

Department of Trade

ACCIDENTS INVESTIGATION BRANCH

Piper PA-31 Model 350 G-BBPV
Report on the accident at Little Sandhurst,
Berkshire, on 19 October 1975

LONDON

HER MAJESTY'S STATIONERY OFFICE

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9/76	Piper PA25 Series G-BCAK at Wootton nr. Woodstock, Oxfordshire June 1975	July 1976
10/76	Piper PA28 Model-140 G-AVLA south of Biggin Hill Aerodrome, Kent May 1975	August 1976
11/76	Wessex 60 Series 1 G-ATSC in the North Sea north-east of the River Humber Estuary March 1976	November 1976
12/76	Piper PA28 Series 180 (Cherokee) G-AVSB at Denham Aerodrome, Bucks June 1975	October 1976
13/76	Boeing 747 Series 136 G-AWNB north-west of Prestwick Airport, Scotland May 1975	November 1976
14/76	Piper PA 23-250 Turbo Aztec 'D' N6645Y at Arkley golf course, Hertfordshire November 1975	December 1976

Department of Trade
Accidents Investigation Branch
Shell Mex House
Strand
London WC2R 0DP

19 November 1976

*The Rt Honourable Edmund Dell MP
Secretary of State for Trade*

Sir,

I have the honour to submit the report by Mr G C Wilkinson, an Inspector of Accidents, on the circumstances of the accident to Piper PA-31, Model 350, G-BBPV which occurred at Little Sandhurst, Berkshire, on 19 October 1975.

I have the honour to be
Sir
Your obedient Servant

W H Tench
Chief Inspector of Accidents

Accidents Investigation Branch
Aircraft Accident Report No. 15/76
(EW/C543)

Operator: British Car Auctions (Publications) Ltd

Aircraft: Type: Piper PA-31

Model: 350 Navajo Chieftain

Nationality: United Kingdom

Registration: G-BBPV

Place of Accident: Little Sandhurst, Berkshire

Latitude 51° 21' 23" N

Longitude 00° 49' 33" W

Date of Accident: 19 October 1975 at 0811 hrs approximately

All times in this report are GMT.

Synopsis

The accident was notified to the United Kingdom Department of Trade at 0915 hrs on 19 October 1975 by the London Air Traffic Control Centre, West Drayton. The accident was investigated by the Accidents Investigation Branch of the Department of Trade and operations, engineering and human factors groups were formed.

The aircraft was *en route* from Blackbushe to Stansted when about three minutes after take-off it descended to aerodrome level and flew into some trees which were obscured by fog and low cloud. The aircraft caught fire and the pilot, the sole occupant, was killed.

There was no evidence of mechanical malfunction or failure of the aircraft. A post mortem examination of the commander revealed that his coronary arteries were severely affected by atheroma although there was no evidence to show that he suffered an acute incapacitation prior to the accident. The report concludes that although no cause for the descent into the ground could be definitely established, there is, however, sufficient medical evidence to support the theory that the commander suffered symptoms of coronary artery disease that were sufficiently serious to impair his ability to fly the aircraft.

1. Factual Information

1.1 History of the flight

The aircraft was making a positioning flight from Blackbushe aerodrome to Stansted with the pilot the sole occupant. At the intended time of departure there was thick fog with an estimated visibility of about 200 metres at Blackbushe and the pilot first visited the control tower in order to examine the local area weather forecast and listen to the London Volmet broadcast. Having satisfied himself that the weather at Stansted was good enough for landing he proceeded to the aircraft and carried out the normal pre-flight inspection checks. The aerodrome controller cleared the aircraft to taxi to the holding point for Runway 26 at the pilot's discretion and soon lost sight of it in the fog as it taxied away from the apron. He later heard the aircraft's engines being given a pre-departure power check at the runway holding point. At approximately 0807 hrs the controller cleared the aircraft for take-off and a right turn after getting airborne but once again he advised the pilot that it was at his own discretion as he was unable to see the runway. After becoming airborne the pilot reported to Blackbushe tower that the top of the fog was 700 feet on the QFE altimeter setting and commented that the weather was fine above. He was then cleared to call the Heathrow Director on frequency 119.9 MHz.

