

Department of Trade

ACCIDENTS INVESTIGATION BRANCH

**Piper PA 23-250 Turbo Aztec 'D' N6645Y  
Report on the accident at Arkley golf course,  
Arkley, Hertfordshire, on 29 November 1975**

List of Aircraft Accident Reports issued by AIB in 1976

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13/76	Boeing 747 Series 136 G-AWNB north-west of Prestwick Airport, Scotland May 1975	November 1976

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29 September 1976

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

Sir

I have the honour to submit the report by Mr P J Bardon, an Inspector of Accidents, on the circumstances of the accident to Piper PA 23-250, Turbo Aztec 'D' N6645Y which occurred at Arkley golf course, Arkley, Hertfordshire, on 29 November 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. 14/76  
(EW/C547)

*Operator:* Grand Prix (Bahamas) Ltd

*Aircraft:*        *Type:* Piper PA 23-250

*Model:* Turbo Aztec 'D'

*Nationality:* None. Formerly USA

*Registration:* Unregistered – formerly N6645Y

*Place of Accident:* Arkley golf course, Arkley, Hertfordshire, Latitude  
51° 39' N Longitude 00° 14' W

*Date and Time:* 29 November 1975 at 2129 hrs

All times in this report are GMT

## Synopsis

The accident was notified by the Supervisor at the London Air Traffic Control Centre (LATCC) to the Department of Trade at 2221 hrs on 29 November 1975. The Accidents Investigation Branch of the Department of Trade carried out an investigation and operations, engineering and human factors groups were established under the investigator in charge.

The accident occurred as the pilot was attempting a visual contact approach at night into Elstree aerodrome with a reported visibility of 800 metres. After radar advisory service had positioned the aircraft 4 nautical miles (nm) east of the runway with further descent at the pilot's discretion he was heard to call Elstree tower and give his position as 'finals.' The aircraft subsequently collided with trees and crashed 3 nm (5.6 km) from touchdown of Runway (RW)27. All six occupants were killed.

The report concludes that it was not possible to establish the exact cause of the accident but the possibility that the pilot underestimated his range from the airfield and in consequence descended prematurely in conditions of thick fog cannot be excluded.

# 1. Factual information

## 1.1 History of flight

The aircraft was making a private flight from Le Castellet in the South of France to Elstree with an intermediate stop at Marseille for refuelling and the embarkation of further passengers. Whilst at Marseille, the pilot filed an Instrument Flight Rules (IFR) flight plan via airways to Elstree giving an estimated *en route* time of 4 hours and an estimated time of arrival (ETA) of 2200 hrs. Luton was given as the alternate and the endurance as 6 hours. There were six persons on board.

Prior to his departure for the UK, the pilot visited the self-briefing unit at Marseille Marignane aerodrome where the weather forecasts for the London area for the period 1300 - 2200 hrs were displayed.

The aircraft took-off from Marseille at 1747 hrs and after an uneventful flight via airways made contact with London Air Traffic Control Centre (LATCC) at 2045 hrs. The pilot was passed the Elstree weather report for 2040 hrs which gave a visibility of 2 km and a cloud base of 300 feet above ground level (agl). After being cleared to Elstree via the Detling and Lambourne VORs, the pilot was asked his intentions after Lambourne. He replied: 'I'll have a look at Elstree'. At 2100 hrs, the pilot reported overhead Dover at Flight Level (FL) 80 and was then re-cleared to fly direct to Lambourne. At 2108 hrs London ATCC tried to contact the aircraft and despite repeated attempts was unable to do so for 10 minutes. The pilot finally replied at 2118 hrs and reported his position as 'just coming up to Lambourne' and requested descent clearance. A clearance to 4,000 feet on the London QNH of 1002 was then given and the pilot confirmed his intention to 'have a look' at Elstree. He also confirmed that Luton remained as his alternate.

At 2119 hrs when the aircraft was 8 nm south of Lambourne VOR, the pilot was told that the Elstree visibility was then 1,000 metres and that he was cleared to contact London Heathrow Approach. Having contacted the approach control the aircraft was instructed to turn onto a heading of 290 degrees magnetic direct to Elstree and at 2121 hrs when the pilot reached 4,000 feet he was informed the Elstree visibility had reduced further to 800 metres. A change of heading onto 280 degrees was given at 2122 hrs and shortly afterwards the pilot was cleared to descend to 1,500 feet on the London QNH of 1002 mb. At 2127:18 hrs the pilot reported at 1,500 feet and at 2127:24 hrs he was advised that his range from Elstree was 4 nm. He then asked for further descent clearance, and was advised that further descent was at his own discretion. Nineteen seconds later the voice of the pilot was heard to say 'Elstree' on the London Approach frequency of 119.2 MHz, indicating that he believed himself to be in contact with Elstree though he had not been cleared by London Approach to change transmitter frequency. At 2128:02 hrs the London Approach controller passed the Heathrow QFE of 999 mb and informed the pilot he had 3 nm to run to Elstree. There was no reply to this transmission. Shortly afterwards, when the aircraft was observed on radar to be 2½ nm from Elstree, the primary and secondary surveillance radar (SSR) returns from the aircraft on the London Approach radar both disappeared. Further calls by the London Approach controller remained unanswered.

