No: 1/89 **Ref: EW/C1088** **Category: 1c**

Aircraft Type and Registration:	Robin DR400/180R, G-BHHR	
No & Type of Engines:	1 Avco Lycoming 0-360-A3A piston engine	
Year of Manufacture:	1973	
Date and Time (UTC):	21 October 1988 at about 1045 hrs	
Location:	Drumochter, Invernesshire, Scotland	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 2
Injuries:	Crew - 1 (fatal)	Passengers - 2 (fatal)
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	39 years	
Commander's Total Flying Experience:	420 hours (of which about 200 hours were on type)	
Information Source:	AAIB Field Investigation	

The aircraft was a Robin DR400-180R aircraft that was primarily used for glider towing. It was equipped with basic flight instruments which consisted of an airspeed indicator, altimeter, turn and slip, vertical speed indicator, and a small magnetic compass; it did not have a serviceable artificial horizon or a serviceable direction indicator. No radio aids to navigation were fitted however it did carry two VHF radios which were capable of transmitting and receiving the normal air-to-ground ATC VHF radio frequencies.

G-BHHR was owned and operated by the directors of a gliding club based at Bidford-on-Avon, and, since 17 September 1988, it had been operated from Feshiebridge aerodrome, near Aviemore, carrying out glider towing flights during a club excursion to the Scottish Highlands. No unservicabilities were recorded during the time that the aircraft was operated at Feshiebridge. On 21 October 1988 it was intended to ferry the aircraft from Feshiebridge back to Bidford-on-Avon, via Carlisle where a re-fueling stop was to be made. The planned route for the first sector was to fly under VFR following the main A9 road south towards Perth, and thereafter request VFR clearance through the Edinburgh and Glasgow Control Zones and thence to Carlisle. There were 3 persons on board a pilot and two passengers on board.

The pilot held a Private Pilot's Licence for aircraft in Group A and SLMGs, with a current medical certificate. He did not hold either an Instrument or IMC rating. His total flying experience was 420 hours of which about 200 hours were on the Robin DR400-180R. This flying (on type) was almost

exclusively concerned with glider towing and thus had invariably been carried out in Visual Meteorological Conditions. The passenger who occupied the aircraft's front right side seat was a qualified glider pilot who was well experienced in cross-country navigation. She had made the flight between Bidford-on-Avon and Feshiebridge on at least six previous occasions and was familiar with the intended route.

Prior to departure from Feshiebridge the aircraft's fuel tanks were filled to capacity with 4-star motor gasoline purchased from a local garage. The duty Air Traffic Control Officer at Carlisle Airport reported that at about 1000 hrs he received a telephone call from a female person advising that a Robin aircraft, registration G-BHHR, would be arriving at Carlisle for re-fuelling at about 1300 hrs and requesting details of the weather. The Carlisle weather actual at that time was reported as a surface wind of 120/08 knots, visibility 9000 metres in haze, 2 oktas cloud at 1500 feet, 5 oktas at 25000 feet, temperature +14 (C). There is no evidence that details of the flight were passed to any other ATC unit or that details of the en-route weather were requested. Had the details of the weather at Perth been asked for they would have been reported as a surface wind of 080/06 knots, visibility 100 metres in drizzle, sky obscured.

The aircraft took off from Feshiebridge at about 1025 hrs and was observed to climb away normally towards Kingussie and the A9 road, and thereafter to head south. Witnesses report that the weather at Feshiebridge was then fine, and the Aviemore 1050 hrs weather observation recorded a surface wind of 030/02 knots, nil weather, 1 okta cloud at 2500 feet, 6 oktas at 3200 feet. Thereafter it has not been possible to establish the precise flight path of the aircraft as it appears to have been flown at an height that was below any possible radar cover and also below that which would have allowed two-way radio contact with an ATC unit. However an eye-witness, who was travelling in a motor vehicle that was heading southbound on the A9, reported seeing the aircraft, which was also heading southbound, pass overhead the vehicle before it disappeared from sight in cloud. The same eye-witness reports seeing the same aircraft, but at a position a further 5 miles south down the A9 road, when it re-appeared from cloud in a steep nose down attitude from which it did not recover. The distance between the two sightings of the aircraft by the witness in the motor vehicle on the A9 was just over 9 kilometres and the vehicle was reported to be travelling at 55 miles per hour. The straight line distance between the points was 8.75 kilometres. The normal cruising speed of the Robin DR400-180R is 120 knots (139mph) and the stalling speed, flaps up is 52 knots (59mph). It therefore follows that, between the two sightings reported by the eye-witness, the aircraft must have completed at least one 360 degree orbit and that this must have been carried out in cloud.