At 0809:40 hrs the pilot established contact with the Heathrow Director and reported that the aircraft was climbing through 1,000 feet for 2,000 *en route* to Stansted and requested an Instrument Flight Rules (IFR) clearance through the London Zone at 2,000 feet via the Chiltern non-directional beacon (NDB). The Heathrow Director replied that the aircraft was cleared through the zone on a Special VFR clearance not above 1,000 feet and requested the aircraft to report when entering the zone. The pilot acknowledged this clearance and then, at the controller's request selected code 7042 on his transponder equipment. The transponder return from the aircraft was identified on the controller's radar screen.

At 0810:30 hrs, immediately after this exchange of communications, the pilot of another company aircraft, Aztec G-BAVY which was inbound to Blackbushe from Birmingham, asked the pilot of G-BBPV to change to frequency 129.7 MHz. The two pilots then had a short discussion on this frequency about the weather at Blackbushe and the possibilities of making a landing there. The Heathrow controller noticed shortly after this that the transponder echo from G-BBPV had disappeared from his radar screen and at 0811:42 hrs he called the aircraft to ascertain whether its transponder was still 'squawking'. He received no reply from the aircraft although he called it several times. At 0812:44 hrs the Aztec pilot reported that he had called G-BBPV on 129.7 MHz and that he also had received no reply. In spite of repeated calls no further radio communication was received from the aircraft.

About the time radio contact with the aircraft was lost a witness living about 2 miles north of Blackbushe Aerodrome saw the aircraft briefly in the mist as it passed very low over his house. It was flying in a northerly direction and both propellers were rotating. Shortly after losing sight of the aircraft the witness heard three loud successive bangs. Several other people in the vicinity also heard the sound of the aircraft's engines followed by the bangs but were unable to see the aircraft because of the fog which covered the area. A search revealed the crashed aircraft lying in a nearby field having apparently struck some trees. A fierce fire which broke out on impact extinguished itself fairly quickly and was only smouldering when the fire services arrived at the scene. The pilot was killed. It was later established that the aircraft had initially flown into a clump of large trees which covered the top of a small knoll whose elevation was approximately the same as Blackbushe Aerodrome. Considerable damage was done to the aircraft but it remained

airborne briefly until it hit a large dead elm tree and then fell into the field beyond. The exact time of the accident was not recorded but the first emergency '999' telephone call was received at 0815 hrs.

1.2 Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>
Fatal	1	—	—
Serious	—	—	—
Minor/none	—	—	—

1.3 Damage to aircraft

Destroyed by impact forces and post crash fire.

1.4 Other damage

A large beech tree was damaged and a dead elm tree was destroyed. An area of grass pasture was damaged by fuel spillage.

1.5 Personnel information

1.5.1 Commander:	Age 36 years
Licence:	Commercial Pilot's Licence, valid to 4 May 1976
Aircraft ratings:	Part 1 – PA 28 and 32; PA 23, PA 31 and PA 34
Instrument rating:	Valid to 8 October 1976
Medical certificate:	Last medical examination 17 April 1975 and valid until 30 April 1976. This examination included a routine electrocardiogram which showed no abnormalities.
Total pilot hours:	5,391
Total flying hours in command of PA 31 aircraft:	122
Total flying hours in last 28 days:	39 of which 4 hours were on PA 31 aircraft
Rest period:	Approximately 16 hours prior to accident flight

1.5.2 Commander's experience

The commander had been flying regularly from Blackbushe since March 1969 when he was appointed as a flying instructor with a local flying club. He remained with the club until February 1973 when he helped to found an air charter company based at

Blackbushe. The company operated PA 34 (Seneca) aircraft and at the time of the accident the commander was its chief pilot and operations manager. He retained his flying instructor's rating. In addition to his company flights the commander also occasionally flew PA 23 (Aztec) and PA 31 (Navajo) types of aircraft. Besides being very familiar with the Blackbushe local area the commander had flown over the Blackbushe to Stansted route many times including eight occasions in the preceding 6 months.

