

Robinson R22 Beta, G-DLDD

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

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

Year of Manufacture: 1991

Date & Time (UTC): 28 November 1998 at 1500 hrs

Location: Cambridge Airfield

Type of Flight: Private (Training)

Persons on Board: Crew - 1 - Passengers - 1

Injuries: Crew - None - Passengers - None

Nature of Damage: Minor fire damage in engine compartment

Commander's Licence: Private Pilot's Licence (Helicopters)

Commander's Age: 40 years

Commander's Flying Experience: 1,414 hours (of which 1,385 were on type)
Last 90 days - 87 hours
Last 28 days - 20 hours

Information Source: Aircraft Accident Report Form submitted by the pilot

Circumstances

The helicopter was approaching the airfield at 75 kt in cruising descent through 1,000 feet agl when the crew noted a scraping noise, which reportedly lasted less than a second. Some 5 seconds later the transmission clutch light illuminated and did not extinguish. The clutch circuit breaker was then pulled, in accordance with the Emergency Procedures in the Flight Manual. The helicopter continued and was approaching the hover when the main rotor RPM decayed in response to raising the collective lever. A rapid descent was followed by a successful run-on landing onto the taxiway. After the helicopter had come to rest, a 'dull thud' was heard from the engine compartment, with smoke and flames subsequently observed emanating from this area. The engine was shutdown and a 'Mayday' call transmitted before the crew evacuated the aircraft. The fire was then extinguished with the aircraft fire extinguisher. Subsequent inspection found part of one transmission drive belt

in the engine compartment, with the remainder being later recovered from the taxiway. The other belt was not found.

Description of drive train system

The engine output shaft on the R22 has a 'sheave', or pulley assembly, that carries two drive belts. Each belt effectively consists of two 'vee' belts joined together; thus the pulley assembly has four grooves. The belts transmit the drive to a similar pulley assembly located immediately above, which is mounted on the main gearbox/tail rotor drive shaft. The forward end of this shaft is connected to the main rotor gearbox, and the aft end is attached to the tail rotor gearbox. Flexible couplings accommodate the alignment changes that occur when rotor drive is engaged and disengaged. An electric actuator is mounted between the upper and lower pulleys, and raises the upper pulley when the clutch switch on the centre console is set to ENGAGE. This tensions the 'vee' belts so that drive is transmitted from the engine to the rotor system.

Examination of the helicopter

It was found that the supply and return lines to the oil cooler had fractured as a result of having been struck by a flailing drive belt, with the cooler matrix also being damaged. This had caused oil to be sprayed onto the exhaust, leading to the fire in the engine compartment. Some charring of electrical cables and smoke damage had occurred as a result.

A small 'nick' was subsequently discovered on one of the upper pulley rims. As it did not appear that this could have been caused by anything within the engine compartment, it was considered that a foreign object may have damaged the rim which then led to failure of one belt. The helicopter (and drive belts) had accumulated some 500 hours since new, with 10 hours having elapsed since the last 100 hour inspection. The belts are maintained 'on condition' and do not have a finite service life imposed on them. According to the maintenance organisation responsible for this helicopter, the belts usually last at least 600-700 hours before being rejected due to their condition, or exceedence of clutch actuator travel limits (ie excessive belt stretch). R22 drive belt failures have occurred in the past, but reliability has reportedly been much improved following associated design revisions.

It was presumed that the initial scraping noise heard by the crew was the first transmission belt departing the aircraft. This would have halved the tension loads between the pulleys, thus causing the actuator to extend in order to compensate. It appears that the remaining belt had coped with the torque requirements until the collective lever had been raised on the approach to the hover. The

absence of abnormal engine indications or signs of fire following the initial belt failure indicated that it was the second belt failure which had resulted in the damage to the oil cooler and pipes.