgow. Before departure the pilot had informed the ground staff that he expected to return at approximately 2130 hrs that night. He was accompanied on the flight by an employee of Cirrus Aviation Ltd. After spending the day at Barra, the aircraft took-off at dusk and arrived at Glasgow at 2208 hrs. After experiencing some difficulty in re-starting the engines due to low battery voltage, the aircraft left Glasgow at 2300 hrs on a special visual flight rules (VFR) clearance to Auchterarder.

Prior to take-off, the pilot was seen by his passenger to reset both altimeters after he had been informed by Air Traffic Control (ATC) that the Glasgow QNH was 1013.5. However she was unable to say if the altimeter sub-scales were accurately set to this value. After take-off the aircraft was seen by ATC on radar to track towards the northeast and to clear the zone boundary at 2306 hrs. At this point the pilot was told that flight information was available on 133.2 MHz which he acknowledged, but there is no record of any subsequent transmission from the aircraft on this or any other frequency.

The passenger recalls that after leaving Glasgow, the conditions became noticeably darker although she was unaware of any particular deterioration in the weather. At about this time, an aircraft at low altitude was heard to circle Dunblane, a town directly on track from Glasgow to Auchterarder. The passenger confirmed that this might have been G-APXN as she recalled that the pilot wanted to point out to her some local feature to the south of the town, but she was unable to recall at what height this circuit was flown. After overflying Dunblane, the pilot asked his passenger if she knew the name of the next town, the lights of which she could see ahead and slightly to starboard. She replied that it was Blackford and the pilot agreed.

The aircraft was next seen by the occupants of a house some 4½ nautical miles short of the accident site when it flew directly overhead at a low altitude on a northeasterly heading and although the navigation lights were the most noticeable feature, the aircraft was low enough for its general shape also to be discernible against the night sky. Apart from its unusually low altitude the aircraft appeared to these witnesses to be functioning normally. One of the witnesses also noted at the time that there was mist on the foothills which lay a short distance to the southwest of the house.

At some time after midnight (local time) the occupants of a caravan parked on the Auchterarder-Braco road near the Gleneagles Hotel heard the sound of breaking trees and tearing metal. When they went out to investigate they first noticed a strong smell of petrol and shortly afterwards discovered the wreckage of an aircraft in the wood bordering the road. After finding that one of the occupants was alive, although seriously injured, they sought the assistance of the hall porter at the Gleneagles Hotel, who in turn informed the police. When this witness went to the accident site shortly afterwards he noticed that there were dense patches of drifting mist in the area and that these extended up to the tops of the trees.

1.2 Injuries to persons

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

1.3 Damage to aircraft

Destroyed.

1.4 Other damage

Destruction of a small number of fir trees lining the Auchterarder-Braco road on the Strathallan estate.

1.5 Crew information

Mr David Gordon Denby Roberts, aged 31, was the sole director of Cirrus Aviation Ltd which was based at Auchterarder. He held a valid private pilot's licence with the following endorsements and ratings:

Certificate of Test for the PA 23 aircraft dated 2 June 1970

Group A & B aircraft

IMC Rating (valid until 18 February 1972)

Night Rating

R/T Licence

Medical Certificate (valid until 26 May 1972).

Mr Roberts learnt to fly with the University of Edinburgh Air Squadron in 1958 and since that time he had flown regularly as a private pilot, mostly from Auchterarder. He was well acquainted with the local flying area and he was known to regard 600 feet amsl as the minimum safe altitude in the vicinity of the River Earn valley in which Auchterarder airfield is situated. His total flying at the time of the accident was 587 hours of which 115 hours were in the Piper Aztec PA 23-250, 70 of these being as pilot in command. He had flown approximately 34 hours on instruments, of which 4 hours had been in the last six months. His total at night was 17 hours, of which 9 hours were on the Piper Aztec.

Mr Roberts had landed at Auchterarder at night on five occasions, all within the previous three years. Three of these occasions had been in the Aztec, the last being on 21 December 1970. Prior to his departure to Barra on the day of the accident, Mr Roberts last flew on 16 May 1971.

1.6 Aircraft information

The aircraft was manufactured by the Piper Aircraft Corporation, Pennsylvania, USA in May 1960 and flown to the United Kingdom shortly afterwards with a valid American export certificate of airworthiness.

