ACCIDENTS INVESTIGATION BRANCH
Department of Trade and Industry

Beagle 206 Series 2 G–AVAL

Report on the accident at Chouppes (Vienne) near Poitiers, France on 6 March 1971

Copy of the official report produced by the French Bureau Enquêtes-Accidents, Inspection Générale de l'Aviation Civile

LONDON: HER MAJESTY'S STATIONERY OFFICE
1973

List of Civil Aircraft Accident Reports issued by AIB in 1973

No.	*Short title*	*Date of publication*
1/73	Douglas DC3 PH–MOA at Southend Airport, June 1971	February 1973
2/73	Bolkow BO 208C Junior G–ATVB near Hambledon, Surrey, January 1972	February 1973
3/73	Beagle 206 Series 2 G-AVAL at Chouppes (Vienne) near Poitiers, France, March 1971	May 1973

SBN 11 510813 0

Accidents Investigation Branch
Civil Accident Report No EW/A 219

Aircraft:	Beagle 206 Series 2 G–AVAL
Engines:	Two Continental GTS 10-520-C
Owner:	Sterling Armament Co Ltd
Operator:	Sterling Armament Co Ltd
Pilot:	Clive Anthony Raphael – Killed
Passengers:	3 – Killed
Place of Accident:	Chouppes (Vienne) near Poitiers, France
Date and Time:	6 March 1971 at 1345 hrs
	All times in the report are GMT

Summary

On Saturday 6 March 1971 at about 1345 hrs, Beagle 206, G-AVAL, a twin-engined aircraft, owned by the Sterling Armament Company Limited struck a tree when it was flying very low in a snow-storm and crashed at Chouppes (Vienne), a village about 14 nm north of Poitiers, France. The four occupants of the aircraft were killed and the aircraft was totally destroyed. The pilot, Mr Clive Raphael, accompanied by his parents and a friend, was making a private flight from Luton to Toulouse under a VFR flight plan.

1. Investigation

1.1 History of the flight

The aircraft departed from Leavesden, its home base, at 0841 hrs on 6 March for Luton where customs clearance was obtained. At 1005 hrs the pilot filed a VFR flight plan for Toulouse Blagnac, in which the following details were given: estimated departure time of 1030 hrs, ground speed of 180 knots; an estimated flight time of 3 hours 30 minutes with an endurance of 5 hours 40 minutes; route via Seaford-Caen-Amboise-Limoges-Gaillac; cruising altitude of 5,500 feet from the Channel onwards. Clermont-Ferrand was given as the alternate aerodrome.

The aircraft took off at 1054 hrs and followed a route at 1,500 feet clear of London TMA, passing over Midhurst VOR at 1133 hrs on track for Seaford.

At 1155 hrs the pilot changed frequency from London Flight Information to Paris Flight Information, but the latter received no call from G-AVAL.

Shortly before the accident at about 1330 hrs the aircraft was seen by Madame Samain, the custodian of Loudun Aerodrome, situated about 14 nm north of the accident site. The aircraft was flying at a height of about 200 m on a southwesterly heading and did not appear to be in difficulty. At Loudun Aerodrome there was still some very light snow-fall, but the heavy snow-fall of the early afternoon had ceased.

At about the same time, Monsieur Sarrodet, Loudun gendarmerie brigade commandant, heard and saw the aircraft fly over the town of Loudun (situated about 2 nm southwest of the aerodrome), where it was still snowing heavily; the aircraft was at a fairly low height on a southwesterly heading.

At about 1400 hrs, the police at St Jean-de-Sauves were informed by Monsieur Berton, a local resident, that an aircraft was flying in the direction of St Jean-de-Sauves - Chouppes (ie heading southeast) and appeared to be in difficulties as the engines were misfiring.

At about 1345 hrs the aircraft was heard at Chouppes by Monsieur Bourdon who was out of doors, 1,200 m from the point where the aircraft crashed. The witness, who at first could not see the aircraft due to the snowstorm, thought that it turned through 180°. He then saw it fly across Route Nationale 147, heading approximately northeast. He next heard sounds of an explosion, breaking trees and impact.

