

ACCIDENTS INVESTIGATION BRANCH
Department of Trade

Beagle A.61 Series 2 (Terrier) G-ARZT
Report on the accident at Home
Farm, Leigh, near Tonbridge,
Kent, on 15 August 1973

List of Civil Aircraft Accident Reports issued by AIB in 1974

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8/74	AA-1 Yankee G-AYHD at Beverley Nursery, near Uxbridge, Middlesex, April 1973	June 1974
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Department of Trade
Accidents Investigation Branch
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18 April 1974

The Rt Honourable Peter Shore MP
Secretary of State for Trade

Sir,

I have the honour to submit the report by Mr P J Bardon, an Inspector of Accidents, on the circumstances of the accident to Beagle A.61 Series 2 (Terrier) G-ARZT which occurred at Home Farm, Leigh, near Tonbridge, Kent on 15 August 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 No 10/74
(EW/C461)

Aircraft: Beagle A.61 Series 2 (Terrier) G-ARZT
Engine: Gypsy Major Mk. 10-2
Registered Owner: Sheila K N Heard
Operator and Pilot: Captain D W H Heard – Killed
Passengers: Two – 1 Killed
– 1 Injured
Place of Accident: Home Farm, Leigh, near Tonbridge, Kent.
Date and time: 15 August 1973 at 1734 hrs
All times in this report are GMT

Summary

During a private flight from Ashford (Kent) to Blackbushe the aircraft was seen circling in the vicinity of Tonbridge and its engine was heard to be faltering. Shortly afterwards, whilst making an approach to land in a field near Leigh, it stalled and struck the ground. The pilot and one passenger were killed. The other passenger received only minor injuries.

1. Investigation

1.1 History of the flight

The pilot, an experienced airline captain, was returning in a Beagle Terrier aircraft from a private visit to France. He left Le Touquet with his two passengers at 1604 hrs and after landing at Ashford aerodrome for customs clearance took off on a VFR flight to his home base, Blackbushe. Shortly afterwards he reported by radio to the control tower that he had passed Ashford town at 1,500 feet. This was acknowledged and he was informed that London Flight Information was available on 124.6 MHz. No further transmissions were received from the aircraft. Some 15 minutes later it was seen circling in the area between Leigh and Tonbridge, and its engine was heard to be faltering. After circling at low level over the trees surrounding a field near Home Farm, Leigh (two miles west of Tonbridge), it was seen coming in to land with little or no power in approximately the direction giving the longest run which lay between some cows along the south side of the field and poles carrying electricity cables across the north side. (see Appendix 1).

When nearing the grass strip, and almost clear of some corn which was growing in the first part of the field, the aircraft stalled from a height of between 75 and 100 feet. It struck the ground in a slightly nose-down attitude.

The pilot was killed as was one passenger sitting in the rear seat. The other passenger, a boy aged seven, was rescued from the front right hand seat with only minor injuries.

1.2 Injuries to persons

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

1.3 Damage to aircraft

Destroyed.

1.4 Other damage

Slight damage to fencing.

1.5 Crew information – Captain Denis William Henry Heard

- (a)
- | | |
|-----------------------------|---|
| Age: | 49. |
| Licence: | Airline Transport Pilot's No 26856, valid until 16 June 1974. |
| Instrument Rating: | Valid until 21 December 1973. |
| Aircraft Ratings: | Group I; Britannia 100/300, Boeing 707, DC6A/B, PA30. |
| Private Pilot's Privileges: | Groups 'A', 'B' and 'C'. |
| Medical Certificate: | Valid until 4 December 1973. |
| Recorded flying hours: | Total 13,885;
In command 13,353;
Beagle Terrier 195;
Beagle Terrier in previous six months 35. |
- (b) Captain Heard was employed as a Boeing 707 Captain. A condition of his licence was that he should wear spectacles to correct for near vision and should have a second pair available. No spectacles were found on the pilot or in the cockpit, but two pairs were found in a small bag in the aircraft's luggage locker. The fact that Captain Heard was not wearing spectacles at the time is not considered to be relevant to the cause of the accident.

