

ACCIDENT INVESTIGATION BRANCH
Department of Trade

Societe Aeronautique Normande
Jodel D. 117 G-AVEI
Report on the accident at Brixham, Devon
on 3 September 1973

List of Civil Aircraft Accident Reports issued by AIB in 1974

No.	Short title	Date of publication
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
11/74	Beagle A.61 Series 2 (Terrier) G-ATMS near Saltby, Leicestershire, August 1973	July 1974
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	October 1974
15/74	AESL Airtourer T6/24 G-AYMF near Lands End, Cornwall, June 1972	September 1974
16/74	Piper PA 28-140 G-AVBM near Dursley, Gloucestershire, August 1973	September 1974
17/74	Avions Pierre Robin DR 360, Robin Knight G-AZOX at Biggin Hill Aerodrome, Kent, July 1973	November 1974
18/74	Piper PA 23-250E Aztec G-AZIF near Great Sampford, Essex, January 1972	December 1974

List of Civil Aircraft Accident Reports issued by AIB in 1974 (cont)

<i>No.</i>	<i>Short title</i>	<i>Date of publication</i>
19/74	Chipmunk DH C1 Series 22A G-ARCR at Windlesham, Surrey, September 1973	November 1974
20/74	Jodel D 117 G-AZFK at Doncaster Aerodrome, April 1973	November 1974

Department of Trade
Accidents Investigation Branch
Shell Mex House
Strand
London WC2R ODP

30 September 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 Societe Aeronautique Normande Jodel D. 117 G-AVEI which occurred at Brixham, Devon on 3 September 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. 21/74
(EW/C465)

Aircraft: Societe Aeronautique Normande Jodel D. 117 G-AVEI
Engine: One Continental C90-14-F
Registered Owner: The Callington Flying Group, Plymouth (Roborough) Airport
Operator: The Callington Flying Group
Pilot: Mr P McLay – Killed
Passengers: Three – Two killed, one seriously injured
Place of Accident: Brixham, Devon 50°24'N 03°31' W
Date and Time: 3 September 1973 at about 1145 hrs
All times in this report are GMT

Summary

It was the pilot's intention to fly from Plymouth (Roborough) Airport to Wycombe Air Park carrying his wife and two children. Due to extensive low stratus in Southwest England he decided to follow a coastal route to Exeter and thence fly overland to his destination.

When the aircraft reached Brixham the cloud base was 300 feet above mean sea level (amsl). Serious engine misfiring caused the pilot to turn inland over ground 175 feet amsl to attempt a forced landing. However, the engine stopped and the aircraft crashed into a bungalow. The pilot and his two children were killed and his wife was seriously injured. It is concluded that the engine failure was due to the combined effect of a fatigue crack in one cylinder head and the failure of one magneto, the root cause of which lay in unsatisfactory and unsupervised maintenance.

1. Investigation

1.1 History of the flight

Mr McLay was one of five members of the Callington Flying Group which owned a two seat Jodel D.117 G-AVEI. Under the rules of the group no member could take the aircraft for a flight outside the area of Plymouth R/T coverage unless he had been authorised to do so and the Group Secretary had been informed. Without such authorisation and without informing the Secretary Mr McLay made plans for a flight from Plymouth (Roborough) Airport to Wycombe Air Park on 3 September 1973 intending to return on the following day. Unknown to the other members of the Group he decided to carry his whole family which consisted of his wife, a daughter aged six and a son aged two. His wife stated that in preparation for the flight Mr McLay carried out a short test flight on the afternoon of 2 September with the whole family on board. During this flight Mrs McLay sat in the starboard seat with her daughter on her lap, while her son lay on the luggage shelf behind the seats. Mrs McLay stated that her husband was satisfied with the aircraft's flying characteristics during this flight and so decided that it would be safe to make the flight to Wycombe Air Park the following day.