In confirmation of this evidence, a large branch of a pine tree, broken off at a height of over 20 m, was found at the southeast tip of a small pine wood situated to the east of Route Nationale 147 and 500 m from the accident site.

A witness of the final phase of the accident, Monsieur Joubert, who was out of doors 250 m from the accident site, saw the aircraft pass over at very low height, turning towards the west; he lost sight of it because of the snow and then heard an explosion.

1.2 Injuries to persons

Injuries	*Crew*	*Passengers*	*Others*
Fatal	1	3	–
Non-fatal	–	–	–
None	–	–	–

1.3 Damage to aircraft

The aircraft, which before reaching the ground lost part of the port wing and the rear fuselage, was totally destroyed. The wreckage was distributed over a rectangular area, along a trail 300 m in length and aligned approximately east to west.

1.4 Other damage

The only other damage was the destruction of a barbed wire fence.

1.5 Crew information

The pilot, Mr Clive Anthony W Raphael, 31 years of age and domiciled at 49 Grosvenor Square, London, was of British nationality.

He held a US private pilot's certificate for single and multi-engined aircraft, valid until 31 January 1972 (Temporary Airman Certificate No 2048502, issued on 20 February 1971). The pilot also held a first class medical certificate, carrying no limitations, dated 4 January 1971, and a restricted radiotelephone operator permit issued by the FAA, dated 1 May 1970. These certificates enabled the holder to pilot a twin-engined aircraft registered in the United Kingdom, but for the purpose of private flights only.

The pilot's flying log book has not been traced, but according to statements made by Mr Raphael to a Mr Macdonald, the pilot who checked him out on the Beagle 206, his total flying time was 1,500 hours, of which 200 hours were on twin-engined aircraft. Mr Raphael held a British Student Pilot's Licence for single-engined aircraft on 5 September 1970.

As regards instrument flying, Mr Raphael does not seem to have had an instrument flying qualification. According to Mr Macdonald's evidence, corroborated by the presence of the *BLAC Guide for the IMC Rating* among the aircraft papers, Mr Raphael intended to have some instruction in order to obtain this rating. The pilot was, however, aware of his inadequacy in this respect and, according to opinion generally, if faced with bad weather conditions, he would not have attempted to climb above the bad weather but would have remained in visual contact with the ground.

Mr Raphael's experience in the B 206 was very recent. His first flight in this type of aircraft was made on 27 February 1971, ie 8 days before the accident. On the morning of 27 February, under Mr Macdonald's supervision, he carried out a flight from Leavesden to Coventry, ie 1 hour and 5 minutes' flying, and in the afternoon took the aircraft back to Leavesden on a solo flight (35 minutes). The following day he made a local flight of 1 hour 5 minutes. Two days before the accident, he flew from Leavesden to Bristol and back in 1 hour 25 minutes. At the time of the last take-off from Leavesden, his experience in the B 206 therefore amounted to 4 hours 10 minutes flight time including 3 hours 5 minutes as aircraft commander. Mr Macdonald considered him to be a good pilot with no special problems in adjusting to this new aircraft type.

As regards Mr Raphael's attitude to flying, his friends have confirmed that it was extremely unlikely that he would deliberately have taken risks when his parents were on board.

1.6 Aircraft information

The aircraft was a Beagle B 206 Series 2, No 048, and was registered on 26 October 1966 in the name of the manufacturer until 14 July 1967 when it was purchased by the GKN Group Services Limited. It was sold on 4 March 1971 to the Sterling Armament Company Limited.

On 11 August 1967 a Certificate of Airworthiness, Transport Category (No A 9273), was issued for G–AVAL and regularly renewed. It was valid until 21 September 1971.