1.6 Aircraft information

Manufacturer:	Piper Aircraft Corporation
Date of manufacture:	1973
Certificate of Airworthiness:	In the private category. Renewed on 3 October 1975 and valid until 2 October 1976
Maintenance:	The aircraft had been maintained in accordance with the appropriate maintenance schedule.
Total airframe and engine hours:	771 hours at last Certificate of Airworthiness renewal on 2 October 1975
Maximum Authorised Weight:	7,000 lb
Aircraft's weight at time of accident:	5,853 lb (estimated)
Centre of gravity limits:	At 5,853 lb – between 121.3 inches and 135.0 inches aft of the datum
Centre of gravity position at time of accident:	125.3 inches aft of datum (estimated)
Fuel on board at time of accident:	144 imperial gallons (estimated)
Type of fuel:	Avgas 100L

The minimum operating crew specified in the aircraft's Flight Manual is one pilot.

1.7 Meteorological information

An aftercast prepared by the Meteorological Office for the day of the accident showed that a ridge of high pressure from an anticyclone over Scandinavia extended over north and central England. In many inland areas fog patches formed during the night but these gradually dispersed during the morning and the rest of the day was fine. The visibility was generally about 2,500 metres but was reduced to 200 metres in the areas covered by fog. The visibility at Blackbushe Aerodrome when the aircraft departed was estimated to be about 200 metres.

The area of fog which covered Blackbushe was widespread and extended over the accident site. The depth of the fog varied but the pilot of G-BBPV reported by radio after take-off that the tops were 700 feet above aerodrome level and that the weather was clear above.

The London area QNH setting was 1025 mb.

1.8 Aids to navigation

Not applicable.

1.9 Communications

All radio communications between the aircraft and Blackbushe Tower on 122.3 MHz, with Heathrow Director on 119.9 MHz and with another aircraft on 129.7 MHz were normal. The communications with Blackbushe were not recorded nor was there a requirement that they should be. Similarly the conversation between the pilots of the two aircraft on 129.7 MHz was not recorded.

A test showed that radio communications could be maintained between the Heathrow Director and an aircraft flying about 100 feet above Blackbushe Aerodrome.

1.10 Aerodrome information

Blackbushe Aerodrome, elevation 329 feet, was a licensed aerodrome but had an unlicensed air traffic control unit. There were no radio navigational aids or radar equipment situated on the aerodrome.

1.11 Flight recorders

Not fitted and not required.

1.12 Wreckage and impact information

The aircraft descended into a copse of large trees which covered the top of a small knoll positioned just over 2 miles from Blackbushe Aerodrome on a bearing of 012° (T). The general level of the ground to the north of the aerodrome is essentially flat although there are small undulations. A river valley runs in an east/west direction between the aerodrome and the accident site and the ground slopes away from a height of 329 feet above mean sea level (amsl) to between 150 and 200 feet amsl at the bottom of the valley. Beyond the river the ground rises again to a ridge the height of which is about 250 feet amsl. A small, steeply sided knoll on the south side of the ridge rises to 333 feet amsl. The summit of the knoll is covered with a small copse of mixed trees which have grown to a height of about 60-70 feet and it is these trees which the aircraft struck initially while descending at a fairly shallow angle.

The aircraft clipped the top of several of the trees before the main impact when its starboard side struck the main branches of a large spreading beech tree which was growing on top of the knoll at a height of about 40 feet above the ground level. A large section of the starboard outer wing along with the starboard aileron was removed from the aircraft and the starboard fuel tanks were ruptured. The fuselage was also damaged on contact with the trees and some of the cabin transparencies were shattered. Although severely damaged the aircraft continued in the air because of the steep down slope on the side of the hill and finally struck a large dead elm tree about 170 yards further on. The impact with this tree caused massive structural damage and the wreckage spread across a field of grass pasture beyond the tree. An intense fire consumed most of the fuselage including the cabin and the port wing.

Damage to the trees indicated that at the time of the initial impact the aircraft was flying either wings level or right wing low. The angle of descent between the impacts with the beech and the elm trees was approximately 9° indicating a fairly shallow angle of descent prior to the initial contact with the trees. The aircraft was estimated to have been travelling at low cruise speed. The trail of the wreckage from the beech tree to the elm tree and beyond across the field was in a direction of 060° (M).

Examination of the wreckage revealed that the aircraft was structurally complete when it hit the trees and that the undercarriage and flaps were fully retracted. The slash marks on the branches of the trees and damage to the blades of the propellers indicated that both propellers were rotating under power on impact. There was no evidence in what remained of the flying control systems of a pre-crash failure or malfunction. All three trim system control cable runs were totally disrupted during the crash. The trim control cable drums at each tab indicated that the trim tabs were positioned at or close to the neutral position.

