

ACCIDENTS INVESTIGATION BRANCH
Department of Trade

AESL Airtourer T6/24 G-AYMF
Report on the accident near
Lands End (St Just) Aerodrome,
Cornwall on 9 June 1972

List of Civil Aircraft Accident Reports issued by AIB in 1974

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1/74	McDonnell-Douglas DC8 – 63 CF N 801 WA and Aerospatial Caravelle 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	<i>(forthcoming)</i>
8/74	AA-1 Yankee G-AYHD at Beverley Nursery, near Uxbridge, Middlesex, April 1973	July 1974
9/74	Cessna F172H G-AYDC near Humphrey Head, Lancashire, December 1972	June 1974
10/74	Beagle A.61 Series 2 (Terrier) G-ARZT near Tonbridge, Kent, August 1973	July 1974
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12/74	Piper PA-30 (Twin Comanche) G-ASLD at Newchurch, Isle of Wight, May 1972	August 1974
13/74	Tiger Moth G-APVT and Rollason Beta G-ATLY at Nottingham Airport, September 1973	<i>(forthcoming)</i>
14/74	Cessna F172H G-AVHI in the sea 44 nm east of Wick, Scotland, December 1973	<i>(forthcoming)</i>

Department of Trade
Accidents Investigation Branch
Shell Mex House
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29 May 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 AESL Airtourer T6/24 G-AYMF which occurred near Lands End (St Just) Aerodrome, Cornwall on 9 June 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 15/74
(EW/C410)

Aircraft: AESL Airtourer T6/24 G-AYMF
Engine: One Lycoming 0-320-A
Registered Owner: Glos-Air Ltd, Staverton Airport, Gloucestershire
Operator: Westward Airways (Lands End) Ltd
Commander: K Waterfield – Injured
Passenger: D E Ushaw – Killed
Place of Accident: Near Lands End (St Just) Aerodrome, Cornwall
50°06'N 05°40'W
Date and Time: 9 June 1972 at about 1520 hrs
All times in this report are GMT

Summary

The aircraft was on a private flight, and had returned to St Just aerodrome after some ninety minutes flying. It was climbing away from the airfield after a missed approach when the engine stopped. A forced landing was initiated and an approach to a suitable field was satisfactorily carried out but just before the point of intended touchdown the port wing struck the ground and the aircraft crashed. The commander was severely injured and the passenger was killed. It is concluded that the accident resulted from an unsuccessful attempt at a forced landing following engine stoppage due to fuel exhaustion.

1. Investigation

1.1 History of the flight

Both occupants were pilots and members of the Lands End Flying Club. Mr Waterfield had booked the aircraft for local flying, with the intention of taking aerial photographs, and was authorised by a club instructor to take the aircraft for one hour and was advised to check the fuel before the flight. Mr Waterfield was seen making a pre-flight check of the aircraft but was not seen, nor could he recall using the dip stick to ascertain the fuel contents although it was his usual practice to do so. He received head injuries in the accident and suffered a partial loss of memory of the events leading up to the accident.

The aircraft took off from St Just at 1350 hrs. For much of the flight, according to Mr Waterfield, the aircraft was flown by Mr Ushaw. At each of the turning points the aircraft circled with the canopy open with probably one division of flap extended, whilst Mr Waterfield took photographs. A total distance of 66 nm was covered, the route having been determined by Mr Waterfield with the help of photographs taken during the flight.

G-AYMF returned to St Just about 1515 hrs and was seen to make an approach followed by a low overshoot from about halfway down Runway 26. The aircraft flew, with some flap down, about ten feet above the runway surface to the airfield boundary and then climbed away in a normal manner. It was next noticed about four minutes later about one mile southwest of the airfield by witnesses on a caravan site whose attention was attracted to it by an unusually low-level of noise. The aircraft was descending in a turn to port into a shallow valley on the southwest side of the airfield. Part of this descent was also seen by two witnesses on the airfield, one of whom fixed the time as 1520 hrs. The aircraft disappeared from view as the turn took it on to a northwesterly heading. The witnesses both agreed that the aircraft appeared to be making a forced landing and seemed to be under control all the time it was in view.