Mr McLay and his family arrived at Plymouth Airport on the morning of 3 September. After supervising the refuelling of the aircraft he telephoned Wycombe Air Park and the licensed radio operator in charge of air traffic control to whom he spoke gave him landing permission and reported that the airfield weather was satisfactory. It proved impossible to discover from where Mr McLay obtained en route weather information but when he went to the control tower to book out he told the controller that the weather was clear from Exeter onwards and said he intended to fly from Plymouth to the coast, follow it to Exeter and then go direct to his destination. The controller pointed out that there was extensive low stratus in the southwest, that the cloud base at the airport was only 300 feet AGL, and advised Mr McLay that the weather was unsuitable for the Visual Flight Rules (VFR) flight he had planned.

At 1113 hrs Mr McLay called on R/T for taxi clearance. Amongst the information passed by Plymouth ATC at that time was a QFE of 1002 mbs and a QNH of 1020 mbs, and that two helicopters had recently reported a cloud base of 500 feet on the QNH in the Brixham area. G-AVEI took-off at 1119 hours and shortly afterwards reported the cloud base as 300 feet. The pilot was then passed the Wessex altimeter setting region pressure of 1013 mbs. The aircraft flew to the coast southeast of Plymouth Airport and at 1125 hrs the pilot reported that he was half a mile out to sea and that the weather was quite bright with a cloud base of about 500 feet. (The aircraft's altimeter was found to be set to 1002 mbs indicating a cloud base of about 800 feet.) At 1125½ hrs the pilot acknowledged an instruction to change frequency to London ATCC on 124.75 MHz. Having done so the pilot informed London that G-AVEI was out of Plymouth estimating Exeter at 1145 hrs flying around the coast at 500 feet. The acknowledgement of this message by London was the last radio communication with the aircraft.

Mrs McLay commented that the flight appeared to proceed without difficulty until she remembers the propeller suddenly stopping and her husband saying he would have to carry out a forced landing in a nearby rugby field. She cannot recall what happened subsequently. From eyewitness accounts it is apparent that the aircraft was flying along the coast at Brixham under a low cloud base with a visibility of 1.6 nm when the engine began misfiring. It then turned inland over Brixham, where the ground elevation varied between 175 and 200 feet, in an attempt to cross a built-up area to reach a rugby field. Whilst flying over the built-up area at a height of less than 100 feet it entered a port turn to position for a landing in the rugby field. During this turn the engine stopped, the nose fell suddenly and the aircraft crashed into a bungalow in a steep, inverted, attitude. The pilot and both children were killed and Mrs McLay was seriously injured. There was no fire and there was no casualties to persons on the ground.

1.2 Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>
Fatal	1	2	—
Non-fatal	—	1	—
None	—	—	—

1.3 Damage to aircraft

The aircraft was destroyed by ground impact.

1.4 Other damage

The aircraft crashed into a bungalow at 19 Higher Ranscombe Road, Brixham, South Devon, causing extensive structural damage.

1.5 Crew information

Crew role: Pilot.

Name: Paul McLay.

Age: 25.

Licence: Private Pilot's Licence Group 'A'. This did not contain a flight radio — telephony operator's licence, or an IMC rating. The licence had not been signed by the holder but was otherwise valid.

Total flying experience: 106:45 hrs as pilot, of which 29.55 hrs were in the Jodel D.117.

1.6 Aircraft information

G-AVEI was a Jodel type D.117 manufactured by Societe Aeronautique Normande. It was allocated Constructor's number 294. Its date of construction is given as 21 October 1955 and it originally carried French registration F-BHGI. The aircraft had flown a recorded total of 2097 hours 55 minutes up to and including 31 August 1973. Flying times during the two days preceding the accident had not been recorded in the aircraft log book although the personal flying log of the pilot involved in the accident shows that he flew the aircraft a number of times after 31 August. The aircraft flew a recorded total of 168 hours 55 minutes between the last issue of a United Kingdom Certificate of Airworthiness and 31 August 1973 and 33 hours 45 minutes between its last certified check and 31 August 1973. The last certified check, which was completed on 17 March 1973, was a Check I to the General Purpose Maintenance Schedule, Fixed Wing Aircraft (ARB/GPM/FW/1971).

