Department of Trade
ACCIDENTS INVESTIGATION BRANCH

Piper PA24 Comanche 180 G-ARSC
Report on the accident at Austage End Farm, Preston, Hitchin, Herts, on 15 December 1978

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Department of Trade
Accidents Investigation Branch
Kingsgate House
66–74 Victoria Street
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24 October 1979

The Rt Honourable John Nott MP
Secretary of State for Trade

Sir

I have the honour to submit the report by Mr C C Allen, an Inspector of Accidents, on the circumstances of the accident to Piper PA24 Comanche 180 G–ARSC which occurred at Austage End Farm, Preston, Hitchin, Herts, on 15 December 1978.

I have the honour to be
Sir
Your obedient Servant

W H Tench
Chief Inspector of Accidents

Accidents Investigation Branch

Aircraft Accident Report No 3/79
(EW/C 649)

Operator:		Fenland Aviation
Aircraft:	*Type:*	Piper PA24 Comanche
	Model:	180
	Nationality:	United Kingdom
	Registration:	G–ARSC
Place of Accident:		Austage End Farm, Preston, Hitchin, Herts.
		Latitude 51° 54' 36" North
		Longitude 000° 18' 21" West
Date and time of Accident:		15 December 1978 at 1737 hours
		All times in this report are GMT

Synopsis

The accident was reported to the Department of Trade Accidents Investigation Branch by London Air Traffic Control shortly after its occurrence.

The aircraft was on a flight from Cherbourg, France to Luton. Whilst approaching its destination it was positioned by Luton (radar) Director onto a final approach for Runway 26 but the aircraft never became properly established on the Luton Instrument Landing System (ILS). During its approach manoeuvres the aircraft descended and crashed 2½ miles northeast of the airport. The weather at the time of the accident included very low cloud and poor visibility. The two occupants of the aircraft were fatally injured.

The cause of the accident has not been established with certainty but it was most probably the result of an unintentional descent due to inadequate monitoring of the aircraft's altitude by the pilot.

1. Factual Information

1.1 History of the flight

The pilot planned to fly with one passenger from Cherbourg Maupertus Airport to Luton. He submitted an Instrument Flight Rules (IFR) flight plan which showed that the intended route over the United Kingdom (UK) was via Ibsley, Woodley, Bovingdon and Luton. There is no evidence that he obtained any official meteorological briefing for his route or destination before leaving Cherbourg at 1600 hrs (however see sub-heading 1.7).

The flight proceeded normally until the aircraft reached the London area, although at one point, whilst in radio telephony (RTF) contact with Bournemouth Zone, the pilot had mentioned he was losing his voice. At 1710 hrs he called Heathrow (radar) Director and reported that he was 20 miles southwest of London VOR, at 2,500 feet, routing direct to Bovingdon. The aircraft was cleared through the London Zone on a Special Visual Flight Rules* (VFR) clearance not above 1,500 feet, and at 1721 hrs it was handed over to Luton Director. On making RTF contact with the aircraft Luton Director passed the 1650 hrs weather report which included a visibility of 4,000 metres in mist with seven eights cloud at 700 feet and ended with a QNH** of 987 and a QFE*** of 968. There followed an exchange of nine messages between the aircraft and Luton Director before the pilot reported back both these pressure settings correctly. At 1722 hrs the pilot reported to Luton that he was four miles from Bovingdon and requested radar vectoring to the ILS for Luton Runway 26. He was instructed to climb to 2,000 feet QNH and was then passed the 1720 hrs Luton weather observation, which was similar to the 1650 hrs report. Luton Director then vectored the aircraft via a left hand down-wind leg onto a seven mile final approach (see plot at Appendix 1) and at 1733 hrs asked the pilot to report established on the ILS. About a half minute later the pilot was instructed to reduce to minimum safe approach speed. According to the controller the aircraft appeared initially to follow the ILS localiser but he then noticed it veering off to the left. He gave a corrective vector of 330° to bring the aircraft back to the centre line. The aircraft carried out the turn but continued through the centre line. The controller then instructed the pilot to turn onto 260° and asked 'are you receiving the localiser'. The pilot replied 'negative – we just retuned our box two so we have it now'. As the aircraft was only 2½ miles east of the airport and, as far as the controller was concerned, presumably still at 2,000 feet, the controller replied 'roger in that case sir I'll give you a radar approach, continue the right turn now onto zero eight zero, I'll position you in again . . . .'.Shortly after this message, at approximately 1736.30 hrs, the aircraft's (primary) radar echo disappeared from the radar screen, and RTF contact was lost. The aircraft was later discovered to have crashed about 2½ miles northeast of the airport in rolling countryside at about 475 feet above mean sea level. Both occupants were killed and the aircraft destroyed. There was no fire.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	1	1	–
Serious	–	–	–
Minor/None	–	–	