1.6 Aircraft information – Beagle Terrier A.61 Series 2, G-ARZT

(a) *Airframe*

Manufacturer:	Beagle Aircraft Ltd, Leicester.
Date of Manufacture:	1962.
History of Ownership:	1962-1970 Airways Aero Associations Ltd. (1968-1970 in store). 1970-1973 Captain D W H Heard. 1973 (January) Sheila K N Heard.
Certificate of Airworthiness (C of A):	General Purpose Category. Renewed March 1972 and valid at the time of the accident.
Total Airframe Hours:	5,140.
Hours since C of A renewal:	105.
Maximum weight authorised:	2,400 lb.
Accident weight:	2,340 lb (estimated).
C of G Range:	18.0 inches – 23.0 inches aft of datum.
Accident C of G position:	22.0 inches aft of datum (estimated).
Fuel remaining on impact:	16 imp/gal (estimated).

(b) *Engine*

Type:	One Gipsy Major Mark 10-2; 4 cylinder, aircooled; 145 bhp.
Manufacturer:	De Havilland Engine Co.
Date of Manufacture:	Manufactured in 1960 for the RAF. Converted to 10-2 standard from the Mark 8 in 1967 and installed in G-ARZT.
Total hours:	Not recorded.
Hours since last overhaul:	1075.
Hours to next overhaul:	425.
Hours since last check:	105 (Check 4).
Fuel Type:	Petrol (AVGAS) – 80 octane.

(c) *Other relevant information*

Stall Warning: In the absence of any natural stall warning, the Beagle Terrier Series 2 is fitted with an artificial warning device consisting of a sensor in the leading edge of the starboard wing which gives a visual and aural warning in the cockpit of the approach to the stall. However, the warning device in G-ARZT was permanently inhibited by the removal of the wing mounted detector at the time of the C of A overhaul in 1970. The evidence suggests that this modification was carried out at the request of Captain Heard. The aircraft's C of A was subsequently renewed on two occasions, but on neither was it noticed that the stall warning system specified in the aircraft's Flight Manual was inoperative.

Induction Manifold: (See Appendix 2) The failure of the induction manifold was a feature of this accident. It had been in position some 5¼ years during which time the engine had run approximately 660 hours. There are no specific checks laid down in the approved maintenance schedules for ascertaining the internal condition of this component.

Engine Oil System: Some four months after C of A renewal, the engine was reported to be 'breathing heavily' and this was accompanied by oil frothing. No defect was found but the oil was changed. The same symptom was reported one month later, but again no defect was found. There were no later instances of this problem reported in the engine log book.

1.7 Meteorological information

A weather appreciation by the Meteorological Office indicated that a flow of warm dry air was circulating over southeastern England, giving the following conditions:

Surface wind:	light northeasterly.
Visibility:	4-6 kilometres.
Temperature:	18° C.

No low cloud.

1.8 Aids to navigation

The aircraft was equipped with a VOR receiver. This was found selected to 115.3 MHz, the frequency of Ockham VOR, a navigational aid which was situated 27 miles from the accident site and close to the aircraft's track to Blackbushe.

1.9 Communications

The pilot was in communication with Lympne (Ashford) Tower on 119.1 MHz until about five minutes after take-off, when he reported that he had passed Ashford town at 1,500 feet. Ashford Tower acknowledged the call and told the pilot that London Information was available on 124.6 MHz. No calls were heard thereafter from G-ARZT on this or any other frequency. During the wreckage examination the aircraft's transceiver was found selected to the London Volmet frequency (128.6 MHz).

1.10 Aerodrome and ground facilities

Not applicable.

1.11 Flight recorder

Not required and not fitted.