Certificate of Airworthiness No 2214 had been issued for G-AVEI by the United Kingdom Civil Airworthiness Authority (CAA) on 17 October 1972. This Certificate was validated in the Special Category for the period 17 October 1972 to 16 October 1973. One of the compulsory conditions of the Certificate was that: 'The aircraft shall not be flown unless it is in an adequate state of repair and in sound working order'. A further condition was that: 'The aircraft may be used for private flying only'.

At the time of the accident the aircraft was being operated by the Callington Flying Group which was based at Plymouth Airport. There were five members of the group when the current certificate of registration was issued by the CAA on 9 June 1972, and their

names were shown on the certificate as being the owners. Since that date, three of the original members of the Group had been replaced by three new members. The CAA had not been informed of the changes in the composition of the group because changes were still in the process of taking place and thus the Certificate of Registration at the time of the accident did not show the true ownership of the aircraft. The aircraft log book, opened in 1967 following UK registration of the aircraft, shows no history of unusual defects in the aircraft during its recent life. There is, however, an uncertified and undated entry referring to a repair to the starboard magneto on the final page of the book. This entry was similar to one in the engine log book relating to the history of the engine. There were no outstanding mandatory modifications applicable to the aircraft.

The aircraft's Certificate of Airworthiness stated that the number of persons carried should not exceed two 'except that infants under the age of three carried in the arms of passengers may be left out of account for this purpose'. Thus the aircraft was improperly loaded in that a child of six was carried in the arms of a passenger and a child of two was carried on the rear luggage shelf. However the aircraft's all up weight at take-off was calculated as 1,323 lbs which is under the maximum authorised total weight of 1,357 lbs and the centre of gravity was within the laid down limits. The aircraft's instruction manual specifies a limit of 50 lbs for the maximum weight on the luggage shelf; the weight of the two year old child and baggage carried on this shelf totalled 49 lbs.

G-AVEI was powered by a Continental type C90-14F four cylinder engine manufactured by Continental Motors Corporation, Michigan, USA. The Constructor's Serial number was 48047-2-14 and the date of construction 11 June 1962. Up to 31 August 1973 it had run a recorded total time of 4005 hours 25 minutes of which 367 hours 40 minutes were since its last complete overhaul which was completed on 12 May 1968. The last certified check on the engine was carried out on 17 March 1973 and was a Check I inspection based on the General Purpose Maintenance Schedule Fixed Wing Aircraft. (ARB/GPMS/FW/1971.) The engine ran 33 hours 45 minutes between that date and 31 August 1973. Except for one entry the engine log book does not show a recent history of engine running problems. The exception is a single undated and uncertified entry on the final page of the log book which reads: 'Distributor cap replaced in starboard magneto to cure misfiring caused by tracking at this point, magnetos retimed and ground run and flight tested and found to be satisfactory.'

The pilot's personal flying log book includes the following entries relating to the engine of G-AVEI:

- '22/8. Engine test after new helicoil. Mag drop still 200 at 1700'
- '24/8. Test of new distributor head and timing. Engine very hot'
- '24/8. Test under continual rev/min changes. OK.'
- '31/8. Circuits after retiming the mag. Increase in power'

The above entries reflect only in part the work carried out on the engine in the period immediately preceding the accident. Evidence has come to light revealing that a considerable amount of time was spent during the latter part of August 1973 in attempts to rectify ignition defects on the aircraft. This work may be summarised as: removal and cleaning of the engine sparking plugs; replacement of a sparking plug insert; removal and stripping of the right hand magneto; replacement of the right hand magneto distributor block; reassembly and refitment of the right hand magneto; at least one subsequent removal of the right hand magneto at which time it was found to be stiff to turn, adjustments to its internal timing, reassembly and refitting. The work on the magneto appears to have been carried out by the pilot either solely or jointly with acquaintances without the knowledge or consent of other members of the group. There is evidence to show that it was not carried out under suitably controlled conditions and that it was not supervised by appropriately qualified persons. It was established, however, that the parts used in the repairs carried approved aeronautical parts certificates.