The aircraft was bought by Mr Roberts in October 1969 and registered in the name of Strathallan Air Services Ltd. In July 1970, the aircraft was transferred temporarily to the Icelandic register, but was re-acquired by Mr Roberts in November 1970 and restored to the United Kingdom register the following month in the name of Cirrus Aviation Ltd. The certificate of airworthiness, which was valid for two years, had been renewed on 28 May 1971.

The records showed that the aircraft had been maintained in accordance with an approved maintenance schedule and that it had flown 9 hours since the last certificate of maintenance was issued on 4 June 1971.

At the time of the accident the aircraft had flown 3,203 hours.

1.7 Meteorological information

Witnesses stated that in the area where the aircraft crashed there were dense patches of drifting mist which extended at least up to tree top level. Also at Auchterarder airfield it was noticed that there was a halo of thin ground mist around some of the runway lights.

The pilot did not visit the meteorological office at Glasgow prior to his departure for Auchterarder and there is no record of any weather information being obtained by him from any other source.

A weather appreciation prepared by the Meteorological Office for the Gleneagles/Auchterarder (Strathallan) area at about the time of the accident contained the following information:

Weather:	There was widespread rain over central and north Scotland but this was intermittent and slight.
Cloud:	There was extensive low stratus over the east coast of Scotland, but inland the cloud base was relatively high. Glasgow and Turnhouse were reporting no cloud below 5,000 feet. Extensive low cloud was not likely to form in the area, though patches could have formed on the hills and in precipitation outbreaks.
Visibility:	Generally 10 kilometres, but 6-8 kilometres in rain and 200 metres or less in hill fog.

Wind: 230^o, 15 knots.
Regional QNH: Portree – 1010
Turnhouse – 1013.3
Leuchars – 1013.2
Glasgow – 1013.5

1.8 Aids to navigation

The aircraft was equipped with two VOR receivers, both of which were badly damaged. The No 1 receiver was tuned to the Glasgow ILS, the out-bound heading of which was 057^o magnetic. This was close to the aircraft's track from Glasgow to Auchterarder (050^o) and it is possible that the ILS was being used for track guidance by the pilot.

The No 2 VOR was found tuned either to 112.0 or 113.0 MHz, neither of which frequencies could be related to any station within the area, with the possible exception of Talla (113.8 MHz). A radial of 358^o was selected on the No 2 VOR omni-bearing selector and this is close to the magnetic bearing of Auchterarder from Talla (355^o). Thus it is possible that the pilot was using Talla VOR to indicate his proximity to Auchterarder, though it is highly improbable that signals from this station would have been received in the Auchterarder area below 2,000 feet.

The aircraft's ADF receiver was tuned to 277 KHz which is very close to the frequency of the Auchterarder non-directional beacon (276 KHz). This was known to be a difficult beacon to identify due to heavy background static. It had also been unserviceable for some time and the pilot was thought to be aware of this.

1.9 Communications

The last recorded transmission from the aircraft was to Glasgow tower on 118.8 MHz at 2306 hrs. Subsequent to this call, no further transmission was heard on any other frequency by stations in the area.

The aircraft was equipped with two VHF transceivers, both were badly damaged. No 1 VHF was tuned to 123 MHz, the decimal figures having disappeared due to impact damage. This approximates to the frequency of 123.5 MHz to which the single channel VHF equipment at Auchterarder was tuned. However this ground equipment was not switched on or manned at the time of the aircraft's approach, though usually it was when an aircraft was expected.

The No 2 VHF was possibly tuned to 122.5 MHz, which was close to the Leuchars VDF frequency (122.1 MHz). The pilot had used this facility in the past when practising cloud break procedures in the Auchterarder area, but there was no record at Leuchars of any transmission on this frequency from G-APXN at the time of the accident flight.

1.10 Aerodrome and ground facilities

Auchterarder (Strathallan) airfield (120 feet amsl) is situated in the River Earn valley some 14 nautical miles southwest of Perth. It is surrounded on three sides by high ground, the foothills of which are approximately 4 nautical miles distant. The approaches are clear of high ground along the River Earn valley and also to the southwest through a gap in the hills some 5 nautical miles wide, but here the ground extends up to 600 feet amsl. It was in this gap that the accident occurred.

The airfield consisted of a single grass runway 28/10, which at the time of the accident had been marked by gooseneck flares in anticipation of the aircraft's return. These were still burning the following morning.

1.11 Flight recorder

There was no requirement for a flight recorder and none was fitted.

