

ACCIDENTS INVESTIGATION BRANCH
Department of Trade

AA-1 Yankee G-AYHD
Report on the accident at Beverley
Nursery, over the Misbourne Road,
Higher Denham, near Uxbridge,
Middlesex on 26 April 1973

List of Civil Aircraft Accident Reports issued by AIB in 1974

<i>No</i>	<i>Short title</i>	<i>Date of publication</i>
1/74	McDonnell-Douglas DC8 — 63 CF N 801 WA and Aerospatial Caravell 6 N 00—SRG approximately 10 nautical miles southeast of Lands End VOR, March 1973	April 1974
2/74	Piper PA 30 Twin Comanche G—AXRW at Shipdham Aerodrome, Norfolk, January 1973	April 1974
3/74	Slingsby T61A G—AYUO near Wycombe Air Park, Bucks., February 1973	May 1974
4/74	Viscount 802 G—AOHI at Ben More, Perthshire, Scotland, January 1973	May 1974
5/74	Owl Racer 65-2 G—AYMS at Greenwich Reach River Thames, London, May 1971	May 1974
6/74	British Caledonian Airways BAC 1-11 at Corfu Airport, Greece, July 1972	May 1974
7/74	Wallis WA—117 Autogyro G-AXAR at Farnborough, Hants., September 1970	(forthcoming)

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

5 April 1974

The Rt Honourable Peter Shore MP
Secretary of State for Trade

Sir,

I have the honour to submit the report by Mr G M Kelly, an Inspector of Accidents, on the circumstances of the accident to AA-1 Yankee G-AYHD which occurred at Beverley Nursery, over the Misbourne Road, Higher Denham, near Uxbridge, Middlesex on 26 April 1973.

I have the honour to be
Sir
Your obedient Servant

W H Tench
Chief Inspector of Accidents

Accidents Investigation Branch
Civil Aircraft Accident Report 8/74
(EW/C446)

Aircraft: AA-1 Yankee G-AYHD
Engine: One Lycoming 0-235-C2C
Registered Owner and Operator: Miss P F McDermott
Pilot: Miss P F McDermott — Killed
Passengers: Nil
Place of Accident: Beverley Nursery, over the Misbourne Road, Higher Denham, near Uxbridge, Middlesex
Date and Time: 26 April 1973 at 1445 hrs
All times in this report are GMT

Summary

After having received landing instructions to join the right hand circuit at Denham aerodrome, the aircraft entered a descending turn to the left, at a height of about 500 feet over the western boundary of the aerodrome. The turn was briefly interrupted before it steepened, and after a complete orbit and a half the aircraft struck some trees, crashed inverted into a brick building and was destroyed.

The pilot, the sole occupant, was killed.

The report concludes that the accident was caused by a failure to recover from a descending steep turn to the left. The reason for this failure cannot be established. The possibilities that the accident resulted from lack of flying experience or that a double ended ring spanner restricted or prevented aileron control movement were considered in the report but no definite conclusion could be reached.

1. Investigation

1.1 History of the flight

G-AYHD was on a private flight in Visual Meteorological Conditions (VMC) from Elstree to Denham. Miss McDermott had been advised by a fellow pilot before departure that the direction of landing would be similar at both aerodromes. At the time the runway in use at Elstree was 27.

The aircraft taxied out with full fuel tanks at 1425 hrs and at approximately 1433 hrs took off from Runway 27. It made an uneventful flight to Denham where it crossed to the south of the aerodrome, passing in the vicinity of the signal area, and then turned right to fly north towards the western boundary of the aerodrome. By this time the pilot who had experienced difficulty in establishing R/T communication had acknowledged receipt of the landing direction and circuit pattern.