* Special VFR Flight. A flight which is carried out in a Control Zone in Instrument Meteorological Conditions (IMC) or at night, and which is subject to prior authorisation by an air traffic control unit but not subject to the Instrument Flight Rules.

** A QNH altimeter setting will indicate altitude ie height above mean sea level.

*** A QFE altimeter setting will indicate height above the aerodrome elevation.

1.3 Damage to aircraft

Destroyed.

1.4 Other damage

A large ash tree was destroyed.

1.5 Personnel information

Pilot:	Male
Age:	35 years
Licence:	Private Pilot's Licence – Aeroplanes with RTF licence
Ratings:	Landplanes Group A and Group B
	Night Rating
	Instrument Meteorological Conditions Rating valid to 20 March 1980
Medical certificate:	Class III dated 11 November 1978 valid to 30 November 1980
Flying experience:	
Total time as pilot:	1,020 hours
Flying experience on type:	298 hours
Time in previous 28 days:	16 hours
IMC experience:	99 hours

The pilot was working in Cherbourg on business not connected with aviation and in the past ten months had regularly flown G–ARSC, his own aircraft, between the UK and Cherbourg. During November 1978 he had landed twice at Cherbourg at night in IMC using the ILS, and earlier in December he had carried out a number of practice ILS approaches there. All of these procedures are reported to have been properly conducted. In the past twelve months he had landed at Luton about fifty times, including eight times at night, and in the past six months he had carried out six ILS approaches there, of which three were in conditions of low cloud.

A flying instructor had flown with the pilot on approximately twelve occasions when instrument approaches had been made, some of which involved using the ILS in poor weather conditions. He reported that the pilot had always been very competent, one can even say meticulous, especially with regard to his radio and instrument procedures; he would never, under any circumstances, take short cuts.

1.6 Aircraft information

1.6.1 General information

Manufacturer:	Piper Aircraft Corporation USA
Date of manufacture:	July 1961
Registered owners:	Fenland Aviation
Certificate of Airworthiness:	General Purpose Category valid until 4 October 1979
Total airframe hours:	1,860
Hours since last check:	45 (but see paragraph 1.6.2)
Engine type:	Lycoming 0–360–AID
Total engine hours:	1,055
Weight at last take-off:	2,542 lb
Estimated weight at time of accident:	2,442 lb
Maximum weight authorised	2,550 lb
Estimated C of G at time of accident:	88.56 inches aft of datum
C of G range applicable:	87.0 to 94.0 inches aft of datum
Fuel remaining at time of accident:	260 lb (36 gallons) Avgas 100 LL

Note: aircraft hours are approximate; the aircraft logbooks were not up to date.

1.6.2 Maintenance

The aircraft was being maintained in accordance with an approved maintenance schedule.

The last check due, a check 3, was carried out on 8 October 1978. However certain items were waived, as allowed for in the maintenance schedule, to be completed by 8 November 1978, and a check certificate was issued with a rider to this effect. It was also intended on this date to fit upper torso restraint harnesses for which a Civil Aviation Authority (CAA) dispensation had lapsed on 31 July 1978. Further dispensation, so that fitting could coincide with the check in October, had been refused by the CAA and the maintenance organisation had attempted without success to advise the owner of this fact. According to the CAA, the failure to fit upper torso restraint harnesses after the CAA's permission ceased to have effect, could be viewed as a contravention of Article 13(1) of the Air Navigation Order (ANO) 1976.