1.12 Wreckage

An examination of the wreckage trail, together with height measurements of impact marks on the trees, indicated that the aircraft was approximately in straight and level flight when it struck the tops of 50-foot fir trees with its starboard wing tip and starboard engine nacelle. The trees were in part of a wood bordering the Auchterarder-Braco road where the ground is 600 feet amsl; the position relative to Auchterarder airfield was 2.9 nautical miles on a bearing of 207° (magnetic).

After the first impact the aircraft continued at about the same level for 28 yards during the course of which it struck four more trees. It then dived into the wood coming to rest 60 yards further on. During its passage through the trees the aircraft sustained progressive damage to all parts of its structure and on impact with the ground broke up completely. The starboard propeller was flung forward a further 36 yards. The port side of the cockpit was completely crushed by collision with the base of a tree. All the fuel in the tanks, an estimated 30 gallons of 100/130 octane, was released at impact but there was no fire.

The overall length of the wreckage trail was 124 yards on a bearing of 050° (magnetic).

A detailed examination of the wreckage after it had been removed to a hangar indicated the following:

- (a) Configuration – landing gear up
flaps up
stabilator anti-balance tab set to give a small amount of nose-down trim.
- (b) The aircraft was structurally complete when initial impact occurred. All doors and hatches had been secure in flight.

- (c) Both engines were under power. There was no evidence in either of pre-crash failure or malfunction.
- (d) The aircraft clock was stopped by impact damage at 2323 hrs.
- (e) Both electrical and vacuum driven instrument gyros showed signs of rotational damage, indicating normal functioning prior to impact.
- (f) Both altimeters were set to 1014.5 mbs. The port altimeter was extensively damaged and all the pointers had been torn off. However the 'hundreds' point had left an impact mark on the instrument face and under ultra violet light this mark could be seen to correspond to a reading of approximately 530 feet. The starboard altimeter was undamaged apart from a fractured layshaft pivot which under microscopic examination could be seen to have failed in shear. It is considered that this occurred during impact.
- (g) The condition of the filaments in the navigation and cabin lights indicated that they were on at impact.
- (h) The cabin heater was selected to 'OFF'.
- (i) Both fuel cocks were selected to their respective outboard tanks; the crossfeed cock was 'OFF'.
- (j) The left hand seat had become detached from the aircraft at final impact and its lap strap was undone. The right hand seat was still attached to the aircraft structure and its left hand lap strap showed signs of having failed in tension.
- (k) There was no indication of pre-crash failure of the flying control system.

1.13 Fire

There was no fire.

1.14 Survival aspects

The absence of fire and the fact that the starboard side of the cockpit was not in direct collision with a tree was largely responsible for the survival of the passenger in the right hand seat.

2. Analysis and Conclusions

2.1 Analysis

A study of the evidence obtained, particularly that relating to the impact damage to the trees and the condition of the wreckage, suggests that at the moment of impact the aircraft situation was as follows:

- (i) It was flying in approximately straight and level flight at 650 feet amsl on a heading of 050^o (magnetic).
- (ii) The time, as given by the aircraft clock and believed to be accurate, was 2323 hrs.
- (iii) The aircraft was possibly flying in or had just entered the tops of low cloud.
- (iv) The aircraft was serviceable and functioning normally in every respect.

All the indications are that the accident was due to the pilot not allowing sufficient vertical clearance above the terrain over which he was flying and that this in turn was due to either an error in height interpretation or an error in navigation. This analysis attempts to identify which of these two alternatives was the most likely.

Height error

In examining the first of these two alternatives, note has to be taken of the setting of 1014.5 mbs applied to the sub-scales of both altimeters. It is considered that this was the pre-crash setting in both cases as it is extremely unlikely that the sub-scales would have been moved to precisely the same value by impact forces, especially as the port altimeter was badly damaged and the starboard one relatively undamaged. This setting of 1014.5 mbs did not relate to any regional or airfield pressure in the central Scottish area at the time of the accident, though it was exactly 1 mb different to the Glasgow QNH which had been passed to the pilot prior to departure. It must be assumed therefore that an error in setting up the sub-scales was made at that time.

The actual pressure in the Auchterarder area at 2300 hrs, calculated by an interpolation of those recorded at neighbouring stations, was 1013.3 mbs. Therefore with the sub-scales set to 1014.5 mbs, the altimeters would have been over-reading by 35 feet, or in other words the aircraft would have been flying 35 feet lower than that indicated. This is not a significant error as it is well within the normal variation of height keeping accuracy when an aircraft is being flown by external reference as is believed to have been the case in this instance.

