No: 7/90 **Ref: EW/C1154** **Category: 2c**

Aircraft Type and Registration:	Robinson R22 BETA, G-DEAL
No & Type of Engines:	One Lycoming O-320-B2C piston engine
Year of Manufacture:	1988
Date and Time (UTC):	28 March 1990 at approximately 0900 hrs
Location:	1 nm west of Chinnor, Buckinghamshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (fatal) Passengers - N/A
Nature of Damage:	Helicopter destroyed
Commander's Licence:	Private Pilot's Licence (H)
Commander's Age:	42 years
Commander's Total Flying Experience:	137 (all on type)
Information Source:	Air Accidents Investigation Branch Field Investigation

History of the flight

The helicopter, which was owned by the pilot, was kept at, and flown from, his property situated about 5 miles south of Lincoln. On the day of the accident, the purpose of the flight was to meet some colleagues at Blackbushe in Hampshire, and the helicopter took off at 0801 hrs. From take-off until 0850 hrs, the pilot used the various advisory radar services available, which monitored him flying at either 500 or 1000 feet, as requested by them. At 0850 hrs, the helicopter was well clear of the Bedford area, so the radar controller suggested that the pilot should contact RAF Benson, which the pilot acknowledged. However, he did not call Benson and the investigation has been unable to trace any further communications from the helicopter. Coincident with the final communication with Bedford, the position of the helicopter was four miles north of Aylesbury, where the radar at Debden lost sight of his trace due to intervening high ground.

The route flown between Aylesbury and the accident site, about 10 nm to the south, cannot be described with absolute certainty, but two witnesses, at about 0900 hrs, saw a Robinson R22 flying on a south westerly course over Weston Turville and Princes Risborough towards the accident site. They could not, however, positively identify it as G-DEAL. Nevertheless, the helicopter was first seen flying

level, in and out of the cloudbase at about 500 feet, and then descending slowly as it flew towards the ridge of high ground on which G-DEAL crashed. Witnesses also stated that the top of the 800 foot high ridge was in cloud.

As the pilot had not filed a flightplan, the Aerodrome Flight Information Service at Blackbushe had no reason to initiate overdue procedure and it was therefore not until midday, when the people waiting for the arrival of the pilot reported his absence, that the air traffic services were made aware that the helicopter was missing. The accident site was first located by the police helicopter at 1902 hrs.

Examination of wreckage

The aircraft lay within Bledlow Great Wood just below the crest of a ridge at an altitude of about 800 feet. A tree which showed some impact damage rose to 60 or 70 feet above the local ground level. The helicopter lay vertically below the damage in the tree with detached fragments distributed around it. There was no evidence of any "throw" direction in the distribution of the wreckage and it appeared that the aircraft had descended vertically through the trees. From the air it did appear that some damage to branches in the tops of trees leading into the main tree impact in a southerly direction had been caused by the passage of the helicopter (but not rotor contact).

The aircraft had landed on its right side, three-quarters inverted. The pilot's lap and diagonal restraint was secure; he was not wearing any protective headgear. There was no fire.

The aircraft was found to be complete on site. The cockpit right side had been crushed, the main transmission, main rotor head and blades were still attached and the engine had suffered little damage. The tail boom was partially detached, there was no sign that it had been struck by the main rotor, and the tail rotor, gearbox and the empennage lay separated behind the aircraft. The tail rotor blades had broken up through impact damage while rotating, this was attributed to tree impacts. The blade fragments were located on the ground symmetrically at 13 and 14 metre distances on either side of the wreckage. This evidence suggested an aircraft heading of 205° (M) at the time that the tail rotor had fragmented. The empennage detachment and tail rotor gearbox failure were in overload and were evidently crash damage. There was further evidence of tail rotor rotation in that the pitch change control rod had been wrapped helically around the drive shaft as the tail rotor gearbox broke off from the tail boom.

The main rotor did not show such obvious or strong indications of rotation. One blade, otherwise intact, had some leading edge damage, light chordwise scoring and some distributed rearward and upward bending. The other blade had no signs of rotation and had bent under spanwise compression loads when its tip had dug into the ground. The tip had become detached through a local compression and bending failure. It would appear from this that the main rotor had almost come to a halt after the first blade had struck the trees or the ground. The second blade had then dug into the ground at its tip and had collapsed spanwise in bending and compression. No tree impacts as such were identified on the main rotor blades but a few branches including one of 4 inches diameter were found with typical

blade cuts and at least the largest one was probably caused by the main rotor. The ground had a covering of loose dry leaves and no ground marking was found which could be identified with rotor blade strikes.

An examination of the cockpit gave the following indications. The mixture control was fully rich and the carburettor hot air control half open. (These were later confirmed within the powerplant). The collective lever was almost in the fully raised position and the throttle butterfly was later found to be fully open. The master switch was "ON" and the clutch and emergency avionics switches "OFF" (guarded). The heater blower was "ON". The clock had stopped at 10.01. The filaments of the warning lights were examined and only the engine oil pressure lights showed any sign of the filament being hot at impact. A later detailed examination of the oil pressure filament discounted the indications of illumination and when the engine was test run oil pressure was satisfactory. The magneto switch was found at the "BOTH" position. The altimeter subscale setting was 1022 which corresponded to the Area QNH at the time of G-DEAL's flight.

Both fuel tanks (main and auxiliary) had been punctured and it is likely that some fuel had been lost. As the aircraft was righted for recovery some fuel drained away from recesses in the airframe. With the aircraft upright one gallon was recovered through the fuel strainer drain. Later a further quarter gallon was recovered from the main tank. The total volume recovered and measured therefore exceeded the stated total unusable fuel for both tanks (0.5 Imp Galls (MAIN) + 0.33 Imp Galls (AUX)). Fuel was also found in the fuel line from the strainer to the carburettor and the carburettor bowl was virtually full. The fuel line from tank to carburettor was flow checked satisfactorily and the strainers were found to be clear.

Fuel analysis showed the fuel to be satisfactory. Analysis of a "hose end" sample from the bowser from which the aircraft had been last refuelled showed a high "existent gum" rating probably as a result of deterioration in the hose. That sample had been taken one week after the accident during which time the bowser had not been used and the sample had therefore stagnated in the hose. This discrepancy was not evident in the fuel recovered from G-DEAL and is not considered relevant to the accident.

A preliminary examination of the engine showed no abnormalities and nothing to suggest that it had suffered carburettor icing though this phenomenon does not necessarily leave any physical evidence. The engine was run on a test stand and it functioned normally. It was found to produce 150 BHP at its rated condition of 2700 RPM which is 10 BHP below its specified power of 1690 BHP but as the engine is derated to 131 BHP at 2652 RPM in the Robinson R22 Beta it was still capable of exceeding that requirement.

The airframe mounted ignition wiring and switch ,together with the magneto wiring which provided an engine speed signal to the tachometer, were examined for any insulation defects which could have earthed one or both magnetos but one was found.

All damage to the flying controls appeared to be a result of the ground impact.

The reason for the apparent contrast in rotational evidence between the main rotor and the tail rotor could not be established. However, overall the balance of evidence suggested low rotor energy. The transmission was dismantled and examined. No defect which would have led to a disconnection between the two rotors or between the engine and the rotors was found. The actuator which tensions the drive belts was fully extended but it was not possible to check belt tension because of distortion in the fuselage frame. The belts showed no evidence of distress. No evidence was found of torque being transmitted through the transmission at the time of the crash when the main rotor had evidently been stopped abruptly.

Medical information

A post mortem examination of the pilot revealed no evidence of any medical condition that could have caused the accident.