There is no evidence that the defect on No 2 cylinder head was detected by any person associated with the aircraft during its operation.

There is no record to show that Rolls-Royce Service Bulletins Nos T 151 and T 200 had been complied with on the engine. The subject matter of the bulletins do not relate, however, to the type of engine failure experienced in this accident.

1.7 Meteorological information

The following weather conditions were recorded at Plymouth Airport and Brixham.

Plymouth Airport

From 0800 to time of take-off (1120 hrs):

6/8 stratus base 300 feet, 8/8 strato-cumulus base 1200 feet
Visibility – 8 kilometres
Surface wind – 240° 10 knots
No precipitation
Temperature – 16.9°C
Relative humidity – 96 per cent

Brixham

Observation taken by HM Coastguard Brixham, ¼ mile from accident site, at 1145 hrs:

Sky totally overcast, low stratus base 300 feet ASL
Visibility – 1.6 nm
Condition of natural light – Daylight
Relative humidity – Estimated as high

1.8 Aids to navigation

The aircraft was not equipped with any navigational aids.

1.9 Communications

G-AVEI was in contact with Plymouth (Roborough) Airport ATC on 123.4 MHz from 1114 hrs when taxi clearance was requested until 1124½ hrs when the pilot was cleared to change frequency to London ATCC on 124.75 MHz. After establishing contact with London at this time nothing further was heard from the aircraft.

1.10 Aerodrome and ground facilities

Not relevant.

1.11 Flight recorder

No flight recorder was carried or required.

1.12 Wreckage

1.12.1 Accident site

Examination of the accident site showed that the aircraft had struck the roof and front face of a small bungalow situated in a residential area of Brixham. The aircraft had been

in an inverted and steeply descending attitude at the time of impact, the starboard wing penetrating the roof, and the nose and forward fuselage penetrating the front face of the building. The damage to the building and the limited break-up of aircraft structure showed that the speed of the aircraft at the time of impact was low and the general characteristics of the site and wreckage suggested that the aircraft was out-of-control at the time of impact. No fire occurred although examination showed that the rear fuel tank of the aircraft contained over 10 imp/gal of gasoline subsequent to the accident.

1.12.2 *Airframe and ancillaries*

Examination of the aircraft structure showed that it was complete at the time of striking the building. The forward structure of the aircraft broke up on penetrating the bungalow the power unit and the main wing sections becoming almost completely detached from the remainder of the aircraft. The cockpit area totally disintegrated but the rear section of the fuselage remained relatively intact with the fin, rudder, tailplanes and elevators still attached.

Examination showed that the lap straps provided for each of the two seats were fully fastened and that they were approximately equally extended. The right hand control column had been removed before flight and was stowed in the aircraft.

The aircraft longitudinal trim system was found to be intact and slightly damaged.

Examination of the airframe structure and the associated flying control systems was carried out and it was found that all damage sustained was consistent with impact with the bungalow. Examination of those parts of the structure which escaped damage, showed them to be sound and in a serviceable condition. All flying control system cables were still attached to their respective control system attachments, pins, bearings, and locking were found to be satisfactory. No evidence of any pre-impact damage or failure was found in any part of the airframe or in any part of the flying control systems.

1.12.3 *Fuel*

A quantity of fuel was found in the engine fuel filter. Samples of this fuel and of that remaining in the rear fuel tank were removed for analysis. Tests showed that the samples were of Grade 100L AVGAS, which had no significant contamination and complied with specification requirements.

1.12.4 *Engine*

The wooden propeller blades broke up on impact but the boss remained attached to the engine. Examination of the broken blades revealed no evidence to indicate that they were rotating when they struck the building.