The aircraft passed over the western boundary of the aerodrome in straight and level flight, on a northerly heading and at an estimated height of 500 feet. It then started a descending turn to the left, which continued until the aircraft was heading east towards the aerodrome when a brief interruption of the turn led eyewitnesses to think for a moment that the pilot intended to make an approach to land in that direction. However, the aircraft again banked steeply and continued the left turn at a high forward speed at a low altitude with the engine running under high power, passing under another aircraft that had just taken off from Strip 26 at Denham. The descending aircraft went out of sight to the west of the aerodrome on a southerly heading. It then struck some trees, crashed into a brick building and was destroyed.

The pilot, the sole occupant, was killed. There was no fire.

A diagram of the approximate flight path of the aircraft is shown in Appendix 1.

1.2 Injuries to persons

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

1.3 Damage to aircraft

The aircraft was destroyed.

1.4 Other damage

A brick building was extensively damaged; two motor vehicles sustained minor damage and a number of panes of glass in nearby greenhouses were broken.

1.5 Crew information

Patricia Fionnuala McDermott, aged 36, held a current Private Pilot's Licence endorsed for aircraft in Group 'A', and a R/T licence for VHF only. Her most recent medical certificate was dated 26 February 1973 and was valid until 28 February 1975. She suffered from myopia and her medical certificate was endorsed, 'Holder approved to wear contact lenses provided correcting spectacles are available whilst exercising the privileges of the licence.'

At the time of the accident Miss McDermott had accumulated a total of 100 hours and 18 minutes flying, including 18 hours and 10 minutes on the Yankee. So far as can be established the flight on which this accident occurred was her first cross-country by herself in this aircraft. On the only previous flight to Denham recorded in her pilot's flying log book an accompanying pilot had carried out the approach and landing.

1.6 Aircraft information

1.6.1 Construction and maintenance

The AA-1 Yankee is a side-by-side, two seater, low-wing monoplane with a fixed tricycle undercarriage. It is powered by a four cylinder horizontally opposed 108 horsepower Lycoming engine driving a fixed pitch metal propeller. The aircraft has a high performance for its type with crisp and responsive handling characteristics.

A unique metal to metal bonding process used in the airframe construction eliminates rivets and provides the aircraft with smooth aerodynamic surfaces. The tubular main spar also serves as a two cell fuel tank with each cell holding 9.15 imp/gal of usable fuel or 10 imp/gal of total fuel.

A baggage compartment is situated behind the cockpit seats in the integral centre section of the fuselage. The flight control surfaces are operated by a combination of torque tubes and conventional cable systems. Five semi-enclosed box structures are formed below the baggage compartment floor by the bottom skin of the aircraft and by four longitudinal stiffeners and two lateral members. Flanged lightening holes are pressed out of the stiffeners and the rear lateral member. The flight control cables pass through a hole in the forward member. The aileron torque tubes are carried through bearings in the inner longitudinal stiffeners to the centre box structure where the in-board end of each torque tube has its own operating horn assembly attached by a nut and bolt and connected to the aileron cables. The centre one of three access panels in the baggage floor enables inspection to be made of this part of the aileron control circuit.

The cabin heater consists of a heat exchanger shroud surrounding the muffler of the engine exhaust system. A continuously heated flow of fresh air is ducted to a balance valve mounted through the engine firewall. The valve position can be varied by a push-pull control in the cockpit so that any portion of the air supply is diverted to the cabin and the defroster vents, the balance being by-passed directly overboard.

Yankee G-AYHD was constructed by the American Aviation Corporation, Cleveland, Ohio in May 1970 and was issued with a United States export certificate of airworthiness (C of A) on 26 June 1970. After shipment to the United Kingdom it was reassembled and air tested on 20 August 1970. Adjust-

ments were then made to the aileron control circuits and the aircraft was again air tested on 24 August 1970. In due course the aircraft was issued with a United Kingdom C of A that was current at the time of the accident and which required the aircraft to be operated to the American Yankee Owner's Manual. Records showed that the aircraft had been maintained in accordance with an approved maintenance schedule.