The aircraft was not delivered to the maintenance organisation on 8 November and there is no record of any maintenance since 8 October 1978. However, in the opinion of the CAA, the fact that the aircraft continued to fly beyond the date when the inspection of the waived items should have been completed, does not necessarily invalidate the Certificate of Airworthiness.

1.7 Meteorological information

There is no evidence that the pilot obtained a meteorological briefing at Cherbourg for his route and destination, although on previous flights he had consistently visited the airport meteorological office before leaving for the UK. However it is just possible that he obtained a briefing by telephone from another aerodrome in the UK, which he had been known to do in the past. It has also been established that the pilot had an air band VHF receiver on which he could receive the London Volmet South broadcasts whilst on the ground at Cherbourg and it was his usual practice, before flying to the UK, to listen to these broadcasts. Relevant extracts from the Volmet, prior to the aircraft's departure, are as follows:–

Last broadcast at 1500 hrs:

Luton 1420 hrs 320°/9 knots, 3,000 metres, mist, 2/8 700 feet,
7/8 2,500 feet, temperature 5, dewpoint 5.

Last broadcast at 1529 hrs:

Luton 1450 hrs 320°/7 knots, 3,500 metres, mist, 5/8 700 feet,
7/8 2,500 feet, temperature 6, dewpoint 5.

Last broadcast at 1558 hrs:

Luton 1520 hrs 320°/8 knots, 3,000 metres, mist, 4/8 600 feet,
7/8 1,200 feet, temperature 6, dewpoint 5.

The Luton forecast, valid from 1300 hrs to 2200 hrs, and issued at approximately 1215 hrs was:

Surface wind:	Variable 8 knots
Visibility:	4,000 metres
Weather:	Light rain
Cloud:	3/8 stratus at 500 feet 8/8 stratocumulus at 1,500 feet

Intermittently:

Visibility:	1,500 metres
Weather:	Moderate rain
Cloud:	7/8 stratus at 200 feet

30% probability of:

Visibility:	500 metres
Cloud:	8/8 stratus, less than 100 feet

The following relevant observations were made at Luton Airport:

Time	Surface Wind deg (T)	knots	Visibility metres	Weather	Cloud oktas	feet
1650 hrs	340	08	4,000	Mist	7 St	700
1720 hrs	300	08	4,000	Mist	2 St 6 St	800 1,200
1750 hrs	330	05	1,000	Not reported	5 St 7 St	400 500

1720 hrs Temperature: 5.5° centigrade. QNH: 987 mbs. QFE: 968 mbs.

Natural light conditions: dark night.

An aftercast of the weather situation in the vicinity of Luton was prepared by the Meteorological Office and included the following:

The main feature of the situation on 15 December 1978 was the marked transition from broken cloud, scattered showers and generally good visibility over southern England to overcast conditions just to the north of London, with extensive low stratus, outbreaks of rain or drizzle and very poor visibility.The Luton observations show a marked deterioration in the visibility and lowering of the cloud base between 1720 hrs and 1750 hrs. Examination of reports from nearby stations, in addition to the Luton observations, suggests that there was extensive low stratus in the area base 300 to 400 feet above mean sea level, which would have tended to cover the high ground in fog. Visibility would have been reduced to 1,000 – 2,000 metres, but to less than 1,000 metres in hill fog. The height of the 0° centigrade isotherm was 4,000 feet and the icing moderate. The low level wind flow was generally light and did not suggest that there would be any significant turbulence below 2,000 feet.

A pilot who landed just before the time of the accident, from an ILS approach, reported the weather as freezing fog with a cloud base of 350 to 400 feet. Another pilot, who made a radar approach about 20 minutes after the accident and then overshot and diverted to another aerodrome, reported that he saw the Luton runway lights at approximately 300 feet in restricted visibility.