Thus at the moment of impact, the aircraft's altimeters would have been reading approximately 685 feet amsl. It is assumed incidentally that throughout this flight the pilot would have interpreted all altimeter indications as being above sea level, as it is known that he habitually flew in the Auchterarder area with his altimeters on the QNH, that is, set to read height above sea level.

If at the time of the accident the pilot knew his position precisely, then it can be assumed, because of his intimate knowledge of the area, that he was aware that the aircraft had still to cross a 600 foot ridge before reaching the River Earn valley. As it was night time, it is hardly conceivable that in these circumstances he would deliberately have allowed a vertical clearance above the ground of only 85 feet and considerably less above the tree tops.

Therefore it follows from this that, if the accident was not due to a navigation error, then the low altitude of the aircraft over the 600 foot ridge can only have been unintentional, either because the pilot was not monitoring his altimeter indications closely enough or because he had misread them. Once again it is hardly conceivable in the circumstances that the pilot would not have been paying particularly close attention to his altimeter indications at this stage of the flight. Therefore, though it must always remain a possibility that the accident was due solely to altitude unawareness, it seems unlikely in the overall circumstances of the flight.

Navigation error

The possibility that the accident was due to an error of navigation, as a result of which the pilot reduced height prematurely over high ground, has to be considered in relation to a local safety height of 600 feet amsl which the pilot was known to consider as the lowest safe minimum in the immediate vicinity of Auchterarder airfield. A study of the local topography makes it clear that this minimum safe altitude (which was not officially promulgated) applied only to the River Earn valley between the airfield and Perth and not the region over which the aircraft was flying at the time of the accident.

Before reducing to a height of 600 feet amsl, the pilot would first have had to ensure that he was over the valley, and it seems possible that at the time of the accident this is where Mr Roberts believed himself to be, for the following reasons.

After leaving Dunblane, it would appear that both the pilot and his passenger correctly identified the lights of Blackford ahead and slightly to starboard. It was at about this time that the aircraft was seen by three witnesses as it flew directly over them at a point approximately 4½ nautical miles from the accident site. Their evidence indicated that it was then flying on a heading of 050° magnetic (ie the same as the impact heading). This course would have brought the aircraft to just south of the airfield in a favourable position from which to turn on to the runway heading. Thus it would seem from this evidence that the aircraft was correctly on track at this stage and remained so up to the moment of impact. Therefore if there was a navigation error, it can only have been in range and that the pilot believed himself to be further along

track than he actually was. The only evidence to support this is that when he flew over the witnesses referred to, the aircraft appears to have been flying at a height subsequently calculated to be about 700 feet above ground level or at approximately 1,200 feet amsl. However, when the aircraft hit the trees 4½ nautical miles further on it was at 650 feet amsl. Assuming that the aircraft was flying at normal cruising speed, this indicates that a descent of approximately 300 feet per minute was initiated or continued at the last point of sighting. The only explanation for this descent, if it was deliberate, is that the pilot believed he was approaching the River Earn valley over which it was safe for him to descend to 600 feet. In point of fact he was still 7 nautical miles from the airfield at that stage and the reason for this error may have been the lack of normal visual cues due to the presence of low stratus of which the pilot was most probably unaware. Also, although the pilot knew the area well, his experience of flying at night in the area was limited.

Although there was no positive evidence to say that the pilot was in error as to his position along track, it is considered that this is the most likely explanation and in consequence of which he began his descent to the airfield prematurely and struck intervening high ground.

2.2 Conclusions

(a) Findings

- (i) The aircraft was properly loaded and its documentation was in order.
- (ii) The aircraft had been maintained in accordance with an approved maintenance schedule.
- (iii) The pilot was properly licensed. His experience of flying at night in the Auchterarder area was limited.
- (iv) A detailed examination of the wreckage did not reveal any signs of pre-crash failure or malfunction.
- (v) The aircraft was on track from Glasgow and on the correct heading.
- (vi) There were patches of low stratus covering the high ground in the area of the accident.
- (vii) The aircraft had descended to 650 feet amsl shortly before impact.
- (viii) The aircraft flew into the tops of trees approximately 650 feet amsl in straight and level flight. The accident occurred 2.9 nautical miles from Auchterarder airfield on a bearing of 207° (magnetic).

(b) *Probable cause*

Although the cause of the accident could not be established with certainty, it was probably due to the pilot making a premature descent before he had positively established his position to be clear of high ground.

R C Warren
Inspector of Accidents

Accidents Investigation Branch
Department of Trade and Industry
January 1972