At the time of the accident the aircraft had completed 1,455 hours of flying time, including 534 hours since the test flight carried out on 16 September 1970 for the renewal of the Certificate of Airworthiness. Examination of the documents has not revealed any evidence on the basis of which the aircraft's maintenance could be called in question, although no maintenance documents of the usual type for the Transport Category are available. This is because British regulations permit an aircraft certificated in the Transport Category to be operated in a lower category for private purposes in accordance with the less stringent requirements.

According to Mr Mallory, the chief pilot of GKN, G–AVAL was a good aircraft although it flew slight right wing heavy which necessitated a small amount of corrective aileron and rudder trim.

On 3 March 1971, Mr Raphael arranged for the rectification of two defects by Leavesden Air Servicing Limited. The first, a minor defect, related to the aircraft heater operation and the other defect involved the press-to-transmit switch which was unserviceable. This switch was dismantled, cleaned and put back and found satisfactory on test.

G-AVAL was equipped with Continental GTS 10-520-C engines and Macauley 3F C 86 J propellers. The operating times were as follows:

Engine no	*Port 150,875 8C*	*Starboard 150,645 6C*
Total operating time since manufacture	304 hours	225 hours
Operating time since last inspection	23 hours	23 hours
Major overhaul	None	None

Propeller no	*Port 683,187*	*Starboard 67,182*
Total operating time since manufacture	1,062 hours	820 hours
Operating time since last inspection	23 hours	23 hours
Major overhaul	None	455 hours since major overhaul

Comparison of the fuel delivery notes and the declaration made for Customs purposes shows that the quantity of 100/130 fuel on take-off from Luton was 185 imperial gallons, ie nearly a full fuel load (195 imp/gal).

The weight and balance of the aircraft on take-off from Luton has not been established precisely but appears to have been within the prescribed limits.

According to a telex found among the aircraft papers, Shackleton Aviation London had arranged for the insurance of the aircraft.

1.7 Meteorological information

1.7.1 On 6 March 1971 high pressure over Great Britain dominated the weather over Western Europe. A thick cloud layer over France was moving towards the southwest.

At about 1200 hrs GMT the eastern edge of this layer extended along a line Granville-Tours-Poitiers, with cloud bases between 200 m and 400 m and tops to 3,500/5,000 m. Snow was falling from this layer and icing was occurring in the cloud.

To the east of the line, the weather was favourable for VFR, with 3/8 to 5/8 cumulus cloud, base 600 m and top 2,000 m.

After a small depression near Tours had filled, the cloud layer, pivoting about Poitiers, moved towards the west.

Tours reported a visibility of 1,000 to 2,000 m between 0900 hrs and 1200 hrs, with continuous slight snow and the cloud base falling from 1,200 feet to 200 to 300 feet.

By 1500 hrs the snow had ceased at Tours and the cloud base had risen to 2,000 to 3,000 feet though at Poitiers the cloud base was still low, 300 to 600 feet, and the visibility 3 kilometres.

The weather in the accident area is known beyond doubt from the evidence of eyewitnesses; there was heavy snow-fall and the visibility varied from 100 to 200 m.

1.7.2 *Meteorological forecasts supplied to the pilot*

Before undertaking his flight, the pilot asked by telephone at 0600 hrs for meteorological information for the flight from Luton to Toulouse.

The forecast indicated that over the Channel and northern and central France, the cloud base would mainly be from 600 to 1,000 feet, lowering in the snow showers to 300/600 feet. The visibility of 3 to 7 kilometres would be reduced to 1 kilometre in snow.

The forecasts for the arrival at Toulouse were better; cloud base 2,000/3,000 feet and visibility 10 kilometres.

At 0915 hrs GMT Mr Raphael asked at Luton Aerodrome for the latest weather information for France. He declined the charts offered him and made the following comment: 'I'll take a chance'.

1.8 **Aids to navigation**

The aircraft was equipped with two VOR receivers and one ADF receiver. The Radio Installation Certificate was dated 21.9.70 and contained the following list of equipment:

ARC 15	VOR/LOC
ARC 15 F/R 31 A	VOR/ILS
ARC 21 A	ADF
ARC 33 A	Marker

A navigation flight plan was found among the aircraft papers and it included the frequencies, call signs, and distances to Bovingdon, Seaford, Caen, Amboise, Limoges, Gaillac and Toulouse VORs.