The engine and its associated components broke away almost completely from the surrounding structure when the aircraft struck the building. The engine was subjected to high inertia loading but sustained limited impact damage. It was subjected to a detailed examination and the following salient features concerning its post-crash condition were established:

- 1.12.4.1 The magneto timing was checked prior to engine strip. It was found that the timing of the left hand magneto was satisfactory. The timing of the right hand magneto was initially found to be advanced by 3 degrees but inspection showed that this figure was variable due to an internal defect in the magneto.
- 1.12.4.2 The left hand magneto was functionally tested and found to be satisfactory. The right hand magneto was found to be partially seized and could not be functionally tested. Examination showed that the seizure was due to a break-up of the drive shaft cam and

bearing ball race. There were indications that the bearing break-up was not caused by impact with the building. There had been a malalignment of the bearing components within the housing which had caused the damage and break-up had occurred whilst the magneto had been operating. The bearing failure resulted in further internal damage notably to the teeth of the distributor drive gear.

1.12.4.3 The engine was progressively stripped to determine its mechanical condition during which the valve timing was checked and found to be correct.

1.12.4.4 Inspection of the mechanical condition of the engine revealed a failure of No 2 cylinder in the cylinder head to barrel thread attachment area due to fatigue. The fatigue area extended over approximately 25 per cent of the total aluminium alloy wall section and resulted in subsequent complete fracture of the cylinder head. The growth rate of the fatigue could not be assessed but abrasion of the faces and evidence of the passage of hot gasses indicated that the cylinder had probably been leaking for some time before complete separation took place. It was not possible to determine whether the final fracture of the head occurred in flight or was the result of inertia and other loadings during impact.

1.12.4.5 Other than the bearing and associated failure in No 2 magneto and the material failure in No 2 cylinder, strip examination of the engine showed that its mechanical condition was satisfactory and no evidence of further mechanical or material failure prior to impact was apparent.

1.12.4.6 The sparking plugs fitted to the engine were of an approved type. Two of the plugs had been damaged during impact and could not be functionally tested. The general condition of the plugs was poor, but functional tests on the undamaged plugs showed they would function under controlled test pressure conditions.

1.12.5 *Engine Associated Components*

1.12.5.1 The fuel cock operating linkage became detached during impact. The fuel cock was examined radiographically and was found to be selected to No 1 fuel tank, a position in agreement with its cockpit selector.

1.12.5.2 Examination of the fuel tanks and supply revealed no evidence of restriction not attributable to impact.

1.12.5.3 The ignition switch which, after impact, was found to be selected to No 1 magneto was undamaged. Functional tests revealed that it operated satisfactorily on all four positions.

1.12.5.4 The carburettor air control was found selected to the hot air position. The nature of the damage to its cable assembly suggested that it had not been moved during impact. The associated valve in the carburettor air intake became disconnected when the engine broke away from the surrounding structure and was found jammed in a mid-range position. This position was attributed to the impact disturbance. No evidence of moisture was found in any part of the air intake or in the induction system.

1.13 **Medical and pathological information**

Post mortem examination and a study of the pilot's medical history revealed nothing which might have had a bearing on the accident.

1.14 **Fire**

There was no fire.

1.15 Survival aspects

It was fortuitous that one occupant survived this accident. The damage to the aircraft was such that the accident would normally have been classified as non-survivable.

1.16 Tests and research

Not applicable.

1.17 Aircraft insurance

The aircraft's insurance policy included legal liability to third parties up to a total £50,000 in respect of each accident, and liability up to £25,000 for each passenger. A crash such as this in a built-up area might easily have resulted in third party claims well in excess of the sum insured. Aircraft are not required by law to carry third party insurance. In practice, it appears that light aircraft do normally carry third party insurance; the total sum insured varies but £50,000 in respect of the third party liability would seem to be the more usual figure.