At approximately 2130 hrs three witnesses in the area of Barnet heard an aircraft flying very low and caught a glimpse of a flashing light through the fog travelling from east to west in the direction of Arkley. A witness 650 metres east of the accident site also heard an aircraft flying very low. Shortly afterwards he heard the sound of an explosion in the direction of Arkley golf course. Weather conditions at the site were described as being dark with a visibility of about 50-100 metres in thick fog.

At Elstree the air traffic control officer on duty recognised the voice of the pilot and heard him say: - '45 Yankee finals'. He answered the call giving the aerodrome information and the Elstree QFE of 990 mb, together with clearance to land.

The pilot answered with a brief - '45 . . .', followed by a click as if the microphone button had been released. There was no further contact with the aircraft by Elstree or London.

At 2131 hrs the London Approach controller contacted Elstree to inquire if N6645Y had landed as the radar trace had disappeared. Elstree confirmed a loss of contact and instituted the ALERT emergency phase on N6645Y and requested the London controller to take the appropriate action.

At 2145 hrs Elstree ATC received police reports of a possible aircraft accident and it was subsequently confirmed at 2200 hrs that an aircraft had crashed on Arkley golf course, Latitude 51° 39' N, Longitude 00° 14' W after striking trees 458 feet above mean sea level (amsl), 3 nm east of Elstree aerodrome. The aircraft had caught fire and was completely destroyed. All six occupants had been killed.

## 1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	1	5	—
Non-fatal	—	—	—
Minor/none	—	—	—

## 1.3 Damage to aircraft

The aircraft was destroyed by impact, the subsequent fuel explosion and ground fire.

## 1.4 Other damage

There was minor damage to the golf course surface and extensive damage to trees in the vicinity.

## 1.5 Personnel information

### 1.5.1 Licence details and flying experience

The pilot, who was aged 46 years, qualified for a United Kingdom private pilot's licence (PPL) in 1965. On the basis of this, he was issued by the United States Federal Aviation Administration in June 1966 with a Special Purpose pilot's certificate, which the pilot last renewed in November 1970, at which time he also qualified for an FAA instrument rating. Both the certificate and the instrument rating expired 13 months later in December 1971 and neither was renewed by the pilot, though it is believed that subsequent to that date he continued to meet the qualifications for renewal had he applied.

At the time of the accident therefore, the pilot held only his United Kingdom PPL which was valid until December 1975. This contained Group A & B ratings and a night rating. An Instrument Meteorological Conditions (IMC) rating which had been issued in March 1970 had not been renewed and was therefore invalid. The Certificate of Experience was current and valid until February 1976. The Medical Certificate was also current and valid until 31 December 1975 with no restrictions.

The pilot's current log book could not be found and it is assumed to have been destroyed in the accident together with other aircraft documents. The pilot's flying experience could not therefore be established precisely, but it is believed that he had flown a total of about 1,600 hours, 1,124 hours of which were on the Aztec. An earlier log book completed in 1972, indicated that up to that time the pilot had flown 81 hours at night and 160 hours on instruments.

The pilot used Elstree as his base and had operated from there on many occasions.

#### 1.5.2 *Other information*

The pilot had flown to Le Castellet on 28 November, arriving there at 1625 hrs. He stayed the night at a local hotel and left there at 0930 hrs the following morning. He was reported to be in good health and in good spirits.

He spent the day at a motor racing circuit nearby where final adjustments were being made to a prototype racing car, though he did not drive the car himself. At about 1200 hrs he had a sandwich lunch but took no alcohol. At 1515 hrs he telephoned Nice aerodrome and at 1530 hrs he took-off from Le Castellet for Marseille Marignane.

#### 1.6 **Aircraft information**

The aircraft was a Piper PA 23-250 Turbo Aztec'D'. It was fitted with two turbo charged Lycoming TIO - 540 - J4A5 engines driving Hartzell fully feathering propellers. There was seating for six persons including the pilot.