Most of the instrument panel was destroyed by the impact and the subsequent fire and very few pre-crash settings remained. However, the barometric subscale on the left hand pressure altimeter was set to 1026 millibars and that on the right hand altimeter to 1021 millibars. The frequency selectors on the VHF communications sets were badly damaged but the evidence indicated that the No. 1 set was selected to 119.9 MHz (Heathrow Director) and the No. 2 set to 129.7 MHz (company frequency). The VHF transmit selector switch was selected to No. 1 VHF set and the receive switches for both VHF communication sets were selected to the phones position. The ADF frequency selector was set on 279 (Chiltern NDB).

1.13 Medical and pathological information

A full autopsy with histological and toxicological examinations was carried out on the body of the commander which had received severe injuries. The examination revealed no definite medical cause for the accident and there was no evidence of intoxication by alcohol or carbon monoxide. The left coronary artery showed evidence of over 90 per cent occlusion of the lumen by atheroma for about 5mm in a position some 2cm below the origin. There was no sign of any recent incident arising from this pathological condition. In addition there was no pathological evidence of a previous myocardial infarction.

The commander was apparently in excellent health generally and there was no history of his having suffered any cardiac symptoms in the past.

1.14 Fire

The fuel tanks were ruptured during the impact with the trees and as a result a severe fire developed which consumed a large part of the aircraft including the cabin area. The fire, however, quickly extinguished itself and the fire services who arrived soon after the accident were not required to use their equipment.

1.15 Survival aspects

The accident was not survivable.

1.16 Tests and research

Nil.

1.17 Additional information

1.17.1 Navigation information

The direct track from Blackbushe Aerodrome to the Chiltern NDB was 042° (M). The distance from the accident site to the London Control Zone boundary was 1¼ statute miles.

1.17.2 Automatic Pilot

The aircraft's auto-pilot was fitted with an automatic pitch trim. The pitch trim servo could be overridden by the aircraft's manual trim crank. When the auto-pilot was engaged the pilot could adjust pitch trim electrically through a switch on the pilot's control wheel or manually through the manual crank.

The following extracts are taken from the auto-pilot operating instructions.

“Checking the override

Approximately nine to fifteen pounds of pressure on the control wheel should override both the roll and pitch functions when they are engaged

“Malfunction

Autopilot

If the system malfunctions depress the disconnect switch mounted on the control wheel

Automatic pitch trim system

Should a malfunction occur in the automatic pitch trim system:

- (a) Place aircraft's trim indicator in approximately correct position by overriding Trim Servo through use of trim crank or wheel.
- (b) Depress the control wheel button to disengage the autopilot. Be sure to have manual control of the control wheel.
- (c) Correct trim by hand.
- (d) Pull out trim circuit breaker, check to make certain correct breaker was opened by employing the trim switch on pilot's control wheel. If trim can be activated it would indicate incorrect breaker was opened

1.18 New investigation techniques

Nil.

2. Analysis

- 2.1 The poor visibility at Blackbushe when the aircraft took-off had no direct bearing on the cause of the accident which took place some time after the aircraft had climbed through the fog layer and had become established in the clear sky above. The location of the accident site was just over 2 miles north of Blackbushe and at this point under normal circumstances the aircraft would be taking up its departure heading. However, in this instance, instead of proceeding to a safe altitude, the aircraft then lost height until it flew into the trees which were obscured by fog. The elevation of the trees was only slightly higher than that of Blackbushe Aerodrome and the angle of descent into them was fairly shallow. There was no evidence that the loss of height was associated with any upset in flight such as a stall or a spin.

The exact time of the accident was not determined but it is most likely that it occurred about the time that radar and radio contact was lost with the aircraft. The duration of the flight was therefore only about 3 minutes. There is no direct evidence showing the aircraft's movements during this time because it was obscured from the ground by fog from the moment it started its take-off run until seconds before it crashed. However, certain deductions were possible based on the evidence of the one person who saw the aircraft in the air. This witness lived about 450 yards from the accident site and the aircraft was flying on a northerly heading when it passed low over his house. When the position of the aircraft at this time was compared to the heading on which it flew into the trees, it became apparent that it was turning to the right during the last few seconds of the flight. Calculation showed the turn was in excess of rate one and could have been as great as rate three indicating a moderate to steeply banked turn.