From his communications with the British control services, the pilot is known to have navigated by VOR up to the FIR boundary.

On 6 March 1971 no reports were received of any malfunctioning of the VOR stations in this area.

1.9 Communications

The aircraft was equipped with two ARC 210 VHF transceivers (Radio Installation Certificate dated 21 September 1970 refers).

Transcripts of the recordings of the communications with Luton and London Information, ie between 1046 hrs and 1155 hrs GMT, have been studied. As regards the functioning of the radio equipment, it should be noted that between 1113 hrs and 1123 hrs the pilot does not appear to have been receiving London Flight Information (124.75 Mc/s). He did, however, receive the transmission of an aircraft acting as a relay, but the latter heard him only very weakly. When contact was re-established with London, the Control complained of a distorted transmission. At 1125 hrs everything seemed to be in order again. Nevertheless, the pilot did not seem to be as communicative as he was reputed to be.

Between 1155 hrs GMT and the time of the accident no message from the aircraft was received on the ground. Investigation has not revealed any radio contact with French stations.

It does not seem that the pilot could have been hampered by any lack of information regarding the frequencies to be used. He had with him recent Aeradio documentation covering Western Europe.

1.10 Aerodrome and ground installations

Not relevant. Nevertheless, it should be noted that Loudun Aerodrome, flown over by the aircraft before the accident, is a small private aerodrome with a grass strip 660 m long and without any installations.

The aerodrome is shown in the general aviation flight guide, a copy of which was in the pilot's possession.

1.11 Flight recorder

No flight recorder was installed in the aircraft. It was not required under the regulations.

1.12 Wreckage

1.12.1 *Wreckage trail*

The aircraft crashed at a place known as 'Le Casse' at an elevation of 95 m in flat farmland with small woods. No part of the wreckage remained near the pine tree initially struck by the aircraft. The wreckage trail lay further to the north, in a rectangle of 100 m by 300 m aligned approximately east-west, astride Route Nationale 147.

The parts were distributed along the wreckage trail in the following order:

East of Route Nationale 147, the two elevator horn balances broken off in line with the hinge, the port outer wing detached in line with the engine, the port aileron and the right hand emergency exit.

West of Route Nationale 147, the tail plane, bent upwards at mid-span on the left hand side, with the elevator still attached to it.

The rear part of the fuselage, detached from the cabin by shearing of the rivets flush with the entrance door, and including the fin and rudder; the port engine embedded flat in the ground and two propeller blades embedded in the ground.

The remainder of the airframe lying flat on the ground with the nose in a hedge.

Finally, the starboard engine upside-down.

1.12.2 *Examination of the control surfaces and control tubes*

Ailerons:

The fittings of the port aileron were detached. The starboard aileron was in position, jammed by the rigid control tubes which were intact in the starboard wing.

Tail unit:

The rudder was in position, with the trim tab positioned slightly to the right. The elevator tab on the right hand side, which had suffered little damage, was in the aircraft nose-up position. The torque tube was broken on the left hand side. The control tubes were broken at the first transmission point.

1.12.3 *Examination of the airframe*

The flaps were retracted. The undercarriage was partly down. The port wing had fallen practically vertically into some poplar trees without hitting any of them. The tears in the skin showed that they were of earlier origin than the impact with the ground.

The damage to the fuselage indicated an impact blow from the left.

