ACCIDENTS INVESTIGATION BRANCH
Department of Trade

Piper PA 23-250E Aztec G-AZIF

Report on the accident near Great Sampford, Essex, on 5 January 1972

LONDON: HER MAJESTY'S STATIONERY OFFICE
1974

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ISBN 0 11 511385 1

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

16 August 1974

The Rt Honourable Peter Shore 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 23–250E Aztec G-AZIF which occurred near Great Sampford, Essex on 5 January 1972.

I have the honour to be
Sir
Your obedient Servant

W H Tench
Chief Inspector of Accidents

Accidents Investigation Branch
Civil Aircraft Accident Report No 18/74
(EW/C398)

Aircraft:	Piper PA 23–250E Aztec G-AZIF
Engines:	Two Lycoming Model 10-540-C4N5
Registered Owner:	Enterprise Hotels Ltd, Renfrew, Scotland
Operator:	Air London (Executive Travel) Ltd, Gatwick Airport, Surrey
Crew:	Captain J M McCracken – Killed
Passengers:	Captain R F Jolly – Killed Mr N A de Bruyne – Killed
Place of Accident:	Near Great Sampford, Essex 51° 58'N 00° 22'E
Date and Time:	5 January 1972 at about 1824 hrs All times in this report are GMT

Summary

The aircraft was on a night flight in poor weather from Gatwick to Stansted Airport. At 1821 hrs when over the Stansted NDB it was cleared to descend to an altitude of 2,500 feet and to change to the tower radio frequency in preparation for an approach to land. The pilot's acknowledgement of this message was the last communication with the aircraft. Search and rescue procedures were initiated at 1900 hrs. The aircraft was found the following day at 1100 hrs. It had crashed eight miles northeast of Stansted Airport on ground 300 feet above mean sea level (amsl) at a point below the traffic pattern where it should have been making a level turn at 2,500 feet amsl to intercept the Instrument Landing System (ILS). All three occupants were killed on impact.

It is concluded that the accident was probably the result of a loss of control and that this was likely to have resulted from a flight instrument failure, leading to a steep dive during which the aircraft struck the ground.

1. Investigation

1.1 History of the flight

G-AZIF was flown to Geneva on 3 January 1972 by Captain Jolly, an experienced American commercial pilot, for rectification work under the terms of the manufacturer's warranty, and was flown back to Gatwick on 5 January to be handed over to the operator as a fully serviceable aircraft. The operator had previously agreed to fly Captain Jolly for no charge to Stansted on his return, and Captain McCracken was detailed to carry out this flight. Mr du Bruyne, who held a United States Commercial Pilot's Licence and instrument rating, and a United Kingdom Private Pilot's Licence, was given permission to join the flight.

Captain McCracken was heard to arrange for Captain Jolly to occupy the co-pilot's seat and Mr de Bruyne the rear seat. However, it was dark when the three pilots went out to the aircraft and no one saw how they disposed themselves. Evidence later came to light to suggest that Mr de Bruyne was in the co-pilot's seat.

The aircraft took-off at 1745 hrs and flew to Stansted via Hornchurch and Matching. At flight level 40, as the aircraft approached Sevenoaks, it was cleared direct to Hornchurch but turned and headed towards London (Heathrow) approach lanes. The radar controller immediately gave the aircraft a course correction for Biggin Hill, told the pilot when the aircraft reached that position, and then released it for normal navigation to Hornchurch. When the controller handed the aircraft over to his colleague in the Northeast Sector of the Terminal Control Area he warned him to watch the progress of the aircraft as its navigation was poor. The Northeast Sector controller also had to give corrections of course to starboard to a total of 25° to keep the aircraft on track and clear of the London (Heathrow) inbound lanes. From Hornchurch the flight continued without further assistance and the aircraft left controlled airspace five miles north of Matching.