Other than the reconstruction of the route and the use of flap during photography Mr Waterfield can recall nothing else of significance about this flight. In particular he can give no information on fuel checks, about the engine stopping, or about the accident. Mr Waterfield does not recall who was in control of the aircraft in the final stages of flight and immediately before the crash.

1.2 Injuries to persons

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

1.3 Damage to aircraft

The aircraft was destroyed.

1.4 Other damage

None.

1.5 Crew information

The Commander, Mr K Waterfield, was 28 years of age, and held a valid Private Pilot's Licence. His total flying experience as a pilot was 305 hours of which 3½ were in Airtourer aircraft. He had been checked out in the Airtourer on 29 May 1972, during which he carried out two stalls, two landings and one overshoot. The check did not include a glide approach or practice forced landing, nor did Mr Waterfield practice one during his subsequent Airtourer flying.

The other occupant, Mr D E Ushaw aged 32, held a valid Private Pilot's Licence and had 63 hours flying experience as a pilot. He had flown once before in the Airtourer, with Mr Waterfield, but had not been checked out in it by a club instructor.

1.6 Aircraft information

1.6.1 General

Airtourer T6/24 G-AYMF, constructors serial number B557, was manufactured by Aero Engine Services Ltd of Hamilton Airport, New Zealand in 1970. It was issued with a New Zealand Certificate of Airworthiness and an approved flight manual on 28 September 1970. The aircraft was imported into the United Kingdom by Glos-Air Ltd of Staverton Airport and registered in their name in November 1970.

At the time of the accident G-AYMF had a valid United Kingdom Certificate of Airworthiness in the special category. This certificate required the aircraft to be operated in accordance with the approved flight manual, in this case the New Zealand manual.

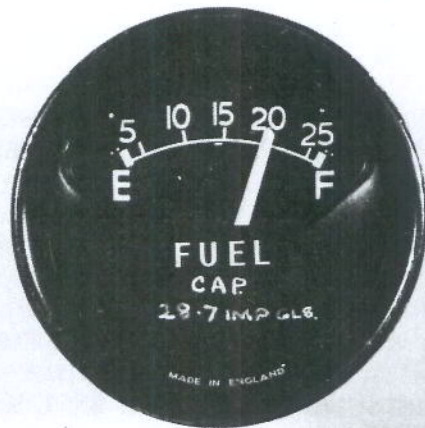
The aircraft had flown a total of 321 hours and had been maintained in accordance with the approved maintenance schedule. G-AYMF had been on hire to the Lands End Aero Club since 26 May 1972 during which time it had flown 26 hours.

A metal two blade Hartzell variable pitch propeller was fitted to the aircraft by Glos-Air on 20 October 1971.

The weight and centre of gravity of the aircraft were considered to have been within the permissible limits during the flight.

1.6.2 Fuel

Fuel was contained in a single flexible tank of 29 imp/gal capacity, and was drawn from a sump located in the rear of the tank by an electrically driven pump and also an engine driven pump. Each pump could supply the engine with adequate fuel should either fail. The fuel gauge system was of the motor car 'hot wire' type and the gauge was calibrated from 0 to 29 gallons. The full size photograph below shows that the 5 gallon mark is close to the empty mark, particularly in comparison with the width of the needle.



The only reference to fuel in the flight manual is the following:

'Use 80/87 minimum grade Aviation fuel.

Total capacity: 29.0 imp/gal
Total usable: 28.7 imp/gal'

According to Glos-Air Ltd no measured fuel consumption figures for the Airtourer were published and none were available from the manufacturer. The only documentary information appeared in the Lycoming Model O-320-A Series engine operator's manual, a copy of which was issued to all UK operators of this type of aircraft. No mention of this booklet appears in the flight manual. The Lands End Flying Club possessed a copy but Mr Waterfield had not seen it. The information quoted was for a fixed pitch propeller and US gals per hr only and was as follows:

<i>Operation</i>	<i>rev/min</i>	<i>Manifold Pressure (inches Hg)</i>	<i>Fuel Cons (US gals per hr)</i>	<i>Added for comparison</i>
Normal Rated Performance	2,700	28.7	14.0	(11.7 imp/gal per hr)
Cruise	2,450	24.5	10.0	(8.3 imp/gal per hr)
Economy Cruise	2,350	22.8	8.6	(7.1 imp/gal per hr)