1.8 Aids to navigation

1.8.1 On the ground

All the radio navigational aids at Luton Airport were serviceable. These consisted of the ILS for Runway 26 on 109.1 MHz, callsign I–LJ; the non–directional radio beacon (NDB) on 345.5 kHz callsign LUT, situated 3.9 nm from the threshold of Runway 26; Luton radar; and the very high frequency direction finding (VDF) facility.

A report on ground measurements, taken on the ILS installation at Luton immediately following the accident, shows that all readings were within the specified tolerances.

A post accident flight inspection of the ILS installation was carried out on 16 December 1978 by the Civil Aviation Authority (CAA) Flying Unit. All parameters were found to be within the limits specified except for glide path clearance below path at 8° right of the localiser centre line, range 10 nm, height 1,500 feet. This information is promulgated in the United Kingdom Air Pilot, Com 2–29*.

*A footnote on the information concerning the Luton ILS, given in the Radio Communication and Navigation Facilities section (Com 2–29) of the Air Pilot states: The localiser usable coverage sector is ± 35° about the nominal course line. At 10 nm from touchdown and 8° right of the localiser centreline, aircraft glide slope indicators will not indicate a full scale 'fly up' deflection.

A pilot, who landed from an ILS approach at Luton just before the time of the accident, reported that the ILS was working perfectly normally during his approach. Another pilot, who was held at the outer marker following the accident and used the ILS localiser on the inbound heading, reported that all indications were normal.

1.8.2 In the aircraft

The aircraft was equipped with two VHF communication transceivers, and two VHF navigation receivers, of which one could receive ILS localiser and glide path signals and one ILS localiser signals only. A single automatic direction-finding (ADF) receiver, a single distance measuring equipment (DME) and a radar transponder equipped with Mode C, were also fitted.

The No 1 VHF communication transceiver was found to be switched on and tuned to 128.75 MHz (the Luton Director frequency). The set was serviceable except that, as a result of the impact, one component had been damaged and an internal screwed connector had become disconnected. Examination showed that this disconnection could not have occurred if the connector had been fully tightened prior to impact. This evidence could be related to information from the flying instructor, who had flown with the pilot in G–ARSC, that "there had been a slight intermittent fault with the No 1 VHF communication transceiver – bad reception, etc".

The No 2 VHF communication transceiver was found to be switched off and tuned to 128.6 MHz (the London Volmet South frequency). Examination showed that this was in full working condition.

The No 1 VHF navigation receiver (with full ILS facility) was found to be switched on and tuned to 119.1 MHz (a communications frequency). Examination showed that this set was in full working condition and that the frequency selection must have been made prior to the aircraft's break-up. In particular when the Luton ILS frequency of 109.1 MHz was selected and tested, in combination with the associated glidepath receiver and ILS indicator instrument, the localiser deviations and sense were correct and the glidepath indication for a zero deviation signal input was satisfactory.

The No 2 VHF navigation receiver (ILS localiser only facility), was found to be switched on and tuned to 109.2 MHz (not an ILS frequency, but only 0.1 MHz from the correct frequency of the Luton ILS). This set was too badly damaged to check, although none of the damage was in the area of the frequency selector. It was possible to ascertain that the selected frequency on the instrument was also selected within the receiver and that the frequency selection had most probably been made prior to the aircraft's break-up. Although 109.2 MHz is a VOR frequency, tests subsequent to the accident showed that no station with this frequency was within range of an aircraft at 2,000 feet or below in the Luton area. Consequently zero deviation and a warning flag should have been displayed.

The illumination of all the VHF radio equipment frequency selector dials was in working order and found switched on, although not at full brilliance.

The ADF receiver was found to be switched off and tuned to 320 kHz. The DME was off and the radar transponder on.

1.9 Communications

VHF communications were established on all the frequencies employed from the time the aircraft entered UK air space until shortly before the impact. An RTF transcript of the communications between the aircraft and Luton is at Appendix 2.

1.10 Aerodrome information

Luton Airport is situated 1.5 nm east of the town of Luton and is at an elevation of 525 feet. There is one asphalt surfaced main runway 08/26 to which the aircraft was making its approach in a westerly direction. Runway 26 has a length of 2,160 metres and at the time of the accident the approach, VASIS and runway lights were serviceable and switched on. An instrument approach and landing chart is at Appendix 3.