An aftercast of the weather conditions prevailing in the Scottish Highlands at the time of the accident, prepared by the Meteorological Office at Bracknell, records that a south-south-easterly airflow was predominant and that the air was very moist up to 5000 feet amsl. Several observations were recorded in the Highlands mainly north of the accident site and all showed between 3 to 6 oktas of cloud with a base no lower than 2000 feet amsl. These relatively high bases would have been due to the general SW-NE orientation of the Grampians providing shelter from the moist south-easterly flow, which would have shed the bulk of its moisture on the south-east side of the mountains. The most recent observation immediately to the south-east **of the accident site was at Tummel Bridge (546 feet amsl)** which recorded light drizzle, with a cloud base of 8 oktas at 1000 feet agl, visibility of 3200 metres, and a surface wind of 6 knots from the south-east. At the same time the weather at Leuchars on the coast was reported as 8 oktas of cloud at 100 feet agl. The gradient wind would have caused the moist low level air to feed up Glen Garry as far as the 'bend' in the A9 road close to Drumochter. The actual weather conditions at the accident site, recorded by the flight crew of a Royal Air Force Search and Rescue helicopter, were 8 oktas cloud at 200 feet agl, visibility 2 kilometres, drizzle, with a surface wind from the south-east at 12 knots.

The aircraft had crashed into a peat covered slope whilst on a southerly heading and with a flight path angle of 35 degrees below the horizontal. The accident site was 1500 feet amsl. The force of the impact had been taken by the engine which had penetrated 3 feet into the peat to the rocks beneath, leaving the wing leading edges apparently undamaged by the impact. The fuselage had then hinged downwards from the engine bulkhead burying the main landing gear legs vertically in the peat to the

tops of the wheels. The aircraft had caught fire and, being primarily constructed of wood, had burnt out almost completely. Both propeller blades had broken away from the hub in rearwards bending, and examination of their leading edges showed no signs of the propeller having been under power at impact. The flying controls runs were checked and found to be intact.

The engine and flight instruments were taken to the AAIB facility at Farnborough for more detailed examination. Strip examination of the engine showed that it had been mechanically serviceable at impact. The fuel pump and magnetos were also checked and found to be serviceable. The carburettor air inlet system was too badly damaged by the impact to determine whether hot air had been selected. The flight instruments had been subjected to an intense fire which had caused considerable damage and prevented any useful information being obtained from them. An entry in the maintenance log dated 15 September 1988 recorded that the drive from the engine to the vacuum pump had broken and that no spares were available; this was confirmed by inspection. The entry further stated that the vacuum driven flight instruments had been marked as inoperative, these included the artificial horizon and the directional gyro.

The use of motor gasoline (mogas) in aircraft is covered by Airworthiness Notice No 98, issued by the Civil Aviation Authority, which also draws attention to the greater probability of carburettor icing when using mogas. This aircraft was not cleared to use mogas, however a 40 gallon drum was identified by the owner as containing 4-star fuel bought from a garage and used to fuel the aircraft. A Ministry of Defence Quality Assurance laboratory analysis of a fuel sample obtained from the 40 gallon drum showed that:

a. It complied fully with BS 4040 - 4-star leaded petrol (intermediate grade) for motor vehicles.

b. It did not comply with Airworthiness Notice No 98 Schedule 2 requirements in terms of constituents and additives.

BS 4040 allows the addition of significant quantities of propane and butane to both the summer and winter grades of fuel to increase the volatility and hence the ease of starting. An increase in volatility, measured by its Reid Vapour Pressure (RVP), also increases the fuel's susceptibility to both carburettor icing and vapour locking. The increase in carburettor icing with RVP is caused by increased evaporative cooling of all induction system surfaces that are wet with fuel. This particular fuel sample had twice the RVP of the Avgas 100LL specification, but the winter grade fuel to BS 4040 may have a maximum RVP of over 3 times that of 100LL. In addition, BS 4040 has a higher quantity of other low boiling point material than does Avgas (it has a lighter front end), which will further increase the tendency to carburettor icing,

The AAIB, in conjunction with the Directorate of Quality Assurance Technical Support, intend to publish comparative data for induction icing for Avgas 100LL and the range of fuel covered by BS 4040.