At 1812 hrs G-AZIF called Stansted Approach and received a clearance to flight level 45, an expected approach time (EAT) of 1820 hrs, and the current Stansted weather, which included the sea level altimeter setting (QNH) 1019 mbs and the aerodrome altimeter setting (QFE) of 1006 mbs. In repeating the clearance back, the pilot quoted the EAT as 1827 hrs and the QFE as 1016. The controller corrected the mistaken approach time but not the QFE error. At 1815 hrs the aircraft was cleared to flight level 35 and half a minute later the pilot reported over the Stansted radio beacon, taking up the holding pattern. At 1817 hrs the aircraft was cleared for an Instrument Landing System (ILS) approach to Runway 23, to report at the outer marker beacon outbound. At 1821 hrs the following radio conversation between Stansted and the aircraft took place:

> 'India Fox is outbound-er-leaving three thousand five hundred.'
>
> 'Roger India Fox. The QNH is 1019. Report Sampford inbound at two five zero zero feet on the tower frequency one one eight one five.'
>
> 'Roger Sampford inbound two thousand. One zero one nine-er-to one one eight nine.'

The pilot's errors in reading back the cleared height and next radio frequency were not corrected by the air traffic controller. No further transmission was received from the aircraft on any frequency and continued transmission from

Stansted to the aircraft on approach and tower frequencies elicited no reply. A search by radar units at London, Southern and Luton airports failed to find any echo that might belong to G-AZIF. Search and rescue action then started. At 1900 hrs the 'Alert phase' of the Distress procedure was initiated and at 1930 hrs the 'Distress phase' commenced.

The search was hampered by darkness and fog, consequently the wreckage was not located until 1100 hrs on the following day (6 January) in a field at Houses Farm, Great Sampford, Essex. The aircraft had been destroyed and the three occupants killed on impact. There was no fire.

1.2 Injuries to Persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal	1	2	–
Non-fatal	–	–	–
None	–	–	–

1.3 Damage to Aircraft

Destroyed.

1.4 Other Damage

None.

1.5 Crew Information

Captain John Maurice McCracken was 34 years of age and held a valid Airline Transport Pilot's Licence, issued in 1967, endorsed for Piper PA 23, PA 28, and PA 32 aircraft, Beagle 206, Viscount, and Comet variants. His initial Instrument Rating had been issued in October 1967 after a flight test in a Piper PA 30, and had thereafter been renewed annually in the BEA Viscount and later Comet 4B simulators. The last renewal was in November 1971. His total of flying and rest periods with BEA and Air London in the 28 days before the accident were well within the authorised limits. His total flying experience was recorded as:

Total as pilot:	4,210 hours (3,495 day, 715 night).
" " " in charge:	1,870 hours (1,670 day, 200 night).
" on PA 23:	8.35 hours (7.55 day, 0.40 night).

He joined British European Airways on leaving the Royal Air Force in 1967 and flew in Viscount aircraft until March 1970, when he transferred to the Comet 4B.

At the time of the accident Captain McCracken was employed as a First Officer in BEA Airtours Ltd and had been flying part-time as a pilot for Air London (Executive Travel) Ltd since June 1971. In that month he converted to the Beagle 206, and this conversion included 1½ hours instrument flying that included a holding pattern, an ILS approach, an overshoot on one engine, and 40 minutes night flying.

Between June 1971 and the day of the accident he had flown some 50 hours with Air London on Beagle 206, PA 30 and PA 23 aircraft, and had given instrument flying instruction to candidates for civil instrument ratings. He had also accumulated about 30 hours as an instructor on a Link Trainer between March and December 1971. This experience had made him familiar with the route between Gatwick and Stansted and the Stansted approach pattern.

1.6 Aircraft information

Piper PA 23–250 G-AZIF was built in the United States of America in 1971 and was granted a United Kingdom certificate of airworthiness in the general purpose category on 16 November 1971. This certificate was valid at the time of the accident. The aircraft had flown a total of 93 hours and had been maintained in accordance with an approved maintenance schedule. A maintenance release issued on 24 December 1971 was valid at the time of the accident. The weight and balance of the aircraft were within the prescribed limits throughout the flight.

The aircraft was owned by Enterprise Hotels Ltd, Renfrew, Scotland, and operated on their behalf by Air London (Executive Travel) Ltd, Gatwick Airport, Surrey. When Air London took delivery of the aircraft its Piper Altimatic IIIB autopilot was unserviceable. On 3 January 1972 Captain Jolly, an employee of the aircraft's vendors, took it to Geneva Airport to have the automatic pilot made serviceable and to have certain other minor rectification work carried out under the terms of the manufacturer's warranty. The engineer who carried out the work in Geneva said that an air test established that there was a slight rolling motion with the autopilot engaged. The artificial horizon was changed, and after ground and air tests the engineer and Captain Jolly were both satisfied that the autopilot was fully serviceable. On 5 January 1972, the other work having been satisfactorily completed, Captain Jolly flew the aircraft back to Gatwick. The technical log was damaged in the accident, and the records of Captain Jolly's flight to Geneva, the work done there, and the two flight tests, were destroyed.