The aircraft had been built in 1968 by the Piper Aircraft Corporation USA and registered as N6645Y in the name of Melridge Aviation, a company whose offices were in Vancouver, Washington, USA. There is evidence that the pilot was associated with the aircraft from new. In April 1972 Melridge Aviation made a routine return to the FAA on an Aircraft Registration and Activity Report on which the company requested cancellation of the aircraft's US registry as its ownership was being transferred out of the country to Grand Prix (Bahamas) Ltd of Nassau. Due to the large number of aircraft that had to be processed by the registration authorities at that time, it was not until August 1974 that the aircraft was actually removed from the US register. However Grand Prix (Bahamas) Ltd did not re-register the aircraft elsewhere and therefore at the time of the accident it was unregistered and stateless. However the aircraft continued to display its former US registration marks, N6645Y, and a copy of its US Certificate of Registry was carried in the aircraft. It was maintained in accordance with an FAA approved maintenance schedule but the United States Certificate of Airworthiness (C of A) had ceased to be effective when the aircraft was removed from the US Register in August 1974 though the maintenance organisation and the inspector concerned were unaware of this.

The remainder of the aircraft information is as follows:

Total hours flown	1,131
Hours since last annual/100 hours inspection	30
Total engine hours	1,131
Maximum weight authorised	2,360 kg
Estimated weight of take-off	2,515 kg (155 kg overweight)
Estimated weight at the time of accident	2,201 kg



Centre of Gravity range (accident weight)	96 inches to 100.5 inches
Centre of Gravity at the time of accident	97.9 inches
Estimated fuel remaining at accident	63.5 imperial gallons
Fuel type	AVGAS 100

## 1.7 Meteorological information

1.7.1 The weather forecast for the London area that was available to the pilot whilst he was at the Marseille Marignane self briefing unit covered the period from 1300-2200 hrs. This indicated that at Luton and Stansted the visibility was expected to improve to 8 and 10 km respectively and that at London Heathrow the visibility was expected to improve to 9 km. At Gatwick however, it was expected to fall to 1.5 km later in the period. A later forecast issued for the period 1600-0100 hrs and available at the Marignane main MET office indicated that the visibility at London Heathrow would deteriorate to 800 metres between 2000 and 2300 hrs. Similarly at Gatwick, Stansted and Southend, the visibility was expected to deteriorate between 600 and 800 metres. It could not be established if the pilot received this forecast. Nor is there evidence that he sought later weather information prior to his departure from the Marseille Marignane meteorological office. During the period of the aircraft's approach to the United Kingdom airspace, the London Volmet South weather broadcast on 128.6 MHz reported that at 2020 hrs the visibility at London Heathrow, London Gatwick and Southend was 100 metres and at Stansted it was 400 metres. Luton was reported as having a visibility of 2.5 km, though at 2050 hrs this had changed to 800 metres.

At Elstree aerodrome, where there was no qualified meteorological observer, nor apparatus for measuring the height of the cloud base, the weather was reported by the ATC unit as follows:

	<i>Wind</i>	<i>Visibility</i>	<i>Cloud</i>
2043 hrs	Calm	2 km	8/8 at 400 feet (estimated)
2107	"	1 km	8/8 at 400 feet (estimated)
2115	"	800 metres	8/8 at 300 feet (estimated)

During the period of the aircraft's flight from Dover to the London area, the weather at Manston aerodrome in Kent was reported as being clear with a visibility of between 12 and 20 km.

### 1.7.2 *Weather conditions at Arkley*

An appreciation of weather conditions at the accident site on 29 November 1975 at 2129 hrs provided by the Meteorological Office at Bracknell is as follows:

There was a slack westerly gradient over Southern England at the time and with a very light south-westerly wind at the surface this would produce upslope motions of air over Arkley. As a result the hill would be completely covered by low stratus giving thick hill fog and visibility of less than 200 metres. Airframe icing in fog or low cloud was unlikely. It was a dark night with the moon in its last quarter.

### 1.7.3 *Pilots' inflight weather reports*

Evidence of the in-flight weather conditions prevailing at Elstree earlier during the evening was available from an experienced pilot who entered the London TMA prior to N6645Y. This pilot, who was flying a Piper PA 24, attempted three approaches into Elstree aerodrome between 1715 and 1815 hrs with positioning provided by London Approach radar advisory service. He contacted Elstree during his transit of the TMA to obtain the QFE setting which he used for all approaches. Radar headings and distances were given for an approach to Runway 27 but on his first approach the pilot was unable to identify the runway lights from a height of 500 feet agl although other lights on the ground were visible downwards through the mist and fog. Above 1,000 feet above mean sea level (amsl) the visibility was very good. On his second approach the pilot descended to 300 feet on the QFE and identified the illuminated landing T on the left side of the runway at Elstree, but this was sighted too late for a landing to be made. On his third approach down to 300 feet agl the pilot saw what he took to be a row of runway lights through his front window and was just about to change radio frequency to Elstree when he realised that what he saw was not the runway but some other ground lights. The pilot then made his third overshoot and diverted.