1.12 Wreckage

Inspection of the accident site indicated that immediately before impact the aircraft had been descending rapidly with little forward speed and in a relatively flat attitude. It broke through a barbed wire fence on a heading of about 010° (M) and struck a farm track bordering a meadow. The impact bent both wheel struts upwards and displaced the engine downwards and backwards. The aircraft then tipped onto its nose and slid along the ground for some 50 feet before turning right through 180° and coming to rest.

A detailed examination of the wreckage did not disclose any evidence of pre-crash failure or malfunction other than in the case of the engine. The examination of the wreckage established the following:

- (a) Elevator Trim – approximately neutral.
- (b) Flaps – fully up. Operating mechanism in good condition and without excessive wear.
- (c) Safety harnesses – the shoulder harnesses for each of the front seats and the lap strap for the rear passenger seat were fastened at the time of the crash.
- (d) Propeller – almost stationary on striking the ground.
- (e) Generator Failure warning light – on at moment of impact, consistent with low engine.
- (f) Engine Controls – Ignition – on;
Fuel – on;
Mixture – mid range;
Throttle – fully open, friction control tight.

A strip examination of the engine established that although the wear of cylinders and piston rings was within permissible limits, oil had been able to infiltrate past the piston rings, thereby contaminating the sparking plugs and producing an extensive coating on the piston crowns and cylinder heads. However, this defect alone would not normally cause serious engine malfunction.

The undersurface of the induction manifold heater muff (normal thickness 16 SWG) was found to be excessively corroded and porous (see Appendix 2). The pipe which drains the condensate from this area was partially blocked. The thickness of the outboard wall of the fore and aft ducting within the heater muff had been reduced by corrosion to wafer thin proportions. There were also several areas where larger holes had recently formed in the fragile and already perforated wall of the ducting.

The internal condition of the manifold suggested that progressive deterioration of the ducting within the heater muff had allowed increasing amounts of exhaust gas to leak into, and thus contaminate, the flow of fuel/air mixture from the carburettor to the cylinders. In due course some local areas of the corroded internal wall of the ducting had suddenly disintegrated into sizeable holes thus allowing relatively large amounts of exhaust gas contamination.

1.13 Medical and pathological information

A full post mortem, histological and toxicological examination was carried out on both bodies. Death in each case was almost instantaneous and due to multiple injuries. The only medical evidence relevant to the cause of the accident was that the level of ethanol (alcohol) in the pilot's blood was 149 mg. per cent. There was contributory evidence of ethanol in the urine and stomach.

1.14 Fire

There was no fire.

1.15 Survival aspects

Owing to the severity of the impact and consequent deformation of the fuselage, the accident must be considered as non-survivable. The fact that the seven year old passenger in the right hand front seat survived, was due to his small size. His evidence suggested that the pilot made an attempt to open the right hand door before the crash. However there were definite indications that both cabin doors were closed at impact.

1.16 Tests and research

In order to establish the precise effect of the corroded induction manifold on the running of the engine, arrangements were made to carry out two test runs on an engine of similar type to that fitted in G-ARZT:

The first run was made for calibration purposes on the engine fitted with a serviceable induction manifold. The readings obtained during this run indicated that the engine's performance, rev/min and power output were within the approved tolerances.

The second run was made with the corroded induction manifold fitted on the test engine with the following results:

- (1) It was difficult to start.
- (2) The engine's response to normal throttle movements was extremely poor.
- (3) It failed to achieve its normal maximum speed and power output.
- (4) It persistently backfired and ran roughly throughout its limited speed range.
- (5) Any attempt to reduce its speed below 1500 rev/min resulted in its immediate stoppage.

The failure of the engine to run at slower speeds was probably due to a reduction of exhaust gas pressure in the heater muff to the extent where air was drawn through the holes in the externally corroded areas of the heater muff. This further degraded the strength and burning properties of the fuel/air mixture, already contaminated by exhaust gas.

The tests confirmed that any sudden increase in the amount of exhaust gas escaping from the heater muff into the corroded induction manifold would immediately have caused a significant reduction in the engine's performance and handling characteristics.