1.6.2 Weight and balance

The exact weight of the pilot and her personal equipment is not known but estimated weights indicated that the take-off weight of the aircraft was below the maximum authorised all up weight and that the centre of gravity was within the specified envelope and 0.8 inches aft of the forward limit.

1.7 Meteorological information

The weather at the time of the accident was good. Local observations estimated the visibility as more than 10 kilometres, the wind as westerly 5 to 8 knots and no cloud. The Denham aerodrome altimeter setting (QFE) was 1,009 millibars and although no records of the QFE are kept at Elstree it has been calculated as 1,006 millibars.

1.8 Aids to navigation

Not applicable.

1.9 Communications

Both Elstree and Denham had R/T facilities but as qualified Air Traffic Controllers were not employed at either aerodrome the information provided was purely advisory. No recordings were made of R/T transmissions.

Prior permission was required before making a flight to Denham but aircraft fitted with serviceable two way radio could obtain the requisite authority to land by R/T when approaching the aerodrome. The pilot of G-AYHD was heard calling on frequency 123.5 MHz both by Denham and by other aircraft. She was passed landing information as follows: '26, right hand circuit', and, to the best of witnesses' recollection, 'QFE 1009'. She appeared to have difficulty at first in receiving the replies to her request but eventually acknowledged receipt of the information relayed to her from another aircraft by repeating '26, right'.

1.10 Aerodrome and ground facilities

The grass strips at Denham had not been marked as required by Civil Aviation Publication 168, Licensing of Aerodromes, as amended 2 April 1972, and this circumstance had been the subject of correspondence between the owner of the aerodrome and the Civil Aviation Authority.

The requirement had not been complied with because the realignment of the most frequently used strip, to reduce the nuisance of aircraft taking off and overshooting, was imminent. The realignment had been delayed by the need to fell trees on locally owned land. At the time of the accident red and white

rectangular markers were attached to the aerodrome boundary fence adjacent to the holding and take-off positions of their respective strips.

The grass strip 26 was equipped with centre line lights which were not lit and were not required to be lit. There were no other runway markers.

On the day of the accident aircraft were operating from grass strip 08 and flying a left hand circuit until about midday when the grass strip in use was changed to 26 and the circuit to right hand. According to witnesses the landing T in the signal area was realigned at the same time to indicate the new direction of landing and markers were displayed to show that right hand circuits were to be flown. During the investigation an anonymous letter was received stating that at the time of the accident the landing T was still indicating grass strip 08, but the weight of the evidence shows that the T was aligned with strip 26.

An outline plan of Denham aerodrome is at Appendix 2.

1.11 Flight recorder

Not required and not fitted.

1.12 Wreckage

Inspection at the scene of the accident showed that the aircraft had passed through the top branches of a birch tree, collided with two large oak trees in quick succession, and then crashed inverted into a brick building at the junction of a wall and the roof. Debris from the trees and the aircraft indicated that it had been travelling at a high forward speed for its type, that it had been steeply banked to the left when collision with the first oak tree occurred, and that it had continued rolling to the left after this impact. It had travelled in a straight line and on a heading of 180° (M) for approximately 47 yards from the first place of contact with the trees before hitting the building.

Examination of the wreckage revealed that the fuselage forward of the main spar had disintegrated. The engine, its firewall, and the detached propeller were found on the floor of the building, which bore considerable evidence of fuel and oil spillage. The engine ignition switch was found in the 'off' position and damage to its key and lock was consistent with its having been switched off before impact. This would explain why the propeller, although rotating at the time of the crash, was not under any significant degree of power. There was no evidence of any pre-crash defect or malfunction of the engine other than a crack in the muffler of the cabin heater. The balance valve regulating the flow of heated air to the cabin was found half open, but because of separation damage its pre-impact position could not be determined. A laboratory examination of the crack indicated that it had been present before the accident. The throttle lever was found in the fully open position and the fuel selector was switched to the starboard tank.