## 1.8 *Aids to navigation*

### 1.8.1 *Aircraft equipment*

The aircraft was fitted with dual VHF Omni Range (VOR) receivers and Omnibearing Indicators (OBI), a Radio Magnetic Indicator (RMI) and Distance Measuring equipment (DME). As the navigation equipment was heavily damaged by impact forces and the subsequent fire, it was not possible to determine the frequencies selected, however readings were identified on the OBI's. Receiver No. 1 was reading 266 degrees and receiver No. 2 indicated 311 degrees. The 312 degree radial may have been selected by the pilot when he was routed from Dover direct to the Lambourne VOR, but no explanation can be given for the 266 degree radial. The measured VOR radial from Lambourne VOR to Elstree aerodrome is greater than 270 degrees. As the pilot had been flying airways without reporting any difficulties, there is no reason to believe that the equipment was functioning other than correctly.

### 1.8.2 *VOR Receiver errors in light aircraft*

The normal VOR total aggregate error of 'Class 1' radio equipment in light aircraft of less than 5,700 kg (12,500 lb) weight is considered on a 95 per cent probability basis to have a VOR system accuracy of plus or minus 5 degrees.

A Civil Aviation Authority (CAA) Aeronautical Information Circular, (12/1976) warns owners of light aircraft fitted with 'Class 1' approved VOR equipment of the incorrect functioning of a number of Doppler VOR ground stations including Lambourne. The improper functioning includes large bearing errors and very low pointer deflection sensitivity. Although the pilot had been known to make use of the Lambourne and London VORs as navigation aids to approach Elstree aerodrome, there is no evidence whether or not the pilot was using VOR aids on this occasion.

### 1.8.3 *London Approach ACR6 type radar*

As stated in the UK Air Pilot RAC section, London Heathrow approach control provides a radar vectoring service to assist pilots during approaches to Elstree and provides azimuth and range information. The achievable accuracy of the Type ACR 6 10 cm radar is assessed as plus or minus 1 per cent error in range and 2 degrees in azimuth from the radar head. This is assuming optimum operation by the radar operator. During an aircraft's final approach to RW 27 at Elstree, the 2 degree allowable azimuth error could result in an error of plus or minus 1,000 metres in relation to the distance of the aircraft from Elstree. The radar advisory service is not intended to be used as a precision

final approach aid to Elstree aerodrome and the service is normally terminated in the vicinity of Chiltern NDB at 2,500 feet on the Heathrow QNH when the flight is handed over to Leavesden ATC. However, at the time of the aircraft's approach Leavesden aerodrome was closed.

## 1.9 Communications

After entry into UK airspace at Dover the pilot had utilised four VHF radio frequencies as the aircraft crossed the London TMA prior to contacting Elstree tower. All tape recordings for the relevant period were played back and transcribed. Communications were normal except for one period from 2108 hrs until 2118 hrs as the aircraft was flying between Dover and Lambourne VOR when the pilot failed to answer repeated calls and no explanation was given or asked for when contact was re-established. Communication was again normal from 2118 hrs up until the pilot changed frequency to Elstree. One brief call of 'Elstree' was made on the London Approach frequency at 2127:48 hrs by the pilot.

There is no requirement for RTF recording apparatus to be installed at Elstree on 122.4 MHz and none was fitted. However the ATC officer stated that at 2129 hrs he received a brief radio call as follows: '45 Yankee finals'. Recognising the pilot's voice he replied, '45 Yankee roger, Foxtrot Echo 990, check 3 greens clear to land'. The pilot answered, '45 - - -', this was followed by a click as if the microphone transmitter button had been released, and there was no further contact with the aircraft. The aircraft radio equipment was subject to severe damage and intense fire.

## 1.10 Aerodrome information

### 1.10.1 *Elstree facilities*

Elstree is a private aerodrome for use by day or night by prior permission only and an Ordinary aerodrome licence for hire and reward flying is held. By night, RW 27 only is licenced. The Air Traffic Control Unit (ATCU) is staffed by unlicenced controllers who are not certificated meteorological observers. No facilities exist for the accurate measurement of cloud base height. The elevation of RW 27 is 334 feet. The runway has a tarmac surface and is 656 metres in length. It is equipped with runway lights, a low intensity two colour approach slope system (LITAS) and an illuminated landing T. RW 27 has no approach lights or radio aids and there is no published let down chart.