1.12.4 *Examination of the cockpit*

Altimeter:	setting: LH 1013 RH 1025 pointer: '4,300 feet' '10,300 feet'
Airspeed indicator:	returned to zero
VOR/RMI:	heading 300°, No 1 needle 170° No 2 needle 119°
Rate of climb indicator:	returned to zero
VHF 1:	121.5 (distress frequency). On and selected
VHF 2:	124.1 (Paris - Flight Information). Selected and on
VOR 1:	115.5 (Limoges)
VOR 2:	115.5

ADF:	540 kc/s BFO off
De-icing:	airframe: off propeller: off pitot heater: off
Throttle, mixture and rev/min:	forward
Manifold pressure:	LH 31", RH 30.5"
Rev/min:	LH zero, RH zero
Fuel contents gauge:	LH 550 lb, RH 0 lb

The position of the switches is of no great significance, because the rescuers extricated the bodies of the occupants of the front seats laterally, after removing the cockpit windows.

1.12.5 *Examination of the marks on the ground*

The port wing struck the ground in an almost vertical position.

The ejection from the aircraft of the radio equipment, baggage and miscellaneous articles in the rear of the cabin and their position on the ground implies that the rear part of the fuselage became detached from the aircraft before the main impact.

The fact that the port engine was embedded on impact with the ground implies considerable vertical speed and kinetic energy.

The fact that the main wreckage was damaged on the left hand side indicates that it was side-slipping to the left when it touched the ground.

The starboard engine was flung over a hedge, forward of the wreckage, before it made any contact with the ground.

1.13 Fire

There was no fire.

1.14 Survival aspects

Although according to the first witnesses the occupants had not fastened their seat belts, this precaution would have been useless since the accident was not survivable.

1.15 Tests and research

1.15.1 *Engines and propellers*

The engines and propellers were examined at the Centre d'Essais des Propulseurs de Saclay and no evidence of any defect was found.

Nevertheless, the damage sustained by the engines indicates clear differences in the conditions on impact. The port engine, which was the right way up on impact, was not developing power and the propeller pitch was about 45°. The starboard engine was upside-down on impact and also was not developing power; the propeller was at fine pitch.

1.15.2 *Fuel*

One hundred cubic centimetres of fuel were recovered from the starboard engine filter and analysed at the Saclay fuel laboratory. It was not possible to make any valid measurement of the fuel characteristics from this very small quantity.

1.15.3 *Radio equipment*

The radio equipment was examined at Poitiers. The damage was too extensive for any conclusion to be formed regarding its functioning.

1.15.4 *Electric power supply*

The landing filament on each wing light was burning.

The filaments on the anti-collision lights were intact and did not show any damage typical of that which would have occurred had they been burning on impact.

The batteries located in the aircraft nose were examined. The battery elements which were not damaged in the accident were fully charged.

1.16 Examination of the papers found in the wreckage

In addition to the Aeradio navigation charts, the 1/500,000 low level navigation charts for France were found.

A navigation flight plan was also found, giving the enroute radio communication frequencies including the frequencies of aerodromes situated near the route; the VOR frequencies together with the call-signs in Morse and distances between beacons; the approximate calculation of the flight time with no wind at an indicated airspeed of 160 knots; namely 3 hours 15 minutes for a total distance of 518 nm.

Also found was a rough flight plan indicating a flight of 3 hours 35 minutes at 170 knots and an endurance of 4 hours.

2. Analysis and Conclusions

2.1 Analysis

2.1.1 *Accident sequence*

Although no part of the aircraft was found near the broken tree, there seems no doubt that this damage was caused by the aircraft. The breakage was fresh and there is no evidence that it could have been due to any other cause.

The condition of the port wing, its detachment in flight and the flight path indicated by the witnesses confirm that it was this wing which struck the tree.

It is less certain that the elevator also struck the pine tree. But the detachment in flight of the mass balances of the elevator indicates heavy vibration after contact with the tree.

The detachment of the rear part of the fuselage very probably occurred in flight during the side-slip to the left which followed the detachment of the port wing.

The side-slip was halted on the impact of the port engine with the ground. The aircraft then very probably pivoted round by reason of inertia, the starboard engine becoming detached and being flung forward.

