

Aircraft Type and Registration: Robinson R22 Beta, G-BSRG

No & Type of Engines: 1 Lycoming O-320-B2C piston engine

Year of Manufacture: 1988

Date & Time (UTC): 29 January 1993 at 1310 hrs

Location: Leicester Airport, Leicestershire

Type of Flight: Private (training)

Persons on Board: Crew - 1 Passengers - None

Injuries: Crew - Minor Passengers - N/A

Nature of Damage: Damage to most of the airframe, skids, main and tail rotors

Commander's Licence: Student Pilot

Commander's Age: 25 years

Commander's Flying Experience: 17 hours (all on type)
Last 90 days - 10 hours
Last 28 days - 4 hours

Information Source: Aircraft Accident Report Form submitted by the pilot

The student pilot was on a solo training detail to practise transitions from the hover. After successfully carrying out several transitions, he taxied downwind towards the concrete apron and turned into wind. He then carried out the relevant checks of engine warning lights, temperatures and pressures etc, and performed another transition. The helicopter had stabilised in the hover at a height of about 20 feet, when the pilot sensed that the helicopter did not 'feel right' and was aware of a judder and a repetitive 'thudding' behind him. The main rotor speed began to decay to 90% and the low rotor warning horn sounded. After manipulation of the throttle, engine and rotor speed were regained but soon exceeded their maximum limits. Several excursions past the upper and lower rotor speed limits then occurred during which the pilot lost control of the helicopter, despite application of the appropriate yaw pedal inputs. The helicopter struck the ground and the pilot shut the engine down using the mixture control, but could not reach the fuel shut-off lever. He later stated that, following the initial onset of low rotor speed, he may have been 'over-aggressive' with his use of the throttle.

Following the accident, the aircraft was examined by personnel from the organisation responsible for its maintenance. It was reported that all damage found was considered to have occurred as a result of the accident; that all flying and engine controls had been correctly connected; that there was adequate fuel remaining in the tanks, and that fuel was available at the carburettor when the fuel switch was

turned on. It was established that the mixture control was at the 'full lean' position and the carburettor heat control at the 'full cold' setting.

Recent instances of power reductions with accompanying vibration have occurred on this type of helicopter as a result of 'stuck', or partially stuck, valves or suspected carburettor icing (Ref: AAIB Bulletins 11/92 (G-HETH) page 80, and 10/92, page 61). In view of such occurrences, the engine was removed, installed on a test bed and run. The engine was found to be capable of running smoothly up to full power, although its maximum power was marginally down when compared with the manufacturer's figure. The cylinders were then removed from the engine and their valves extracted for visual inspection and dimensional checks. Although no specific evidence was found to suggest that valve sticking had occurred, it was apparent that the engine had been running very hot and that there were signs of glazing and blow-by on most of the cylinders. Additionally, the No 1 cylinder exhaust valve stem clearance in the valve guide was below the manufacturer's limit and carbon had built up on the inside of the guide.

Discussions with the engine overhaul company which performed the test run and partial strip revealed that nearly all R22 engines examined exhibited characteristics of running very hot. In addition, these engines are known to run on a relatively weak mixture when using the manufacturer's specified carburettor. Following two recommendations, Nos. 92-92 and 92-93, published by the AAIB following the accident to G-HETH, the Civil Aviation Authority have issued an Airworthiness Directive, No 003-02-93, effective from 15 February 1993. This AD essentially requires the oil to be changed at 25 hour intervals and the valves to be examined at intervals not exceeding 300 flight hours. This is an interim measure as indicated by a statement included in the 'Background' section of the AD as follows:-

" Until the reason for the high incidence rate of exhaust valve sticking and accelerated valve guide wear is fully understood and subsequent preventative design measures are taken, it is necessary to require regular engine oil changes and exhaust valve and guide inspections in order to prevent engine malfunction in flight."

The weather at the time of the accident to G-BSRG was quoted as wind 090°/7-10 kt, visibility 5 km, cloudbase 500 feet agl and temperature +5°C, with the surface wet. Under these conditions there is a possibility of carburettor icing occurring. Part of the section from the pilot's operating handbook relating to the use of carburettor heat is reproduced below:-

" When conditions conducive to carburettor ice are known or suspected, such as fog, rain, high humidity, or operating near water, use carb heat as follows: During hover or cruise flight above 18 inches manifold pressure (MP), apply carb heat as required to keep the CAT gage out of the yellow arc.

If an unexplainable drop in manifold pressure or RPM occurs, apply full carburettor heat for about one minute and check for an increase in MP or RPM.

During autorotation or reduced power below 18 inches MP apply full carb heat regardless of CAT gage temperature. When power is reapplied, return carb heat to full cold or partial heat position ."