The aircraft was fitted with the standard flight instruments including a suction driven artificial horizon and directional gyro plus a DC electrically powered turn co-ordinator. There was only one altimeter, whereas for flights in controlled airspace two were required (Schedule 5 to the Air Navigation Order). Two altimeters are also required to be fitted when an aircraft is flown for the purpose of public transport. The operator intended to fit a second as soon as possible, and did not appreciate at the time the flight was authorised that it would fall into the public transport category even though no remuneration was given. The magnetic compass fitted was a small direct reading type used as a standby compass in large aircraft. The single element pitot head heater was operated by an unguarded switch at the bottom of the inboard side of the right hand instrument panel. The condition of the DC power supply and warning of its failure was indicated by a small centre-zero ammeter, on the right hand edge of the right hand instrument panel, the discharge side of which was unsighted from the first pilot by a pillar light.

The suction power failure indicator was integral with the vacuum gauge which was located on the extreme right of the instrument panel some distance away from the artificial horizon.

The aircraft was equipped with an electrically controlled pneumatically operated de-icing system consisting of inflatable leading edge boots on the wings, tailplane and fin. The boots were inflated by air from the discharge side of the vacuum pumps. When deflated they were held against the aerofoil surfaces by vacuum from the suction side of the pumps, tapped from the hose leading out of the artificial horizon case. Thus the boots, pipe work and joints of the pneumatic de-icing system were connected to the vacuum system which operated the artificial horizon, directional gyro and vacuum pressure gauge, exposing the vacuum instrument system to the effect of cuts or breakages in the de-icer boots and leaks in the suction lines.

The Flight Manual included the following statement:

'The aircraft is not approved for flight in icing conditions.'

1.7 Meteorological information

There is no record at the meteorological office at Gatwick Airport of Captain McCracken or any other pilot asking for information to cover a flight to Stansted on the afternoon of 5 January 1972 and the Meteorological Staff cannot recall that a request was made. However, one of the Air London secretarial staff obtained the Gatwick meteorological office on the telephone for Captain McCracken after he had been detailed to carry out the flight to Stansted. It seems reasonable to assume that he then checked the route weather. Captain McCracken was also seen to visit the briefing room at the Gatwick Airport General Aviation Terminal where information on the weather in the area of Kent, Sussex and Surrey was displayed. In particular he could have noted that the zero degrees Centigrade isotherm was at 1,800 feet, that icing was forecast as moderate, and that there was 5/8 to 7/8 stratocumulus in layers between 3,000 feet and 7,000 feet, with stratus covering high ground at times.

The Meteorological Office prepared a post-accident appreciation of the weather from 1700 hrs to 2000 hrs on the route Gatwick – Stansted on 5 January 1973 which included the following information:

Situation: At 1800 hrs there was a small depression situated over the North Sea centred just to the east of Cromer and filling, giving a light northerly air-stream over East Anglia. Otherwise there was a slack pressure gradient over the British Isles, but the air mass was unstable to sea temperatures.

Surface wind: South 240/280° 02/06 knots
North 320/360° 03/08 knots

2,000 feet and 5,000 feet wind: 350° 15/12 knots

Low cloud: Over Essex and Suffolk 6/8 to 8/8 stratus, base 400 to 800 feet, tops 1,200 to 1,500 feet, occasionally covering high ground. Over the whole route 6/8 to 8/8 strato-cumulus in layers, base 1,800 to 2,800 feet tops 5,000 to 7,000 feet but over East Anglia tops to 11,000 feet with cumuli probably isolated base 2,000 feet tops 10,000 feet embedded.

0° (C) Isotherm: 1,200 to 1,600 feet.

Icing: Moderate in cloud above 1,200 feet, perhaps severe in any embedded cumulus cloud.

