

Robinson R22 BETA, G-DEJL

AAIB Bulletin No: 12/99 **Ref:** EW/G99/04/14 **Category:** 2.3

Aircraft Type and Registration: Robinson R22 BETA, G-DEJL

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

Year of Manufacture: 1991

Date & Time (UTC): 19 April 1999 at 1830 hrs

Location: The Estate, South Elkington

Type of Flight: Private

Persons on Board: Crew - 1 - Passengers - 1

Injuries: Crew - None - Passengers - None

Nature of Damage: Extensive

Commander's Licence: Private Pilot's Licence

Commander's Age: 44 years

Commander's Flying Experience: 90 hours (All on type)

Last 90 days - 33 hours

Last 28 days - 6 hours

Information Source: Aircraft Accident Report Form submitted by the pilot, and an engine test cell run arranged by AAIB

On a flight before the accident, the pilot noticed that the Manifold Pressure (MP) was reading 30 inches of mercury, and that the engine was 'knocking' and running roughly. He immediately lowered the collective to obtain 20 inches MP and returned home without further incident. The pilot was advised to check the bottom plugs for lead; this he did, removing a quantity of lead. Another flight in the circuit showed that the problem still remained.

An engineer checked the engine and, after extensive hovering tests, the pilot and the engineer took off on a test flight. The take off went well with the MP reading 25 inches, but at about 200 feet the engine started to 'knock' again. The MP was decreased to 21 inches and the height was reduced. Extensive hovering checks were again carried out, and as these did not reveal a problem, the helicopter was flown back towards base at low level. After a short distance, the MP went from 21 to 32 ins (sic) very quickly and the helicopter settled gently. As the ground had a slight slope and the helicopter had forward momentum, it pitched onto its nose and the blades contacted the ground.

The pilot reported a witness as saying that the loss of power was accompanied by 'popping and banging' noises.

The helicopter had come to rest lying on its side. The next day it was recovered to the upright position and the engine was run in the helicopter, with the clutch disengaged, at 100% engine RPM for several minutes. The only fault noted was slight rough running, without any tendency to backfire. It was considered that the problem was definitely not attributable to sticking valves, but was more like an intermittent spark plug. The helicopter was then transported to Farnborough for examination, a month after the accident.

The engine was taken to an overhaul agency, where it was observed that the plug leads from the right hand magneto to the bottom plugs on Nos 2 and 4 cylinders were badly burnt, with white exhaust deposits on them, however, insulation checks on the leads were satisfactory. The exhaust outlets from the two cylinders showed signs of having leaked at some time; but no leaks were apparent when the exhaust pipes were removed and replaced with test cell stub exhausts.

The engine was run, without its airbox and fitted with stub exhausts, on a dynamometer test bed for approximately 90 minutes. The magneto drops were well within specification, and maximum power - 10 hp below the pass-off specification of 160 hp - was typical for an engine that had run 1,460 hours since new. The engine was run at 2,700 RPM and maximum load (54.26 lb-feet of torque) at a fuel inlet pressure of one psi, and satisfactorily passed all checks, including slam accelerations. The fuel pressure was then reduced to 0.75 psi, and whilst still under full throttle, the RPM fluctuated and ran down until the load was adjusted to 43.85 lb-feet torque to regain 2,700 RPM. After a period of stability under these conditions, the engine suddenly increased to 2,900 RPM before it was brought under control. There were no signs of back firing during this test. The tests at fuel pressures of 1.0 and 0.75 psi were repeated with similar results, but without the sudden recovery of RPM.

Whilst the runs demonstrated the obvious, that a reduced fuel inlet pressure would cause a loss of power, the lack of backfiring indicated that the problem experienced by the pilot had not been reproduced.

The items not checked on the test bed were examined: the helicopter fuel and air supply, and the exhaust system.

The helicopter had main and auxiliary fuel tanks fitted with twin vent pipes. When the helicopter was collected by the AAIB, the plastic vent pipe from the main tank was detached, and the plastic pipe joining the two tank vents was missing. The fuel flow rate through the filter with the vents in this condition was 422 pints per hour. A month after the accident the tanks contained approximately 50 litres of 100LL fuel. The airfilter, airbox, and its supply pipes, and the exhaust system were checked, but did not reveal any problems apart from oil contamination of the air filter, which had occurred during the time that the helicopter was lying on its side.

An aftercast was obtained from the Meteorological Office for the time and location of the accident; this gave the following information:

Height AMSL	Temperature Deg C	Dewpoint Deg C	Relative Humidity %
Surface	+8	+2	67

200 feet	+7	0	61
500 feet	+6	0	65

All these points lie just inside the boundary for a serious induction icing probability for float carburetors. The R22 pilot's operating handbook contains Safety Notices, from which the following extracts are taken:

SN-25 CARBURETTOR ICE. Carburettor ice is most likely to occur when there is high humidity or visible moisture and the air temperature is below 70°F (21°C).....

SN-31 GOVERNOR CAN MASK CARB ICE. With throttle governor on, carburettor ice will not become apparent as a loss of either RPM or manifold pressure. The governor will automatically adjust throttle to maintain constant RPM, which will also result in constant manifold pressure.

Conclusion

Throughout the test bed runs on the engine it was not possible to reproduce the symptoms experienced by the pilot during the accident and on the immediately preceding days. The engine performance was throughout consistent with an engine having run 1,460 hours since new. Although the meteorological conditions were conducive to carburettor icing the symptoms as described by the pilot are not consistent with the effects of such inlet icing.