1.18 Maintenance requirements

The Certificate of Airworthiness (C of A) carried no reference to maintenance requirements other than the first compulsory condition quoted in paragraph 1.6. The aircraft was certificated in the Special Category and was permitted to be used for private flying only, it was not required to be maintained in accordance with an approved maintenance schedule. Additionally, not being a public transport or aerial work aircraft, the aircraft was not in one of the categories defined in Article 15(1) of the Air Navigation Order (ANO) requiring aircraft, engine or propeller log books to be kept. The aircraft was exempted from the necessity to have Certificates of Compliance issued by virtue of its Special Category Certificate of Airworthiness and by Proviso (a) to Article 11(1) of the ANO. However, Article 8(7) of the ANO makes no differentiation between categories of Certificates of Airworthiness and requires that any repair to be carried out in a manner and with a material approved by the CAA.

Article 11(2) of the ANO refers to the prescribed repairs and replacements that may be carried out by the holder of a UK Pilot's Licence and Regulation 16 of the Air Navigation (General) Regulations 1972 lists these repairs or replacements.

2. Analysis and Conclusions

2.1 Analysis

2.1.1 Under the Rules of the Air and Air Traffic Control Regulations 1972 (as amended) Section V Visual Flight Rules (VFR) an aircraft is permitted to fly VFR outside controlled air space below 3,000 feet provided it is flown clear of cloud and in sight of the surface. Provided the aircraft does not fly over any congested area of a city, town or settlement or an assembly of more than 1,000 persons at an organised event this rule is limited only by Rule 5e which states that an aircraft must not fly closer than 500 feet to any person, vessel, vehicle or structure. The cloud in the Plymouth area was 6/8 stratus at 300 feet and the pilot should have realised that his flight from Plymouth Airport to the coast would be an infringement of Rule 5(1)e.

2.1.2 The Air Traffic Control (ATC) Officer on duty advised the pilot that the weather was not good and that the cloud base at the Airport was 300 feet. ATC can only advise a pilot if the weather seems unsuitable and has no power to prohibit aircraft from taking-off, even if, as happened in this flight, he becomes aware in the normal course of his duties that a pilot cannot fly as 'booked out' without infringing the requirements of the ANO.

2.1.3 The pilot by carrying his whole family in the aircraft had ignored the maximum passenger load as specified in the aircraft's C of A as the child in the arms of the passenger was aged six years and the two year old child was carried on the luggage shelf. However the starboard control column had been removed and the aircraft's weight and centre of gravity were within the specified limits. It is considered that the aircraft loading did not contribute to the accident. The pilot was not licenced to operate the aircraft's radio equipment.

2.1.4 The evidence indicates that the aircraft was flying just off the coast at Brixham under a low cloud base and in a visibility of 1.6 nm when engine malfunction caused the pilot to decide to carry out an emergency landing. The aircraft turned over Brixham at a height probably below 100 feet above ground level (AGL) during an attempt by the pilot to reach a nearby sports field but the engine stopped before the field was reached and the aircraft stalled and crashed. The low height at which the aircraft was flying prior to the onset of engine trouble undoubtedly reduced the pilot's chances of executing a successful forced landing.

2.1.5 The condition of the engine during the post-crash examination is consistent with the indications from the propeller blades and the evidence of eyewitnesses that engine failure took place before the aircraft struck the ground.

The fatigue crack in No 2 Cylinder head could have had a considerable effect on engine performance before the final fracture occurred.

The evidence obtained from No 2 magneto showed that the bearing failure was not the result of crash damage. It is probable that the stiffness of the magneto, found after it was first removed from the aircraft in August 1973 because of unsatisfactory running after a distributor block change, was due to the bearing failure. It is also probable that the bearing failure was due to its incorrect installation in the magneto when the latter was first assembled. One effect of the bearing failure was to permit eccentric movement of the contact breaker cam, a condition which, with the magneto in circuit, could cause misfiring due to variations in ignition timing. The engine ignition switch was undamaged and its position, as found, suggests that No 2 magneto may have been isolated at some time prior to impact.