1.11 Flight recorders

There was no requirement for flight recorders and none were fitted.

1.12 Wreckage and impact information

1.12.1 Site Examination

The aircraft had approached over a field, which sloped slightly downhill, and had struck a tree on its perimeter in a substantially level pitch attitude but with about 10^{o} to 15^{o} of left bank. The aircraft struck the tree about three feet above the ground with the right side of the engine whilst making good a track of about 290^{o} (M) at a fairly high speed. Simultaneously the left wing struck a low bank in which the tree was growing and the outer wing, the leading edge just inboard of it and the aileron became detached. The initial impact with the tree largely destroyed the structure of the engine and forward part of the fuselage and removed a section of the tree trunk. The mainplane passed through the gap in the tree trunk but the right tailplane struck the tree and was severed. The aircraft wreckage then continued as a projectile through the air for 120 metres, dropping debris from the engine, forward fuselage and left outer wing, before striking the ground in the bottom of a small valley about 10 metres below the initial impact point. The aircraft then slid for about 45 metres up the far side of the valley before coming to rest on a reciprocal heading, erect, with the left undercarriage leg extended .

The wreckage of the whole aircraft was found to be contained within the trail from first impact with the tree to its final position, indicating that the aircraft was structurally complete before impact. The fuel selector was found set for the right hand tank to feed the engine, and this tank was still at least three-quarters full of fuel. The left hand tank was found ruptured and empty.

1.12.2 The aircraft wreckage

1.12.2.1 Airframe

Detailed examination of the aircraft revealed no evidence of structural failure nor any evidence of flying and engine control defects or malfunction before impact. Due to the nature of break-up of the aircraft it was not possible to establish the longitudinal trim setting. There was evidence to indicate that both flaps and undercarriage had been in the retracted position at the time of first impact. The subsequent extension of the left undercarriage leg had been due to the failure of the left operating cable, which had in turn allowed the leg to free fall.

1.12.2.2 Engine and propeller

Engine

The engine had been very severely damaged by impact with the tree. Examination revealed no evidence of pre-impact distress of its components, and the appearance of the sparking plugs and combustion spaces were indicative of normal running.

Propeller

One propeller blade had become detached as a result of impact with the tree. This blade had pronounced forward curling and severe leading edge damage, indicative of considerable power at impact. The propeller hub was stripped and examined and impact damage marks made by the piston on the cylinder indicated that the propeller blade pitch was towards the fine end of the mid range.

1.12.2.3 Instruments

Airspeed indicator

The instrument was undamaged by the impact but no evidence of impact speed could be found by examination. The instrument was check calibrated and found to have a maximum error of three knots in the range 0 to 200 knots.

Altimeters

The aircraft was fitted with two altimeters. The subscale settings were:

(i) 987.5 millibars
(ii) 968.3 millibars

Both instruments showed unrealistic altitudes and when tested were extremely erratic in movement. Strip examination revealed both instruments to have suffered near identical failures of the layshaft pivots; the failures of the pivots were consistent with impact forces.

Directional gyro and artificial horizon

Both instruments were found to be operable and functioned normally. The instruments were both vacuum driven from an engine driven pump. Strip examination of the pump revealed that the carbon vane carrier had broken up. There was no evidence that this had occurred whilst the pump was being driven and it must be concluded that this fracturing was caused by a sharp blow after the pump had become detached during the impact.

1.13 Medical and pathological information

On the day of the accident, prior to the flight, the pilot had been engaged in normal office work at Cherbourg for approximately six hours. Evidence was obtained from a business associate that the pilot did not feel well, and when asked if he was leaving that weekend for his vacation (the pilot was due to take one week's holiday), replied that he felt bad but he would take his vacation as scheduled. A French friend, who had been with the pilot the previous evening, also said he was not in the best of form that day and that he appeared to have an ordinary chill but it did not prevent him from having a good dinner as usual. The friend said he had no reason to believe that the pilot had taken any medicine during his stay in Cherbourg.