Glos-Air advise users that at normal economical cruise power settings of 2,300 rev/min and 23 inches Hg manifold pressure a consumption rate of 8 imp/gal per hr should be allowed. Mr Waterfield stated that he used a figure of 6 to 7 imp/gal per hr at normal cruise settings of 22½ ins manifold pressure and 2,250 rev/min. His instructor stated that he advised Mr Waterfield to anticipate a fuel consumption of about 7 imp/gal per hr in cruising flight at 2,000 rev/min and 20 inches manifold pressure. Thus various figures were being quoted for cruising power and cruise fuel consumption but those given by Mr Waterfield were close to the figures in the engine manual.

Glos-Air had been aware of fuel gauge inaccuracies in the Airtourer type since 1969 and had been in correspondence with the manufacturer about it. In May 1971 the manufacturer introduced a modification to Airtourer T6/24 aircraft that involved the replacement of the complete fuel contents indicating system, because of inaccurate and unreliable readings obtained by the existing system. At about this time Glos-Air themselves tested a new fuel gauge and a trial installation was approved by the then Air Registration Board's local surveyor. It was found to be no better than the existing one. A solution to these difficulties was still being sought subsequent to the accident.

No written warning had been issued to operators about the accuracies of the fuel gauge, although a number of operators (but not Lands End Flying Club) were aware from their own experience that this was so. When selling or leasing aircraft Glos-Air verbally advised all operators to use the dip-stick to ascertain the fuel quantity accurately before each flight. This advice had its origin in a Service bulletin issued by the manufacturer in October 1969 stating that careful dipping was necessary, 'as the fuel contents transmitter and fuel filter are not in the same plane, readings will differ if the aircraft is not level'. This statement did nothing to imply that the gauge might be inaccurate in flight. The club instructor at Lands End Flying Club therefore had no reason to suspect the accuracy of the fuel gauge. There seemed nothing unusual about the fuel consumption which appeared to be normal for the type of aircraft, and was estimated as approximately 7 imp/gal per hr at normal cruising power of 2,000 rev/min per 20 inches. Since it was last refuelled G-AYMF had flown 2 hours 55 minutes, all on circuit work with a

significant amount of time spent on the ground. This flying was carried out by the club instructor. He stated that the aircraft was fully serviceable when he landed for the last time and that the fuel gauge indicated 15 imp/gal, a figure he considered consistent with the flying he had been doing.

On 14 July 1971 the Directorate of Flight Safety of the Department of Trade and Industry received a report that certain Airtourer fuel gauges were believed to overread. This information was passed first by telephone and then on 13 August 1971 by letter to the Air Registration Board (ARB). A copy of the letter was on the originator's file but no record could be found of its having been received, nor could the recipient of the telephone call be traced. Thus no action was taken by the ARB. After the accident to G-AYMF Glos-Air, in consultation with the Civil Aviation Authority (CAA)*, issued the following Service Bulletin applicable to all Airtourers.

Details Due to the poor characteristics of the existing fuel gauging system on all Airtourer aircraft and pending the introduction of a more reliable gauge it is imperative that pilots use the dipstick to ascertain the quantity of fuel before flight.

Action A temporary placard be affixed adjacent to the fuel gauge stating

FUEL GAUGE INACCURATE USE DIP STICK

This bulletin is an interim measure and will be revised as soon as possible after tests have been completed on an improved fuel gauge.'

Note: To date no further changes have been made to the aircraft equipment.

1.7 Meteorological information

The weather was fine, with good visibility and the surface wind was 260°/15 knots. Weather is not considered to have been a factor in this accident.

1.8 Aids to navigation

Not relevant.

1.9 Communications

The aircraft was equipped with a VHF R/T set. This was found to be tuned to 122.3 MHz the Lands End (St Just) airfield frequency. It was not in use during the flight.

* The airworthiness duties and staff of the Air Registration Board have been taken over by the Airworthiness Division of the CAA together with advisers from the Airworthiness Requirements Board.

1.10 Aerodrome and ground facilities

Not relevant.

1.11 Flight recorders

A flight recorder was neither fitted nor required to be so.