### 1.11 Flight recorder

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

## 1.12 Wreckage and impact information

### 1.12.1 *Accident site*

The accident site was at Arkley golf course, which at its highest point is 474 feet amsl, and 140 feet above the level of Elstree aerodrome which is situated 3 nm to the west. The aircraft first brushed the top of a large tree 458 feet amsl in a wings level attitude and continued on a 2 degree descent path on a heading of 272 degrees magnetic clipping another tree before colliding with a large ash tree (see Appendix B). This impact tore off the right fibre glass wing tip tank and there were numerous propeller slashes on the tree branches. The flight path continued over a group of young birch trees the tops of which were removed by the aircraft, causing damage to the port wing and fuselage. The aircraft then rolled to the right striking the ground with the starboard wing tip at an angle of bank of about 45 degrees. It then collided heavily with two more trees, rupturing the fuel tanks, and large sections of these trees were carried forward a further 108 metres before final impact with a further copse of trees. The total wreckage trail was 280 metres in length. A fuel explosion and intense fire which followed the final impact consumed most of the aircraft.

### 1.12.2 *On-site and subsequent examination of wreckage remains*

After an initial on-site inspection the wreckage was removed for detailed examination. This indicated that the aircraft was structurally complete when the initial impact occurred. There were very few recognisable or reliable settings of radio equipment, instruments, engine and flying controls in the cockpit area. However the following facts were established:

- |                              |  |
|------------------------------|--|
| (a) Configuration            | Undercarriage down and locked; flaps $\frac{4}{3}$ down.   |
| (b) Engine and propellers    | Both engines were under power with no evidence of pre-crash failure or malfunction. All propeller blades suffered damage to leading edges indicating engine power on impact.   |
| (c) Pilot's No. 1 altimeter  | Fragmented but the face and subscale gear train remained in one piece indicating a setting of 1003 millibars (mb).   |
| (d) Pilot's No. 2 altimeter  | Intact though scorched and the subscale setting was between 997 and 998 mb.  |
| (e) Directional gyro heading | 276 degrees  |
| (f) Auto-pilot heading bug   | 332 degrees  |
| (g) Number 1 VOR indicator   | selected radial 266 degrees  |
| (h) Number 2 VOR indicator   | selected radial 311 degrees  |
| (i)                          | It was not possible to establish rotational damage on either the electrical or vacuum driven gyros. There was however no damage to the two engine driven air pumps.  |
| (j)                          | There was no evidence of pre-impact fire or explosion.   |
| (k)                          | An occupant's watch had stopped between 21.25 and 21.30 hrs. Examination of what remained of the airframe and flying control system did not reveal any evidence of pre-crash failure or defect relevant to the accident. |

### 1.13 **Medical and pathological examination**

The autopsy findings were consistent with all six persons having received instantaneous fatal injuries. Toxicological findings were negative for all six occupants and there was no medical evidence that could have had a bearing on the cause of the accident.

### 1.14 **Fire**

The first notification of the accident was received by the London Fire Brigade at 22.06 hrs and in spite of fog conditions the first vehicles arrived at the accident site at 2218 hrs together with units from the Hertfordshire Fire Brigade. A fuel explosion and intense fire which had occurred at the time of impact had almost burnt itself out by the time the fire services arrived and the small pockets of fire which remained were extinguished with water.

## 1.15 Survival aspects

The accident is considered non-survivable as death was instantaneous to all six occupants. The aircraft had six forward facing seats some of which had been torn out of the fuselage. All six safety straps were burnt, four of the buckles being recovered latched, and of the other two buckles only one male component was recovered. The nature of the pilot's injuries were consistent with him being seated in the front left seat.

## 1.16 Tests and research

Nil

## 1.17 Additional information

### 1.17.1 *Night approaches to Elstree aerodrome*

In order to observe the patterns of ground lights in the built up areas of Barnet, Boreham Wood and Elstree a flight was made at night in good visibility using an Aztec aircraft. The purpose of the flight was to simulate the approach path believed to have been flown by the aircraft and London Approach radar advisory service was utilised to assess distances and maintain a 280 degree heading to Elstree aerodrome. These were compared with normal straight in approaches to RW 27 on the extended centre line. There are radio masts 566 feet elevation approximately 3 nm east of Elstree on the approach to RW 27. These obstructions are 1,600 metres north of the accident site and are fitted with red obstruction lights. It was apparent that when straight in approaches were started from 5 nm out and on the runway centre line, the aircraft's track was over unlit terrain until passing the ground lights of Boreham Wood, after which there was a further unlit area of approximately 1½ nm before reaching RW 27. However when a straight in approach to the aerodrome on a heading of 280 degrees was flown the aircraft first passed over the ground lights of Barnet before entering an unlit area which included the Arkley golf course prior to reaching the ground lights of Boreham Wood.

### 1.17.2 *Private pilots minimum descent altitude (MDA) in the UK*

A pilot exercising the privileges of a UK PPL, with an RTF licence, night and IMC rating who intends to make a landing at a UK aerodrome outside controlled airspace, is entitled to descend to ground level when making an approach to land irrespective of his experience or weather conditions. The fact that there are no landing approach aids or approach lighting facilities at the aerodrome is immaterial.