Actual Weather Reports:

Place:	*Gatwick*	*Stansted*
Time:	1720 hrs	1820 hrs
Wind:	320° /02 knots	350° /04 knots
Visibility:	3,600 m	4,000 m
Weather:	–	Rain
Cloud:	3/8 Sc 3,000 feet 7/8 Sc 4,500 feet	8/8 St 200 feet

Pilot's Reports:

Two twin engine aircraft were in the Stansted holding pattern about the time of the accident. A Dove aircraft arrived overhead at 1830 hrs at flight level 45 and experienced icing that was cleared from the wings and propellers by the de-icing system. The commander could not estimate the degree of icing but when faced with

a delay of unknown duration beyond 1841 hrs considered it prudent to request a higher flight level that would keep him out of cloud. A Piper PA 30 without de-icing equipment was carrying out ILS practices at heights up to flight level 50 from 1750 hrs until 1859 hrs. The commander reported that only light icing formed on the aircraft and caused no difficulty of any sort.

1.8 Aids to navigation

Stansted Airport was provided with an ILS with fan markers at middle, outer, and Sampford (downwind of the outer marker) positions. There was a non-directional beacon (NDB) at the outer marker, and cathode ray direction-finding (CRDF) equipment in the Tower.

All this equipment was serviceable and operating at the time of the accident. G-AZIF carried two VHF R/T sets, two ILS localiser receivers, and ILS glidepath receiver, two VOR receivers, one ADF set, one DME set and one ATC transponder.

All this equipment was reported serviceable at the start of the flight.

1.9 Communications

There was nothing significant in the communications between G-AZIF and the ground stations, other than that relating to the track errors before Hornchurch was reached, until contact was established with Stansted approach at 1812 hrs. The transmissions of the ATC controller and Captain McCracken on the tape recording of the approach frequency were clear and distinct but the ATC controller did not correct mistakes in his readback of the QFE, airfield local frequency and final cleared altitude of 2,500 feet (see Appendix B).

Pilots who know Captain McCracken well are unanimous that his voice sounded normal with no sign of stress. The frequency he repeated back by mistake was, in fact, the local frequency for Norwich Airport, but no message was heard from G-AZIF on this frequency.

1.10 Aerodrome and ground facilities

Not relevant.

1.11 Flight recorder

Not required and not fitted.

1.12 Wreckage

Inspection at the scene of the accident, a ploughed field sloping downwards to the south, revealed that the aircraft had struck the ground at high speed with its wings level on a heading of 180° (M). There was a complete imprint of the wing plan form, the engines and the forward fuselage. The aircraft had then disintegrated, scattering wreckage fan-wise for about 150 yards. This pattern of wreckage distribution is consistent with impact with the ground during a rapid recovery from a dive.

Examination of the wreckage showed no evidence of pre-impact structural failure. The landing gear and flaps were retracted. The engines were both under high power at impact. The carburettor air heat levers were at 'cold', but it was not possible to establish that they were in this position at impact.

No evidence of pre-crash or malfunction of the aircraft's control system came to light. The position of the control surfaces and trim positions before impact could not be determined.

The pitot/static head was capable of satisfactory operation, but there was no evidence to indicate whether or not the heater element was in use at the time of impact. The static source was selected to 'emergency' but the selector cock could well have been driven there on impact.

The altimeter setting scale was found at 1019m mb, which was consistent with the QNH of 1019. The direction gyro indicated 230°, which was not consistent with the aircraft's heading at impact, but the dial showed evidence of having moved during the accident. The horizon gyro had been rotating at impact but it was not possible to assess whether it was running at its correct speed. The two engine driven vacuum pumps were found to be in good condition and there was no evidence to suggest that they had not been operating satisfactorily.

Both alternators were rotating at impact and the alternator switch was selected to 'battery', the normal in-flight position. Bulb filament examination and switch positions showed that at impact the two map lights in the cabin ceiling were off, whereas the two instrument lighting spotlights and the 'undercarriage up' lights were illuminated.

The No 2 VHF radio was selected to 118.15 MHz, the Stansted Tower frequency and the No 1 NAV radio on 110.5 MHz, the Stansted ILS frequency. The ADF was tuned to about 258 kHz, comparable with the Stansted NDB frequency of 252 kHz and the transponder was selected to 6640. The settings of the No 2 NAV and No 1 VHF radios could not be established.

The autopilot Nav/App coupler switch was at 'HDG'. The control box was badly damaged and the face missing, but marks on the height control drum indicated that it had been set at about 3,000 feet.

1.13 Medical and pathological information

Post mortem examination of the occupants revealed no condition or disease that could have had a bearing on the accident. There was nothing in the medical history of either occupant of the front seats to suggest a possible cause.