1.12 Wreckage

Examination of the wreckage at the scene of accident showed that the aircraft first struck the ground with its port wing tip. The outer wing section was torn away on impact and the aircraft then slewed around to the left and pitched on to its nose.

There was severe compressive damage to the cockpit structure and the engine mounting had failed due to crash landing. The condition of the propeller blades showed that the engine was not under power at the time of impact.

Examination of the airframe revealed no evidence of pre-crash structural failure nor of any failure or malfunction of the controls.

A strip examination of the engine revealed no evidence of pre-crash mechanical failure. The carburettor was dismantled and found to be completely empty. Both fuel pumps (one electrical, one mechanical) were tested and found to function normally. The flexible fuel tank was found to be empty.

1.13 Medical and pathological information

Mr Waterfield received serious injuries and there were large gaps in his memory about the flight. The post mortem examination of Mr Ushaw revealed no medical condition causative or contributory to the accident.

1.14 Fire

There was no fire.

1.15 Survival aspects

1.15.1 *Survival*

The aircraft was equipped with full harness for each seat, but neither occupant had his shoulder straps fastened.

Medical evidence shows that the serious injuries suffered by Mr Waterfield and the fatal injuries to Mr Ushaw were consistent with their having 'jack-knifed' over their lap straps and consequently both occupants struck their heads on the cockpit structure.

The accident was considered to have been survivable and if the occupants had been strapped in with the full harness they would probably have both escaped without serious injury.

1.15.2 *Search and rescue*

The local authority emergency services were alerted at 1552 hrs, and responded immediately.

The airport crash tender with a crew of two was the first official vehicle to arrive at the scene of the accident. The other two members of the full complement accompanied it in a private van to seek out the best route to the crash site, which was on farm land away from roads. Both vehicles arrived at 1530 hrs to find that residents from the nearby caravan site were already rendering assistance. Only Mr Waterfield was alive, and he was seriously injured. Fire prevention action and first aid was immediately carried out, and it was decided not to remove either occupant before the arrival of an ambulance. A member of the crash tender crew drove off in the van to relay information on the location of the site, there being no radio or map in the crash tender. He met a local authority ambulance that was searching the area for the aircraft and led it to the site. Thus the first ambulance arrived at 1548 hrs and the first local authority fire brigade appliance at 1601 hrs.

1.16 *Test and research*

Tests carried out by Glos-Air after the accident under the supervision of the Airworthiness Division of the Civil Aviation Authority led to the conclusion that the unusable fuel was greater than was stated in the Airtourer flight manual. The CAA decided that 1½ gallons was a realistic figure and instructed that the Airtourer flight manual be amended to this effect.

1.17 *Rescue services*

The CAA were asked to comment on the Standard of Fire Service equipment at Lands End, St Just Aerodrome, in view of the information contained in CAP 168 concerning R/T equipment on Fire and Rescue vehicles. They answered as follows: 'The fire and rescue facilities provided by the licensee satisfied the minimum requirements specified in CAP 168 Section VI and were considered to be adequate and effective for the operation of the aerodrome. Because of the nature and size of the aerodrome it was not considered necessary for the fire appliance to be fitted with radio. The view was taken that in the circumstances the absence of radio would not prevent or impair the satisfactory functioning of the aerodrome fire and rescue service. In considering the adequacy of fire and rescue equipment provided at an aerodrome the Authority is concerned only with its activity to provide a service within the boundaries of an aerodrome. Services outside are provided by the relevant local authority although if necessary the aerodrome appliances may be used to assist with the agreement of the aerodrome management'.

2. Analysis and Conclusions

2.1 Analysis

2.1.1 *The conduct of the flight*

It has not been possible to establish what happened during the last few seconds of flight, as Mr Waterfield's memory was affected by his injuries and the aircraft was not in sight of eyewitnesses immediately prior to impact with the ground.

There is no evidence of any malfunction or failure of the aircraft which could have caused a loss of control allowing the wing to strike the ground. It is probably significant that the Commander had no experience of forced landing practice in the Airtourer. The forced landing became necessary when the engine stopped due to fuel exhaustion. Because of Mr Waterfield's loss of memory, and the history of inaccuracies in the fuel gauge fitted to this type of aircraft, there is some doubt as to the amount of fuel in the aircraft when it took off. However, a considered estimate of the amount of usable fuel available on take-off on the last flight is 13½ imp/gal. This would give an endurance of one hour and ten minutes at rated power and almost two hours flying at economical cruise power.