A plot was made of the most probable track followed by the aircraft based on the assumptions that the aircraft made a right turn after take-off and was heading towards the north just before it reached the accident site. The geographical relationship of the accident site to Blackbushe Aerodrome and the short duration of the flight also determined to a significant extent the reconstruction of the aircraft's track. The plot showed that the aircraft must have turned past the direct course to the Chiltern NDB initially and settled on a more easterly heading. After a short period of time it must then have turned to the left in order to pass over the eye witness's house while on a northerly heading. Because of the weather conditions at least part of this left turn and all of the final right turn must have been performed while the aircraft was in cloud.

Analysis of the radio communications record indicated that the aircraft had climbed higher than 1,000 feet amsl by the time that it received the clearance to fly through the London Zone at an altitude not above 1,000 feet. A pilot's normal reaction in such circumstances would be to reduce some of the power on the engines and then trim the aircraft into a descent. It is not known at what height the pilot intended to fly but he was required to remain clear of the cloud in order to maintain VFR. It seems probable, therefore, that the descent back into the fog was unintentional. If the pilot's attention to handling the aircraft relaxed during the descent because of some distraction in the cockpit then the aircraft would continue to lose height because of its trimmed condition. However, there would have been a change in the light intensity as the aircraft re-entered the cloud and this should have alerted the pilot to what was happening in time for him to re-direct his full attention back to flying the aircraft. Another possibility which was considered was that, whether the re-entry into the cloud was intentional or not, the pilot then misread the altimeter and allowed the descent to continue because he imagined that the aircraft was higher than it actually was. However, because the pilot was aware that the cloud was only a thin layer covering the ground, it was considered unlikely that he would make such a mistake.

The evidence indicated, therefore, that the flight path of the aircraft was inconsistent with the intention of the flight and the character of the pilot. The wandering nature of the aircraft's track could be explained by a high cockpit workload at the start of the flight distracting the pilot and causing him to turn through his initial heading. The turn onto a northerly heading might then have been a course correction which enabled the aircraft to remain outside the London Zone until the pilot was satisfied that he could comply with the special VFR clearance. In this case there would seem to be no reason for the final turn towards the north-east which, because of its steepness, was not consistent with normal instrument flying practice. The descent back into the fog is also difficult to understand when it would seem to be more desirable to stay in the clear. The sum of the evidence indicates, therefore, that the aircraft was not being flown with the full attention of the pilot. Various factors which might have distracted the pilot were therefore examined.

2.2 Mechanical aspects

The aircraft was structurally complete when the accident occurred and both propellers showed evidence of rotation under power. An examination of the remains of the airframe and flying controls together with a strip examination of the engines revealed no evidence of pre-crash mechanical failure or defect. Consideration was given to the possibility that the loss of both radar and radio contact with the aircraft was caused by either a complete radio failure or an electrical failure. The radio equipment was too damaged to allow an assessment of its state to be made but there was evidence of electrical power on the aircraft at the time of the accident. However, it is considered that neither of these failures would have presented the pilot with any immediate problems which might have led to the accident. Even if the aircraft had been in cloud at the time the pilot would still have had the availability of the blind flying instruments as none of them required electrical power for their operation. The question of a malfunction in the electrical trim system or the pitch control of the automatic pilot was considered as a cause for the loss of height. If the trim system had wound on nose-down trim to the extent that the pilot could no longer counter the forces on the control column then the elevator trim tab would have run to an abnormal position. The elevator trim tab, however, was found in a substantially neutral position in the wreckage. If the automatic pilot, whilst engaged, had demanded a nose-down pitch then the pilot would have been able to resist this by overriding the automatic pilot demand until such time as he could disconnect the automatic pilot by using the disconnect button. There was, therefore, no reason to believe that either the automatic pilot or the electric trim system, brought about a state of affairs which the pilot could not contain. It is therefore concluded that neither an electrical or radio failure nor a malfunction of the automatic pilot or electric pitch trim could have distracted the pilot.