Evidence from the medical examination and that of the wreckage indicated that Captain McCracken was in the pilot's seat, Mr de Bruyne was in the co-pilot's seat, and Captain Jolly in one of the rear seats.

1.14 Fire

There was no fire.

1.15 Survival aspects

The accident was not survivable.

1.16 Tests and research

None.

1.17 Other information

1.17.1 *Search and rescue*

Search action was initiated promptly at 1827 hrs when the air traffic controller did not receive G-AZIF's expected call over the Sampford marker and continued with attempts to contact the aircraft and to locate its position using nearby radar units. The 'Alert phase' of the Distress Procedure was initiated at 1900 hrs and the 'Distress phase' at 1930 hrs.

The Essex and Southend Constabulary, upon whom the task of searching for the missing aircraft fell, were informed at 1920 hrs by the London Air Traffic Control Centre, West Drayton, that Stansted Air Traffic Control had lost contact with an aircraft on the approach to the aerodrome. They were told by Stansted Air Traffic Control that there was every possibility that the aircraft had either landed unnoticed at the aerodrome or had diverted elsewhere. Because the ATC controllers took this view the Stansted Airport Emergency Order Part 2 'Aircraft Accidents' was not put into effect nor was the only other reasonable alternative procedure in Part 4 'Full Emergency'. In consequence, none of the airport senior management were informed that contact had been lost with one of the aircraft under Stansted Air Traffic Control, and neither was the Airport Fire Service. The latter organisation knew nothing of any emergency until 2352 hrs when the British Airports Authority duty officer asked them to send a tender out to assist in the police search.

The BAA Operations Manager was in fact called out by the police at 2315 hrs and thereafter performed a valuable advisory role in the search operation. At 2010 hrs the Senior Air Traffic Control Officer coming off watch briefed police officers on the situation and in fact advised them to search an area that included the accident site.

In the continuing bad weather no air search was possible and bad visibility continued to hamper the search the following morning, with the result that the aircraft wreckage was not located until 1100 hrs.

2. Analysis and Conclusions

2.1 Analysis

The evidence obtained from the wreckage trail indicated that the aircraft was near the bottom of a straight pull-out from a steep dive when it struck the ground. This pointed to a substantial deviation from the normal ILS pattern, culminating in a loss of control at a height too low to allow recovery to be completed.

The investigation revealed several aspects that could have led directly or contributed to such a loss of control. These are examined below.

2.1.1 *Operating Technique*

Loss of control in a turn on instruments could result from inadequate flying skill. In the light of Captain McCracken's qualifications and experience and in the absence of any evidence of incapacitation, lack of skill to such an extent can be discounted. However, it is possible that he might have allowed Mr de Bruyne, in the co-pilot seat, to handle the controls for a time.

The uncorrected errors in the R/T exchange between the aircraft and ATC – apart from nullifying the only reason for reading back – suggest either a pre-occupation with something else, or a degree of incompetence in reading back ATC clearances incompatible with Captain McCracken's qualifications and experience. These errors themselves did not contribute to the accident. The incorrect QFE was never set as the accident occurred before the relevant stage of the approach and the correct frequency was found selected on one of the VHF sets.

The aircraft was flying in forecast icing conditions despite the clear instructions in the Flight Manual that such flights were not allowed. However, the aircraft was fitted with a heated pitot head and wing, tail and propeller de-icing equipment.

From the evidence from other aircraft in the Stansted holding pattern it appears unlikely that the crew found difficulties in handling the aircraft because of airframe icing.

2.1.2 *Pitot head icing*

In the existing weather conditions lack of pitot head heating could have caused the aircraft pressure instruments, ie altimeter, vertical speed indicator and air speed indicator to give false readings, resulting in the aircraft making large excursions of height and airspeed during the 180° turn onto the final approach.

The pitot head heater element was found to be serviceable after the accident, but there was no evidence to indicate whether it had been energised at the time of impact. Whilst it is reasonable to assume that the pitot heater was on for the earlier part of flight, it is possible that either the electric circuit failed, the circuit breaker 'tripped' unnoticed, or the switch was accidentally knocked off.

The pitot heater switch was mounted on the lower right instrument panel and was unguarded. On other occasions this switch is known to have been knocked to 'off' by occupants of the right hand seat.

Lack of heating for the pitot head could have contributed to a loss of control by the pilot at too low an altitude to permit recovery.