2. Analysis and Conclusions

2.1 Analysis

The tests carried out with the corroded induction manifold confirmed that the loss of engine power in the air was almost certainly due to the partial disintegration of this component.

By the time the aircraft had reached the Tonbridge area the engine trouble had become sufficiently pronounced to cause the pilot to search for a landing ground in the immediate neighbourhood. With the exception of a considerably larger area a mile to the west which was probably out of reach, the field he chose was the only practicable one in the vicinity. The only suitable landing direction, although across the prevailing wind, sloped gently uphill, and gave a run of 500 m. In normal circumstances this should have been sufficient. However, the pilot had to align the aircraft so as to avoid cows grazing on the south side of the field and poles carrying electricity cables across the north side.

The evidence shows that, from a position well into the field and from a height of 75-100 feet, the aircraft stalled. It cannot be established with certainty why a pilot of this experience allowed this to occur when he apparently had the option, once within the field boundary, of steepening his angle of glide so as to maintain his airspeed, and landing, if necessary, in the corn which was below and immediately in front of him. However, the positions of the flaps, throttle and mixture control suggest that at a late stage on the approach the engine gave a burst of power, thus tempting the pilot to overshoot from a position for landing with which he was not fully satisfied. With hindsight, it can be seen that this decision was a mistake. It appears that during the overshoot the engine failed, leaving the aircraft in a position too high for a successful forced landing. The pilot, perhaps preoccupied in attempting to revive the engine, did not take the prompt corrective action required to avoid the ensuing stall.

The pathologist's evidence showed that the pilot's blood alcohol level was 149 mgm. per cent at the time of the accident. It is significant that this level is almost twice that of the legal limit for drivers of motor cars. It would, of course, have been even higher at the time of take-off from Le Touquet one and a half hours earlier. There is now considerable expert evidence that this concentration of alcohol would almost certainly produce a significant decrease in performance and sensory capacity. Captain Heard was a pilot experienced on many types of aircraft, including the Beagle Terrier, and it must be concluded that his failure to avoid a stall was partially attributable to the amount of alcohol he had consumed.

The Beagle Terrier Series 2 has no natural stall warning and for this reason is required to be fitted with an artificial warning device. It is possible that, had this device been operative, the pilot might have been alerted in time to prevent the stall. The attitude of the aircraft at impact suggests that an attempt to recover from the stall after it had developed failed due to lack of altitude.

2.2 Conclusions

(a) Findings

- (i) The pilot was experienced on the type and properly licensed. The fact that he was not wearing spectacles as required under the conditions of his licence had no bearing on the accident.
- (ii) The pilot's blood alcohol level at the time of the accident was sufficiently high to have impaired his judgement and ability.
- (iii) Apart from the deletion of the stall warning system, the aircraft had been maintained in accordance with an approved maintenance schedule and its documentation was in order. The engine had been maintained in accordance with the requirements of the Civil Aviation Authority and the engine manufacturer.
- (iv) The weight of the aircraft was below the maximum authorised and the centre of gravity was within the prescribed limits.
- (v) Whilst the aircraft was en route between Ashford and Blackbushe its engine began to lose power. This was due to an excessively corroded induction manifold allowing exhaust gases from its associated heater muff to contaminate the engine's fuel/air mixture.
- (vi) During the subsequent forced landing in difficult conditions the aircraft stalled at too low a height for effective recovery. It is considered that the lack of a stall warning device was a contributory factor.

(b) Cause

The cause of the accident was a stall at low altitude during an attempted forced landing following a loss of engine power. The pilot's ability to avoid the onset of a stall in these conditions was impaired by the amount of alcohol in his system.

3. Recommendations

It is recommended that a procedure be instituted for the inspection at suitable intervals of the internal condition of the induction manifold and heater muff assembly on this type of engine. If this proves impracticable the component should be given a limited life.

P J Bardon
Inspector of Accidents

Accidents Investigation Branch
Department of Trade

April 1974