The fuel was exhausted after about one and a half hours flying. If the Commander had been aware of the amount of fuel available on take-off and had been keeping a mental check on the amount of fuel remaining he should have been aware that the quantity of fuel remaining at the time of the overshoot was low.

Because of the shortcomings in the dissemination of information regarding the fuel gauge inaccuracies of the Airtourer type the Commander was not aware that the fuel gauge in this type of aircraft could be inaccurate and unreliable. It is possible therefore that he may have been misled by a false high fuel quantity reading.

As the accident flight included a certain amount of circling flight with the extra drag of an open canopy with at least one division of flap selected, followed by a missed approach, fuel exhaustion after an hour and a half's flying cannot be regarded as being unexpected. Therefore it would seem that either the Commander miscalculated the aircraft's endurance or he did not appreciate the amount of fuel remaining due to inaccuracies in the fuel contents gauge coupled with a possible failure to dip the fuel tank before departure.

Be that as it may, the Commander was operating with too narrow a margin in fuel reserves. The presentation of the fuel contents gauge with its thick needle and the 5 gallon mark so close to the empty mark suggests that there was little to be gained in trying to read quantities of fuel remaining of less than 5 gallons.

2.1.2 *Rescue services*

The arrival of the local authority emergency vehicles was to some extent delayed because the airfield crash tender was not equipped with radio, and could not pass on the precise location of the accident site. HMSO publication CAP 168 *Licensing of Aerodromes* prescribes the appropriate procedure and technical requirements for licensing an aerodrome. In the section relating to Fire and Rescue services it states in part as follows:

‘Efficient communications at aircraft accidents are of paramount importance. Mobile radio telephone equipment for appliances with portable equipment carried by crew leaders is essential’.

The philosophy expressed by the CAA regarding accidents outside the boundary of aerodromes can only be applied when the local authority is in a position to provide appliances of a specialist nature within a reasonable period of time. In the remote parts of the UK, such as Cornwall and the Scottish Islands, this is impracticable. It is considered the carriage of radio equipment in airfield crash vehicles should be specified.

Although the St Just emergency vehicle was fully equipped to the satisfaction of the CAA it carried no map. Thus when a crew member left the scene of the accident in a private vehicle to pass the position of the accident to the local authority emergency services he had to do so without benefit of a map reference.

This accident illustrates the value of emergency vehicles carrying a map inscribed with a grid compatible with that used by the local authority emergency services and a radio as a means of making known the location of an accident.

2.2 **Conclusions**

(a) *Findings*

- (i) The aircraft's documents were in order.
- (ii) The aircraft had been maintained in accordance with the approved maintenance schedule and was properly loaded for the flight.
- (iii) The pilots were properly licensed and adequately experienced for the flight.
- (iv) Examination of the wreckage revealed no evidence of pre-crash failure or malfunction.
- (v) The accident resulted from an unsuccessful attempt at a forced landing necessitated when the engine stopped due to fuel exhaustion.
- (vi) The Airtourer had a history of fuel gauge inaccuracies which had not been promulgated to operators and thus to pilots.

- (vii) The quantity of unusable fuel stated in the Flight Manual was incorrect.
- (viii) The information relating to fuel consumption appeared in an Engine Operator's Manual not readily related to the aeroplane.

(b) *Cause*

The accident resulted from an unsuccessful attempt at a forced landing made necessary when the engine stopped due to fuel exhaustion.

3. Recommendations

It is recommended that:

- (i) Flight manuals for light aircraft should include some reference to fuel consumption at typical power settings.
- (ii) The CAA should review the policy regarding the provision of radio equipment in aerodrome emergency vehicles at small airfields.
- (iii) All aerodrome emergency vehicles should be required to carry a map of the local area inscribed with a grid reference system compatible with local authority emergency services.
- (iv) Consideration should be given to a requirement that: Flight manuals for light aircraft should include information as to the minimum safe indicated fuel quantity for landing and that light aircraft fuel quantity gauges should be placarded to indicate this figure.

G C Wilkinson
Inspector of Accidents

Accidents Investigation Branch
Department of Trade

May 1974