It is known that on a previous occasion, when the pilot was feeling unwell, he had cancelled his flight and in consequence did not fly home until one week later.

Post mortem examination showed that the two occupants had died from severe multiple injuries. Toxicological examination excluded the presence of alcohol, carbon monoxide and drugs. Both men appeared to be in good general health and there was nothing to suggest that either was suffering from an acute or incapacitating illness; however subsequent histological examination of the pilot suggested that he might have been suffering from an early viral infection, which would be consistent with the history of his feeling unwell before the flight.

Article 20 of the Air Navigation Order states, *inter alia*, that 'A person shall not be entitled to act as a member of the flight crew of an aircraft registered in the United Kingdom if he knows or has reason to believe that his physical or mental condition renders him temporarily or permanently unfit to perform such functions or to act in such capacity'.

1.14 Fire

No fire occurred.

1.15 Survival aspects

Following the loss of radar and radio contact with the aircraft just before 1737 hrs, Luton ATC declared an aircraft accident at 1739 hrs. The emergency services were alerted and given the last known approximate position of the aircraft. A full scale search commenced; units of the airport fire service, police, county fire brigade and ambulance services were involved. At 1918 hrs the wreckage of the aircraft was found in an open field. The aircraft was destroyed. The bodies of the two occupants were found nearby.

The non-fitment of the required upper torso restraint harnesses had no bearing on the cause of death of the victims. The accident was non-survivable.

1.16 Tests and research

None.

1.17 Additional information

Radar recording

A radar recorder has been installed at the London Air Traffic Control Centre (LATCC), the data being recorded onto magnetic tapes in digital form. The digital information is received centrally at LATCC from remoted primary and secondary radar. Aircraft approaching to land at Luton are within the coverage of this equipment until descending below the radar horizon. The primary radar data provides aircraft position only; the secondary radar data, from transponder equipped aircraft, provides aircraft position, transponder code and, from suitably equipped aircraft, flight level. At the time of the accident to G–ARSC only the secondary radar data was being recorded. The aircraft was equipped with a transponder which was operating prior to the accident but the flight level (Mode C) facility was not selected on. There was no requirement for Mode C to be on during the aircraft's approach to Luton.

From the radar digital tape recording a listing of range and bearing of the aircraft from the radar head was produced. From this data a plot of the aircraft's track from 1728 hrs to the time of the disappearance of the secondary radar echo was made, and is at Appendix 1. The disappearance of the secondary radar echo at 1735.44 hrs at about 3 nm from touchdown, approximately one minute before the disappearance of the Luton Director's primary echo, is to be expected for aircraft making an ILS approach to Luton at 2,000 feet QNH or below. The plot shows that the aircraft's ground speed on the downwind leg averaged 113 knots, reducing to about 104 knots during the turn to intercept the ILS localiser but then increasing to approximately 127 knots from the completion of the turn to the time of the last radar recording.

2. Analysis

The flight from Cherbourg appears to have been well conducted up to the time that contact was made with Luton (radar) Director. During the subsequent radar positioning for an ILS approach in IMC the pilot never reported that he was established on the ILS. In these circumstances the aircraft should have remained at the initially cleared altitude – 2,000 feet. The pilot's history shows that he was a meticulous person with regard to his flying. He kept himself in current instrument flying practice and was not unused to carrying out ILS approaches in poor weather at various aerodromes, including Luton. It was therefore well within his competence and ability to maintain altitude in IMC. Obviously he did not do so; the aircraft descended through more than 1,500 feet before striking the ground.

The investigation has not revealed any defects in the airframe, engine, flying controls or flight instruments. In addition the evidence shows that the pilot was in normal RTF communication with the Luton controller up to within approximately 40 seconds of the estimated time of impact and had not reported anything amiss. It is considered unlikely therefore that the descent was the result of a mechanical fault or other defect in the aircraft, however a number of factors which may have contributed to the cause of the accident are examined below.