### 1.17.3 *Elstree landing limits*

In the United Kingdom the Civil Aviation Authority (CAA) does not regulate aerodrome operating minima for private aircraft and the decision to operate into Elstree aerodrome in low visibility conditions is entirely at the discretion of a private pilot. However a flying club at Elstree recommends the following limits for its pilots landing at Elstree:

<i>Pilot Instrument Qualifications</i>	<i>Minimum Descent Altitude (MDA)</i>	<i>Visibility</i>
Instrument rating	834 feet (500 feet above ground)	1.5 km
IMC rating .....	984 feet (650 feet above ground)	2 km

### 1.17.4 *Minima applicable to public transport operations at Elstree*

A charter company with an Air Operators Certificate (AOC) operating into Elstree with Piper Navajo PA 31 aircraft has a MDA of 884 feet (550 feet above ground) with a flight visibility of 1,750 metres.

### 1.17.5 *Extracts from relevant regulations*

Article 3(1) of the Air Navigation Order 1974 states that an aircraft shall not fly in or over the United Kingdom unless it is registered in the Commonwealth, a Contracting State or a country with which HM Government has an agreement. Para (2) of the same Article states that it is an offence against the Order to contravene paragraph (1). The only exception is in the case of aircraft satisfying the 'B' Conditions set forth in Schedule 2 of the Order, but these were not applicable to N6645Y.

Article 7(1) states that an aircraft shall not fly unless there is in force a certificate of airworthiness duly issued and rendered valid under the law of the country in which (it) was registered.

Article 19(2) states that . . . a person shall not act as a member of a flight crew . . . in an aircraft registered in a country other than the United Kingdom unless . . . he is the holder of an appropriate licence granted or rendered valid under the law of the country in which the aircraft was registered . . . . Schedule 9 Part A of the Air Navigation Order of 1974 states that the holder of a private pilot's licence (PPL) is not entitled to fly as pilot-in-command . . . on a flight outside controlled airspace without an instrument meteorological conditions (IMC) rating when the flight visibility is less than 1 nm; or when any passenger is carried . . . at or below 3,000 feet amsl in a flight visibility of less than 3 nm. Further, the Schedule states that a PPL holder shall not fly as pilot-in-command at night with passengers unless his licence includes a night rating.

In Part B of Schedule 9 it states that an instrument rating shall entitle the holder of a licence to act as pilot-in-command of an aeroplane flying in controlled airspace in circumstances which require compliance with the Instrument Flight Rules (IFR).

Rule 21 of The Rules of the Air and Air Traffic Control Regulations 1974 states that in Visual Meteorological Conditions (VMC) in controlled airspace notified for the purposes of that Rule, the commander of an aircraft shall comply with Rules 27 and 28 . . . as if the flights were IFR. The flight of N6645Y was made partly in the London Terminal Control Area (TMA) for which notification is given for the purpose of Rule 21 that IFR procedures apply in all weather conditions. This is stated in the UK Air Pilot Vol I (RAC) section. To fly in the London TMA in any weather conditions therefore requires that a pilot hold a valid instrument rating.

## **2. Analysis**

There was no evidence of any kind to suggest that the accident may have been caused by a mechanical or technical failure of the aircraft or its systems. In fact all the indications are that the aircraft was serviceable and contained enough fuel to divert safely to a suitable airfield, for example Manston, which was clear. There was also no evidence that the pilot may have been unduly fatigued; in fact he appears to have spent a restful night and not been too heavily engaged during the day.

The weather conditions which the pilot later encountered in the London area were possibly not mentioned in the forecast available in the self briefing unit when the pilot attended there, but he received adequate indication from London ATCC of the deterioration of the visibility during the latter stages of the flight. Also it is possible that whilst out of contact with London between 2108 and 2118 hrs he may have listened to the London VOLMET which accurately reported the conditions prevailing in the area of his destination. Notwithstanding these indications the pilot decided to continue his flight to Elstree. What he was attempting to do demanded a high degree of skill and concentration together with the assistance of a suitable approach aid and adequate lighting. By reputation the pilot appears not to have been lacking in that skill but it seems that he may have expected too much of his abilities, particularly when it is borne in mind that the cloud base and visibility prevailing at the time was almost half that

allowed in the case of a charter operator based at the same airfield and using the same class of aircraft. Had the pilot been in possession of a valid IMC rating, then there was nothing in law to have prevented him from making an approach in any conditions of visibility. Thus, purely on the basis of his own judgement as to his ability to make an approach in low visibility conditions, an IMC rated private pilot may expose his passengers to a greater risk than is tolerated in the public transport sector. Though it is recognised that different criteria apply in the case of public transport operations, it is nevertheless considered that some constraint should be put on a pilot of an aircraft not engaged in public transport to prevent him from commencing or carrying out an approach to land in weather conditions that are less favourable than those designated, subject to the scrutiny of the Civil Aviation Authority, by public transport operators at the same airfield.