Because of the nature of the impacts with the trees the position of the aircraft control surfaces immediately preceding the accident could not be ascertained.

A double ended 3/8" – 7/8" A/F ring spanner, that is of a size to fit the nut and bolt securing the horn assembly to the torque tube, was found lying on the bottom skin of the integral centre section of the fuselage. Markings, some of them heavy, found below the in-board end of the starboard aileron torque tube and its horn assembly were consistent with the spanner having been lying flat on the skin. A spanner in this position would not foul the torque tube and its horn assembly and the marks could not therefore be taken as evidence that the aileron control movement had been prevented or restricted.

The communications radio set was found to be tuned to a frequency of 125.5 MHz but this setting is considered unreliable because of damage to the selector. The sub scale of the aircraft altimeter was found to be set at 1,009 millibars – the Denham QFE.

A canvas hold-all found in the wreckage contained, inter alia, a pair of contact lenses and a pair of corrective spectacles that were found on testing to be the same prescription as aids to vision normally worn by the pilot.

1.13 Medical and pathological information

A full autopsy revealed no medical cause for the accident.

The level of carboxy haemoglobin found in the pilot's blood after the accident was consistent with her known habits as a heavy smoker. The amount was insufficient to have affected her flying ability.

It was established that the pilot possessed two pairs of contact lenses. An empty holder for one pair of lenses was found at her home but no lenses were found on the eyes at the post mortem.

1.14 Fire

There was no fire.

1.15 Survival aspects

The accident was not survivable. The pilot wore a lap strap but this was of no significance since the fuselage and cockpit forward of the main spar disintegrated when the aircraft hit the building.

1.16 Tests and research

The double ended ring spanner found in G-AYHD was inserted below the in-board end of the starboard aileron torque tube on an undamaged AA-1 Yankee aircraft, in an endeavour to jam or restrict movement of the aileron controls under static conditions. The spanner could not be made to jam or restrict control movement until it was held with one end through the lightening hole in the nearest longitudinal stiffener, however it was not apparent how the spanner could have got into this position.

2. Analysis and Conclusions

2.1 Analysis

Examination of the wreckage revealed no pre-cash defect in the airframe structure or in the engine that could have contributed to or caused the accident. The cracked muffler of the engine exhaust system is not considered to have been a contributory factor in this accident since the level of carboxy haemoglobin found in the pilot's blood was consistent with her known smoking habits and would not have affected her flying ability.

Miss McDermott suffered from myopia and was permitted to fly only when wearing contact lenses or spectacles. No contact lenses were found on her eyes at post mortem but the degree of her myopia was such that unless she had been wearing such aids she would have experienced great difficulty in flying from Elstree to Denham using visual references. Since no such difficulty was experienced, since the canvas hold-all found in the wreckage contained all her corrective aids to vision except one pair of contact lenses, and since the opinion of medical experts is that the possibility of contact lenses becoming detached from the eyes during flight is very remote, it is concluded therefore that she was wearing her lenses during the flight and that they were lost on impact.

It is not known whether Miss McDermott saw the signal area display at Denham or not but she subsequently acknowledged receipt of the correct landing information by R/T and after the accident the Denham QFE of 1,009 millibars was found set on the sub-scale of the aircraft altimeter. She had also, been told by a fellow pilot before taking off on the flight that the landing direction at Denham would be similar to that at Elstree, ie westerly. It is considered therefore that she was aware of the circuit and landing directions at Denham before the aircraft went into the descending left turn over the western boundary of the aerodrome.

In the absence of evidence to the contrary, the entry of the aircraft into this turn must have been initiated for some reason by the pilot and this suggests that she may have become directionally disorientated. Some support for this may be drawn from the circumstances that there were no surface markers on the grass strips at Denham, that the pilot was not familiar with the aerodrome, and that so far as can be established this was her first cross-country flight by herself in the Yankee.