(i) Weather

There is no evidence that the pilot obtained a meteorological forecast from Cherbourg, as was his normal practice. However it is possible that he obtained some information by telephoning to an aerodrome in the UK. If he did so, he would have been alerted to the probability of a deterioration in the weather at Luton. If, on the other hand, he had only listened to the Volmet broadcasts, either before and/or during his flight, this would only have given him the state of the Luton weather at the time. In this eventuality he would have been less well prepared to deal with the situation when the weather deteriorated rapidly on his arrival in the Luton area. It was predictable that in the vicinity of Luton he would have to fly largely in IMC with the correspondingly greater demands on his capabilities;

(ii) RTF and radio–navigational factors

After the pilot changed RTF frequency to that of the Luton Director, he made a number of RTF errors which were subsequently corrected. This could have been caused by lack of concentration consequent upon his indifferent state of health, or alternatively it could have been due to poor reception on the aircraft's No 1 transceiver as a result of the fault in the equipment described in paragraph 1.8.2. However, he should still have had available the No 2 transceiver, which was found fully serviceable, although switched off.

During the final phase of the flight, the pilot experienced problems in receiving the Luton ILS. From examination of the wreckage, it would appear that he had selected 119.1 MHz on the No 1 VHF navigation receiver, instead of 109.1 MHz. This apparent mis-selection could have been the result of his pre-occupation with the RTF communications, or due to his impaired state of health. The frequency indicator on the No 1 VHF navigation receiver is self-illuminated and should be clearly visible. Post accident examination of this equipment showed that it was fully serviceable, including the illumination. It is also difficult to reconcile the pilot's statement that 'we just retuned our box two so we have it now' with the post-crash examination of the No 2 VHF navigation receiver, which like the No 1 receiver, was found selected to the wrong frequency by one digit. The face of this selector should also have been

illuminated and therefore clearly visible, however the figures which follow the decimal point are rather small and correspondingly more difficult to read than the whole numbers. The pilot's remark could indicate that some form of transmission may have been received on the No 2 receiver, although if indeed it had been selected to 109.2 MHz, as found, the signal could not have been the Luton ILS. However it is just possible that the selector could have moved from the correct frequency during the aircraft's break-up, which would then explain the pilot's remark. Nevertheless it would not have been possible to receive any glide slope signal on this equipment. He should in any event have been maintaining his assigned altitude – 2,000 feet – until he was certain that he was receiving the correct ILS (by identifying the call-sign) and that he was positively established on the ILS localiser and glidepath. He would also have found it easier to orientate himself with respect to the runway extended centre line if he had tuned in the LUT NDB on the ADF receiver and it would have been good operating practice to do so. However the ADF was found switched off and tuned to a different frequency.

The pilot's difficulty in receiving the Luton ILS is unlikely to have been due to a fault in the ILS ground equipment. The evidence of another pilot who made an ILS approach just before the accident, the ground readings taken immediately after the accident and the CAA flight test conducted the following day, all indicate that the Luton ILS ground installation was functioning normally. The known error on the glide slope, at a position 10 nm from touchdown and 8^{o} right of the localiser centre-line, would not have affected the aircraft's navigation receivers because the aircraft was positioned onto a seven mile final approach, well away from the area in which the error is known to occur;

(iii) Medical and psychological aspects

There is little doubt that the pilot was feeling unwell on the day of his departure. The evidence from the autopsy that he might have been suffering from an early viral infection; his remark to Bournemouth Zone that he was losing his voice; the information from his friends at Cherbourg that he did not feel well, all support this conclusion. It is also relevant that, before setting out, he had completed the best part of a day's work in the office. In these circumstances he would have been prudent to consider his position with respect to Article 20 of the ANO (see sub-heading 1.13). On a previous occasion he had cancelled a flight home because of feeling unwell, but in this instance it would appear that he considered himself fit enough to make the flight, possibly influenced to some extent by the expectation of the forthcoming week's leave.