An analysis of the evidence suggests three possible reasons for the pilot allowing the aircraft to descend into the ground and these were either an error in height interpretation, a lack of altitude awareness or an error in range. All three possibilities are considered below in some detail.

#### *Error in height interpretation*

The left hand altimeter was set to 1003 mbs, that is within 1 mb of the London QNH of 1002, which was the setting passed to the pilot. There is no particular significance to be attached to this difference of 1 mb (equivalent to approximately 30 feet) as it would not be unusual for an error of this magnitude to be made when setting this type of altimeter, particularly under cockpit lighting conditions.

Thus when the aircraft first brushed the tops of the trees, the altimeter would have been reading about 490 feet. For the accident to have been caused by an error in height interpretation, the pilot would have had to believe at the moment of initial impact that he was 490 feet above ground level, or more precisely, above the level of Elstree aerodrome. The only basis for this belief would be that the pilot thought that his altimeter was set to the QFE. This must always remain a possibility but there would seem to be little support for believing that the pilot made this mistake. Only a few minutes before he had been instructed by London to descend to 1,500 feet on the QNH of 1002, which was the second occasion on which he had been passed that particular setting as a QNH. Later London advised the pilot that the Heathrow QFE was 999, but as it is almost certain that at that stage he had already changed to the Elstree frequency, he would not have heard that particular message. The reason for concluding that the pilot had already changed frequency, despite the fact that he had not been instructed to do so, is that not only did he not acknowledge the QFE setting but also because a few seconds before he had been heard to say the single word 'Elstree' on the London frequency. This is characteristic of someone beginning to make a call to another station and realising as soon as he starts to transmit that he has not changed transmitter frequency, but does so immediately afterwards.

When the aircraft contacted Elstree, the pilot simply said '45 Yankee - finals'. Elstree ATC replied with the aerodrome information and the QFE. The pilot replied simply '45 . . .' and not '45 Yankee' as was his custom. The timing of this reply indicated that it is highly probable that the aircraft made the first impact just at this moment. This being so, the pilot would not, of course have had time to reset his altimeter to the QFE.

#### *Altitude unawareness*

Whilst the aircraft was descending, even during the latter stages below 1,500 feet, it would have been flying in good visibility above the fog layer. As the aircraft entered this layer, there would have been a sudden reduction in slant visibility, though some of the lights almost directly below would have been visible. In these circumstances it would not be surprising if the pilot attempted to remain in visual contact and thus did not keep a close watch on his altimeter and other instrument indications. Although there is no evidence to support this possibility, it cannot be disregarded altogether as a possible factor in the accident.

Also in these circumstances a degree of spatial disorientation could have been a factor, but again there is no evidence of this.

#### *Error in range estimation*

When the pilot reported that he had reached 1,500 feet, London advised him at 2127:24 hrs that he had 4 miles to go to Elstree. At 2128:02 hrs London further advised the aircraft that it was 3 miles from Elstree, though by this time the pilot had most probably left the London approach frequency. However some indication of the aircraft's ground speed at this stage can be obtained from these two messages as it had travelled, according to the radar indications, approximately 1 nm in 38 seconds, that is a speed of 95 knots. This speed of approach, which in the reported conditions of no wind was equivalent to the airspeed, is what might be expected for an aircraft of this type.

Accurate measurement of the damage to the trees which the aircraft first struck prior to ground impact indicated a flight path angle at that moment of 2 degrees, which if flown at 95 knots, gives a rate of descent in still air of 336 feet per minute.

Two possibilities emerge to account for this descent rate. The first is that the descent was inadvertent though inadvertent deviations from an intended straight and level flight path are usually only momentary. If the pilot had allowed his aircraft to descend in this fashion for a brief period of a few seconds, then it must already have been flying at a very low level. If the assumption is made that the pilot was not mistaken as to his height above the level of Elstree aerodrome and presuming that he would not deliberately be attempting to fly straight and level in fog at a very low height, the only conclusion that can be drawn is that the descent was not inadvertent but that the pilot was deliberately making a slow descent from his last reported height of 1,500 feet. Accepting this argument for the moment, it follows that the pilot would not descend to below 600 feet amsl over ground which he presumably knew to be higher than Elstree and on which stood radio masts with an elevation of 566 feet amsl, three miles from the threshold of Runway 27 and in line with it.