2.1.3 *Electrical failure*

There is no evidence that a general failure of the aircraft's electrical system took place. Radio transmissions from G-AZIF were at a good strength up to four minutes before the accident. Electrical failure is therefore considered to have been unlikely.

2.1.4 *Malfunction of artificial horizon*

The connection of the suction pipe to the airframe de-icer system increased the vulnerability of the artificial horizon vacuum system to leakages. However, there was no evidence that there had been a horizon malfunction. Nonetheless horizon failure should be considered. It is possible that the subject accident was initiated by an artificial horizon malfunction. Suction driven artificial horizons fail gradually when the vacuum is lost and there is no fail flag or warning on the instrument to alert the pilot that the instrument has become unreliable. If the failure of the suction supply were to go unnoticed, the pilot would continue to follow the indications of the instrument until it became obvious from some other references that the aircraft was in an unusual attitude. Postulating an artificial horizon malfunction under the prevailing conditions, it is conceivable that the aircraft could have achieved an attitude from which it would not be possible to recover within the height available.

2.1.5 *Search and rescue*

There was no delay in initiating overdue action when air traffic control did not receive G-AZIF's expected call over the Sampford marker. The 'Alert phase' of the distress procedure was initiated at 1900 hrs and the 'Distress phase' at 1930 hrs. However, the aircraft was not found until 1100 hrs on the day following the accident because weather conditions prevented an air search and hindered the ground search. In the event, this lapse of time was not significant since the occupants had been killed on impact.

If the Airport Emergency Orders had been properly complied with the Airport Fire Service and the senior management would have been informed and the chance of finding the wreckage quickly would have increased. This could have been of great importance if there had been injured survivors with no one capable of going for help. To assume that no accident has taken place was, in the circumstances the worst of two evils. It was also important to have the appropriate senior manager called out to take over the airport side of the search operation and to assist and advise the police, rather than to have such responsibilities fall on relatively junior ATC officers who already had their primary task of controlling aircraft to perform.

2.1.6 *Observations*

The accident clearly originated in an upset that led to a large loss of height that was in turn followed by the recovery of a measure of control. The upset may have been pilot induced but it is considered more probable to have been due to a technical failure. The likely possibilities are either a loss of artificial horizon information, or a malfunction of the pressure instruments due to a loss of pitot/static head heat and subsequent icing.

The method of fitting the pneumatic de-icing system inevitably increased the possibility of a failure in the artificial horizon vacuum supply. This would have been tolerable if a standby horizon had been provided powered from a separate source.

The apparent difficulty in maintaining a steady track observed by ATC during the earlier part of the flight could have been related to a flight instrument malfunction or it could simply have been the result of a less experienced pilot handling the controls during the segment of the flight; there is insufficient evidence to enable a firm conclusion to be reached.

2.2 Conclusions

(a) *Findings*

(i) The aircraft's documents were in order. It had been maintained in accordance with an approved maintenance schedule, and it was properly loaded for the flight.

(ii) The aircraft was flying in controlled airspace under instrument flight rules with one altimeter.

(iii) The pilot was properly licensed and adequately experienced for the flight.

(iv) The flight was undertaken in forecast moderate icing conditions against the instructions in the flight manual prohibiting flight in known icing conditions.

(v) The aircraft suffered a loss of control during the turn on to final approach and struck the ground.

(vi) False indications from the pressure instruments caused by icing of the pitot head, and malfunction of the single artificial horizon could have contributed to the loss of control.

(b) *Cause*

The accident was probably the result of a loss of control during the final turn on the approach to land using the Instrument Landing System at Stansted Airport. There was insufficient evidence to establish the reason for the loss of control but it is considered that the most likely cause was flight instrument failure.

3. Recommendations

It is recommended that consideration should be given to:

(1) A requirement for the fitting of a pitot heat switch incapable of accidental operation.

(2) The fitting of a warning light system to indicate loss of charge to the battery.

(3) A re-positioning of the pneumatic de-icing system suction take-off point, so as to improve the integrity of the instrument vacuum system.

(4) A review of the scales of equipment required to be fitted to aircraft flying for the purpose of public transport under instrument flight rules.

G C Wilkinson
Inspector of Accidents

Accidents Investigation Branch
Department of Trade

August 1974

Produced in England by Her Majesty's Stationery Office, Reprographic Centre, Basildon

R 79378/R92 K6 11/74 C