2.3 Medical aspects

The post mortem examination of the pilot revealed that there was considerable occlusion of his left coronary artery by atheroma. This is a slowly progressive pathological condition which may or may not give rise to symptoms varying from an acute chest pain to a sensation comparable to indigestion. In some cases acute incapacitation leading to unconsciousness and sudden death have occurred without previous symptoms. The post mortem examination revealed the absence of a previous myocardial infarct. Experience has shown that the appearance of such symptoms does not produce changes detectable at post mortem examination should the subject die shortly after an attack.

Periods of high stress or increased physical activity which cause the heart to work hard often bring on the symptoms of coronary artery disease. An analysis of the flight revealed that the first 2 minutes or so must have been such a period. The take-off and climb out demanded a high degree of concentration by the pilot because of the poor visibility and

he would not have been able to relax until the aircraft was flying in the clear sky above the fog. Then, before he could settle down, he needed to make power and trim changes in order to descend the aircraft to the new altitude to which he had been cleared by ATC. While these adjustments were being made he was asked to activate the aircraft's transponder on a fresh code number and then change RTF frequencies in order to converse with the Aztec pilot. This represented a high cockpit workload in a short space of time and although it was in no way beyond the capabilities of a competent pilot to deal with this sort of situation, it was never-the-less characteristic of the kind of mental strain which can produce the symptoms associated with coronary disease.

2.4 General

The manner in which the aircraft was flown was not consistent with a normal flight. It is probable that the aircraft was in trim for descent with reduced power on the engines during the last part of the flight and therefore, because of its low altitude, only a slight distraction or incapacitation on the part of the pilot would be required to precipitate the accident. Many factors could have caused such a distraction but the medical theory is the only one which is supported by strong circumstantial evidence. It is therefore concluded that, in the absence of any other apparent cause, the accident was most probably the result of the pilot becoming physically incapacitated by symptoms of coronary artery disease to an extent which affected his ability to maintain full control of the aircraft.

2.5 Consequences and detection of heart disease

At the present time with the methods in use for routine pilot licence medical screening it is not possible to diagnose with any certainty the presence of a condition which was revealed at autopsy in this case. Shortly before the accident the pilot had undergone such a routine examination procedure which included a resting ECG. This had shown him to be an apparently fit subject. His condition need not have caused too much alarm in everyday life for the disease often does not manifest itself and even when it does there are rarely serious consequences. However, the working environment of the pilot is a different matter and even mild physical discomfort can have serious repercussions. In large aircraft, which carry at least two pilots, the dangers of pilot incapacitation can to a large extent be minimised by the introduction and training in crew drills designed to offset such an event. However, in small aircraft where only one pilot is carried this is not possible. This raises the question whether it is reasonable to extend the present legal requirement for carrying two pilots on aircraft which are being used for the carriage of passengers in order to reduce the risk of the single pilot becoming incapacitated. It also emphasises the need to continue research into the problems and risks associated with coronary artery disease and into finding acceptable ways in which the existence of the disease can be reliably detected at routine examinations.

3. Conclusions

(a) *Findings*

- (i) The pilot was properly licensed and qualified for the flight.
- (ii) The aircraft had been properly maintained and its documents were in order.
- (iii) There is no evidence of any pre-crash failure or malfunction of the aircraft, its engines or equipment.
- (iv) The presence of fog at the departure aerodrome had no direct bearing on the accident although it may have contributed to the stress level affecting the pilot.
- (v) When the special VFR clearance was issued the aircraft was probably at an altitude higher than 1,000 feet.
- (vi) About 3 minutes after take-off the aircraft descended into a fog covered clump of trees at a fairly shallow angle of descent.
- (vii) The pattern of the flight was unusual and not consistent with the intention of the flight nor the character of the pilot.
- (vii) The post mortem examination of the pilot revealed that he had considerable occlusion of the left coronary artery. There was no evidence that he suffered a heart attack before the accident.

(b) *Cause*

The accident was caused by the aircraft descending into fog covered ground. No reason for this loss of height could be positively established but there is a strong possibility that the pilot's ability to fly the aircraft became impaired by the onset of symptoms associated with coronary artery disease.

4. Safety Recommendations

It is recommended that priority be given to continuing the research into the problems of prevention and satisfactory detection of coronary disease.

G C Wilkinson
Inspector of Accidents

Accidents Investigation Branch
Department of Trade

November 1976