However if the pilot believed himself to be closer to Elstree than in fact he was, his actions become more explicable when the actual flight path of the aircraft is taken into account. If the aircraft's approach path is examined, it will be seen that it lies to the south of the extended centre line of the runway. Had the aircraft been on the centre line, it would have passed over Boreham Wood and then crossed an unlit area before reaching Elstree with no intervening lights. However the aircraft's actual approach path first took it over Barnet, after which there is a dark area (Arkley golf course) before Boreham Wood is reached. If the pilot believed that he was on the correct centre line, then having seen the lights of Barnet pass beneath him with a dark area ahead, it is quite possible that he mistook these lights for Boreham Wood, and concluded therefore that as he was clear of the radio masts, it was quite safe to descend further. Though none of this can be substantiated, it would seem from the evidence that the most probable explanation for the aircraft's premature descent is that the pilot was mistaken as to his distance from Elstree which in the extremely difficult conditions prevailing is not surprising.

#### *Aircraft and Pilot documentation*

As the aircraft was unregistered its certificate of airworthiness was no longer effective. However the aircraft was always properly maintained in accordance with an approved maintenance schedule by a reputable organisation acting in good faith. This maintenance ought not to have taken place and would not have, had the US Certificate of Registry been surrendered (as it apparently should have been) at the time when the aircraft was removed from the United States registry. As it was, the maintenance organisation quite reasonably presumed that the Certificate of Registration, which was carried in the aircraft, was still current.



It is accepted that the pilot believed that the aircraft was still registered in the United States in which case he should have been aware that US regulations required him to hold a US airman's certificate to fly a US registered aircraft across a State of which he himself was not a citizen, in this case, France.

The pilot was entitled to fly a US registered aircraft in UK airspace as the holder of a UK private pilot's licence. However he was also required to be the holder of an instrument rating when flying in a part of UK controlled airspace in which, under Rule 21, all flights shall be conducted in accordance with IFR. The pilot's night rating and Group B rating entitled him to fly passengers at night in a twin engine aircraft. However to fly in visibility conditions worse than 3 nm when below 3,000 feet with passengers on board, he was required by Schedule 9 of the ANO to be in possession of a valid IMC rating, which he was not.

### 3. Conclusions

#### (a) Findings

- (i) The aircraft had formerly been registered in the United States, but this registration had been cancelled in 1974 following a request by the previous owners to that effect. The aircraft was not subsequently re-registered in any other country, and was therefore un-registered at the time of the accident, though it still displayed its former US registration markings.
- (ii) On the basis of a Certificate of Registration which purported to show that the aircraft was still registered in the US the aircraft was maintained in accordance with an approved maintenance schedule. However the US certificate of airworthiness was no longer effective after August 1974 when the aircraft ceased to be registered in the United States.
- (iii) The pilot filed an IFR flight plan for a flight outside the United Kingdom in controlled airspace when he was not in possession of a pilot's licence appropriate to the registration markings on the aircraft.
- (iv) The pilot flew the aircraft in UK controlled airspace where instrument flight rules were in force when he was not in possession of a valid instrument rating.
- (v) The pilot flew his aircraft with passengers on board below 3,000 feet amsl in a flight visibility of less than 3 nm when he was not in possession of a valid IMC rating.
- (vi) The pilot received adequate warning of the visibility deterioration at his destination airfield, Elstree, prior to commencing his approach to land.
- (vii) The pilot attempted an approach to land at Elstree when the visibility and cloud base at the aerodrome were substantially less than that permitted by his licence. Although the conditions were below the limits set for public transport operation from that airfield, these limits did not apply to this particular flight.
- (viii) The aircraft was descending at approximately 330 feet per minute at a normal approach speed when it struck the tops of trees 458 feet amsl 1 nm south of the extended centre line of Runway 27 and 3 nm from its threshold. The area where the accident occurred was covered in thick fog.

(ix) There is no evidence of any technical malfunction or mechanical failure to account for the accident nor is there any evidence of pilot incapacitation. The reason for the aircraft's descent into the ground could not be established but the possibility cannot be excluded that the pilot was mistaken as to his exact distance from the airfield and believed himself to be closer in than in fact he was.

(x) The air traffic services at Heathrow and Elstree rendered what assistance they could to the aircraft but their actions in no way contributed to the accident.

(b) *Cause*

The accident was caused by the pilot attempting to land in conditions of low visibility at an airfield not equipped with the appropriate precision landing aids. The precise reason for the aircraft hitting the ground short of the runway could not be established but the possibility that the pilot underestimated his distance from the aerodrome and descended prematurely cannot be excluded.

## 4. Safety Recommendations

4.1 It is recommended that consideration be given to the publication of recommended aerodrome operating minima for non-public transport flights at all airfields in the United Kingdom where it is reasonably practicable to do so.

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