The combined effect of an advanced fatigue crack in the cylinder head and the incorrect operation of the magneto can only be a matter of conjecture. Separately each defect would

be a positive cause of rough running. Jointly, because of the related changes in gas distribution and ignition times, their individual effects would have been greatly accentuated.

There was no evidence to show that induction icing occurred at any stage of the flight, although the selection of the Carburettor Air Control to hot air indicates that icing may have been anticipated and the existing meteorological conditions were favourable for the onset of carburettor icing. Selection to hot air could be expected to reduce, to some small degree, the amount of power available from the engine.

The root cause of the engine failure was in this instance, the unsatisfactory and unsupervised maintenance. All aircraft or components are required to be overhauled, repaired, modified and parts replaced in a manner and with material approved by the CAA (ANO 1972 Article 8[7]). However, certain light aircraft, including G-AVEI, may operate without a requirement for approved maintenance schedules to be used, aircraft, engine and propeller log books to be held, or Certificates of Compliance to be issued. These relaxed maintenance requirements do not ensure that aircraft in the same category as G-AVEI are maintained by appropriately qualified personnel or that an adequate maintenance history is kept.

The presentation of information in the ANO regarding the maintenance of aircraft below 2,730 kg maximum total weight authorised and covered by a special category C of A, is poor.

The only guidance as to what maintenance pilot's may carry out is contained in Regulation 16 of the Air Navigation (General) Regulations which is specifically related to Article 11(2) of the ANO. This Article does not include reference to aircraft such as G-AVEI (ie below 2,730 kg with Special Category C of A).

- 2.1.7 Although the Civil Aviation Act 1946 contained provisions relating to compulsory third party insurance cover for aircraft they were never brought into operation and they were finally repealed by S 128 of the Companies Act 1967. There is now no express legal requirement for aircraft to be insured in any way. It appears that light aircraft owners insure against third party risks usually for a total sum in respect of any one accident of £50,000 as was the case with G-AVEI. It is questionable as to whether this sum is adequate today.

2.2 Conclusions

(a) Findings

- (i) The aircraft's certificate of registration was inaccurate in that three of the five persons shown as owners had been replaced without the certificate being amended as the CAA had not been notified of these changes.
- (ii) The aircraft's certificate of airworthiness was current. Aircraft and engine log books were held, although not required by regulations. They contained omissions regarding the aircraft's history.
- (iii) The aircraft had not been maintained in an adequate state of repair or in sound working order.
- (iv) The pilot's licence was not signed by him, nor did it contain a radio-telephony operator's licence.
- (v) The aircraft contained ample fuel for the flight.
- (vi) The aircraft was improperly loaded in that more passengers were carried than were permitted.

However the weight and centre of gravity were within specified limits and loading played no part in the accident.

- (vii) The pilot undertook a VFR flight in weather conditions that necessitated an infringement of Rule 5e of the Rules of the Air.
 - (viii) Whilst flying off the coast at Brixham under a low cloud base engine trouble caused the pilot to turn inland over Brixham in order to reach a field for an emergency landing.
 - (ix) Whilst flying over Brixham at a height below 100 ft AGL the engine failed, the aircraft stalled and crashed into a bungalow.
 - (x) The engine failure was due to the combined effects of an advanced fatigue crack in one cylinder head and a magneto failure, with the possibility that carburettor icing had also occurred.
 - (xi) The root cause of the engine failure lay in unsatisfactory and unsupervised maintenance.
- (b) *Cause*

The accident was caused by a loss of control at a low height following engine failure; the root cause of the engine failure lay in unsatisfactory and unsupervised maintenance.

3. Recommendations

It is recommended that consideration be given to:

- (1) A review of the maintenance requirements of those aircraft certificated in the Special Category covered by Proviso (a) to Article 11(1) of the 1972 ANO.
- (2) The introduction of a compulsory requirement for realistic aircraft third party insurance cover.

G C Wilkinson
Inspector of Accidents

Accidents Investigation Branch
Department of Trade

September 1974