The autopsy confirmed that he was not suffering from any serious illness and that he had not taken medicine or drugs which might have adversely affected his flying capabilities. There was no evidence of carbon monoxide poisoning, nor was there any evidence that the passenger, who was sitting in the right hand seat, had suffered any illness or seizure which might have caused him to interfere with the conduct of the flight. Since he was not himself a pilot, the passenger would have been unable to assist the pilot to any appreciable extent. It can only be a matter of conjecture as to whether or not he might have added to the pilot's workload by talking to him.

The necessity to fly on instruments on a dark night into markedly deteriorating weather, in addition to the difficulty encountered with RTF communications and in selecting the correct ILS frequency had the effect of increasing the pilot's workload. If, as the evidence indicates, he was feeling somewhat unwell and perhaps, by this time, rather tired, the combination of these factors could have led to a deterioration in the degree of concentration required for the task in hand, with the result that his monitoring of the aircraft's instruments suffered.

Some 3½ minutes before the aircraft collided with the ground, the pilot was asked to reduce to minimum safe approach speed. Assuming that he carried out this request in the normal manner by reducing power, it is not inconceivable in the circumstances just discussed, that he overlooked the necessity to re-trim the aircraft, with the result that its nose dropped, and the altitude rather than the airspeed decreased. Consistent with this possibility is the track plot derived from the radar recordings showing an increase in groundspeed, which would be partly due to the upper wind component, from the time of the message until the time of the last radar recording; there is certainly no evidence of a reduction of airspeed.

Although there would have been no external visual cues, because of the low cloud and poor visibility, it is difficult to believe that the pilot would have allowed the aircraft to continue its descent until it struck the ground. Yet there is no evidence that he took corrective action; at impact the aircraft was flying fairly fast, under power, in a flat, almost wings level attitude, evidence of controlled flight. The fact that the undercarriage and flaps were retracted is a further indication that the pilot was not intending to make an immediate landing. The reason why the pilot did not follow the controller's last instructions to turn right onto 080° is not apparent. However, he had, in the previous few minutes, misread the controller's instructions several times and it remains a matter of conjecture whether he might also have misheard this final message and was in the process of turning left onto 280°, as against right onto 080°, when the collision with the ground occurred.

In summary, the cause of the aircraft's apparently unchecked descent cannot be established with certainty. However, the most probable explanation is that the higher than normal workload imposed on the pilot when he was not feeling well led to inadequate monitoring of the aircraft's altitude.

3. Conclusions

(a) Findings

(i) The pilot was properly licensed and competent to carry out the flight.

(ii) The maintenance of the aircraft had been undertaken on the basis of an Approved Maintenance Schedule; however,

(a) the aircraft had been flown beyond the date specified in the last check certificate for items waived at the check to be completed; and

(b) the aircraft had not been fitted with upper torso restraint harnesses by the date specified by the CAA.

(iii) There is no evidence of pre-crash failure or malfunction of the aircraft, its engine or equipment, apart from an intermittent fault on No 1 VHF transceiver. This fault may have contributed to the pilot's apparent difficulty in hearing the Luton controller's RTF transmissions in the final stages of the flight.

(iv) The pilot was feeling unwell prior to departure from Cherbourg on the accident flight, and this feeling probably persisted for the duration of the flight.

(v) The pilot's evident difficulty in receiving the Luton ILS was at first due to incorrect frequency selection in the case of the No 1 VHF navigation receiver. This may have been caused by the pilot feeling unwell or being pre-occupied because of communication difficulties. It was not possible to establish with certainty whether or not the pilot was receiving the Luton ILS localiser on the No 2 VHF navigation receiver.

(vi) Following a radar positioning onto final approach at Luton, the aircraft descended, in controlled flight from its initially cleared altitude, until it struck the ground, without becoming established on the ILS. The reason for this descent could not be established with certainty. However it was most probably due to inadequate monitoring of the aircraft's altitude by the pilot during a period of high workload and whilst he was feeling unwell.

(b) Cause

It has not been possible to establish the cause of the accident with certainty. The most probable cause was an unintentional descent due to inadequate monitoring of the aircraft's altitude by the pilot whilst attempting to make an instrument approach to land. The poor state of the pilot's health was probably a contributory factor.

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Inspector of Accidents

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