2.1.2 *Condition of the aircraft at the time of the accident*

At the time of contact with the tree there was nothing to indicate that the aircraft was uncontrollable. The flight path after this impact shows that the speed was well above the minimum and examination of the wreckage did not reveal any pre-impact defect which would have limited the aircraft's manoeuvrability.

An attempt to land may be discounted, in view of the retracted position of the flaps and the position of the undercarriage which came down as a result of the impact.

Although the witnesses report that they heard unusual engine noise, examination of the engines has not revealed any abnormality. The propeller pitch settings are consistent with the circumstances of the accident and do not indicate any failure before the accident.

A total fuel exhaustion can be discounted in view of the quantity of fuel taken on board and the smell of fuel reported by the rescuers.

There is reliable evidence to show that there was no failure in the electric power supply.

The condition of the aircraft's radio navigation equipment is not known.

But the radio difficulties on departure and the subsequent silence give reason to suspect that the communications equipment was not functioning satisfactorily.

2.1.3 *Preparation for and conduct of the flight*

The meteorological forecasts supplied to the pilot gave an accurate picture of the actual situation. The radio navigation and communication frequencies noted by the pilot were correct. The route distances calculated by the pilot contained a few small inaccuracies but the flight times were valid.

The flight preparation was satisfactory, but the pilot appears to have underestimated the meteorological situation probably more through ignorance than daring. His flying experience, gained mainly in the Bahamas, may explain this error.

Between Luton and Midhurst the pilot experienced some navigational difficulties. The track he made good between Midhurst VOR at 1133 hrs and Loudun about 2 hours later is not known. Loudun and Chouppes are far to the west of the route shown in the flight plan. As a guide, it may be noted that a direct route via Caen at 160 knots would have brought him to Chouppes at about 1315 hrs GMT, ie about half an hour before the accident. Flight at a low altitude would have hampered the VOR navigation planned by the pilot who seems to have had no experience of the route. In addition, the decrease in visibility in the snow-storms was not favourable for visual flight.

It is difficult to see any reason for the distress frequency setting other than that of navigational difficulties. The absence of reception on the ground may be attributed either to the very low height at which the aircraft was flying or to an equipment failure. The radio transmission control had been repaired three days before the accident. In addition, there were communication difficulties at the beginning of the flight.

In any event, any such failure would have become an aggravating factor only after the pilot had flown into the bad weather.

2.2 **Conclusions**

(a) *Findings*

(i) The pilot had the necessary qualifications for carrying out a private VFR flight in a Beagle 206.

(ii) The aircraft was in order for the flight undertaken. It had been maintained in accordance with the requirements for private aircraft.

(iii) The aircraft loading and centre of gravity position were correct and its endurance was adequate for a flight from Luton to Toulouse.

(iv) The aircraft carried full IFR equipment.

(v) The meteorological conditions forecast for the landing were fairly good but the forecast enroute conditions were such that it was doubtful if VMC could be maintained throughout the flight.

(vi) The pilot had little experience either on the aircraft type flown or of instrument flight. He had no instrument flight qualification.

(vii) The pilot encountered bad weather conditions which made it necessary for him to fly progressively lower in order to maintain visual contact with the ground. During at least the last five minutes of the flight the aircraft was flying in a snow-storm and making considerable changes in heading.

(viii) The aircraft struck a tree when it was flying at a very low height on a NE heading in visibility of not more than 100 metres. At the time the pilot appears to have been turning through 180°.

(ix) Examination of the wreckage has not revealed any pre-crash defects.

(x) The pilot never contacted the French control services – which was not mandatory – but seems to have tried to do so. This silence may have been due to failure of the airborne radio equipment.

(b) *Probable cause of the accident*

The aircraft struck a tree when it was flying at a very low height in a snow-storm in order to maintain visual contact with the ground.

3. Recommendations

This accident shows the advisability of making an accurate assessment of the meteorological situation, both from the charts and during flight.

When there is a danger of encountering bad weather conditions, it may be of advantage for the Meteorological Officer to inform a VFR pilot of the position of probable clear areas in relation to the route planned.

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