At one point it appeared to eyewitnesses that a brief interruption of the turn indicated the pilot's intention to approach from west to east. If this was so the resumption of the turn in a more steeply banked attitude is consistent with the possible sighting of another aircraft climbing out from Denham to the west and a realisation that she was approaching in the wrong direction. The continuation of the turn is compatible with an attempt to avoid this aircraft.

The reason for the subsequent failure to recover from the descending steep turn to the left cannot be positively established. A witness heard the engine running under high power before the aircraft went out of sight to the west of Denham so the ignition must have been switched 'off' by the pilot prior to impact, presumably when she concluded that the aircraft was irrecoverably out of control.

The possibility that Miss McDermott lost control simply as a result of inexperience is a real one. She was flying an aircraft with a high performance and less docility than the type she trained on. Her apparent initial confusion with the traffic pattern had led her to approach the aerodrome against the flow of traffic and she seems then to have elected, or thought herself obligated, to make a descending steep turn, the effect of which was to involve her in having to avoid another aircraft. As a result she found herself in an unfamiliar mode of flight, with a steeply banked aircraft travelling at high speed at low altitude. The handling of this situation could well have been beyond her training and experience.

However, in the light of the evidence available, this explanation of the failure of the aircraft to recover from its descending steep turn can be no more than a plausible hypothesis. Although it is considered unlikely that the spanner found in the wreckage may have restricted the movement of the aileron controls at a critical time and prevented recovery, the possibility of its having done so cannot be entirely dismissed.

Investigation of the Civil Aviation Authority records led to the conclusion that the spanner had been left in the aircraft either on its initial assembly in the United Kingdom or when the aileron controls were adjusted after the first test flight on 20 August 1970. In spite of a number of subsequent routine inspections of the aileron control circuits the spanner had remained undetected. Precautionary measures to prevent extraneous objects or matter being left in aircraft after maintenance work are detailed in the Civil Aircraft Inspection Procedures, Basic Leaflet/6-19 first issued 13 April 1970 and reissued 1 November 1971. It is considered that these measures had not effectively been put into practice.

2.2 Conclusions

(a) Findings

- (i) The pilot was properly licensed to carry out the flight.
- (ii) The weight of the aircraft at take-off was less than the maximum authorised and the centre of gravity was within approved limits.
- (iii) The documentation of the aircraft was in order.
- (iv) The aircraft had been maintained in accordance with an approved schedule, except that the exhaust muffler of the cabin heater was defective, and that the presence of a double ended ring spanner left in the fuselage centre section had remained undetected.

Precautionary measures detailed in the Civil Aircraft Inspection Procedures Basic Leaflet 6-19 had not effectively been put into practice.

- (v) The defective muffler of the cabin heater did not contribute to the accident.
- (vi) Although considered unlikely, the possibility that the double ended ring spanner found in the aircraft restricted or prevented aileron control movement cannot be entirely dismissed.
- (vii) The pilot was wearing contact lenses during the flight, the possibility that these became detached from the eyes before impact is very remote.
- (viii) The pilot was aware of the landing information at her destination before the aircraft entered the descending left turn which culminated in the accident.
- (ix) Turning in the wrong direction may have resulted from disorientation, to which a lack of surface markers on the grass strips at Denham may have contributed.
- (x) The subsequent steepening of the turn is compatible with a realisation that the approach was being made in the wrong direction.
- (xi) Attempted recovery action may have proved ineffectual because of lack of flying experience.

(b) *Cause*

The accident resulted from the failure to recover from a descending steep left turn. The reason for this failure cannot be established. The possibilities that the accident resulted from lack of flying experience or that the double ended ring spanner restricted or prevented aileron control movement have been considered but no definite conclusion was reached.

3. Recommendations

That consideration be given to reminding aircraft personnel of the precautionary measures detailed in Civil Aircraft Inspection Procedures, Basic Leaflet/6-19.

G M Kelly
Inspector of Accidents

Accidents Investigation Branch
Department of Trade

April 1974

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