ACCIDENT

Aircraft Type and Registration:	Robinson R22 Beta, G-UNYT
No & Type of Engines:	1 Lycoming O-320-B2C piston engine
Year of Manufacture:	1989
Date & Time (UTC):	13 January 2007 at 1021 hrs
Location:	Hollis Farm, Tupton, Derbyshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Minor) Passengers - None
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence
Commander's Age:	46 years
Commander's Flying Experience:	2,697 hours (of which 1,500 were on type) Last 90 days - 30 hours Last 28 days - 12 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and examination of the wreckage by the AAIB

Synopsis

Following a successful approach to a low hover, the helicopter was manoeuvring when it struck the ground.

History of the flight

Following a 10-minute local flight the helicopter was returning to its base, which was a private landing site at Hollis Farm. The wind was from the west at 20-25 kt. The helicopter approached over an adjacent field, entered a hover and began to manoeuvre towards the landing site. As the helicopter began to turn, the pilot, who was also an instructor on this type of helicopter, reported seeing the low rotor rpm light illuminating and hearing the associated horn sounding. The helicopter began to descend and struck the ground with the front of the skids. It then nosed over and came to rest in an inverted position. Both occupants were uninjured and vacated the aircraft without difficulty and, having done so, the pilot re-entered the cockpit in order to turn off the engine ignition and the battery master switch.

The pilot inspected the impact site and noted from the ground marks that the left skid had slid approximately 2 ft and then dug into a hole in the ground. He concluded that this was what had caused the helicopter to nose over. He commented that he believed the low rotor rpm warning was due to a 'partial governor failure', which he had experienced previously on another R22 helicopter.

The Hollis Farm landing site is a confined farmyard with a small hangar to the north, and bordered by a single-storey house to the east and the main farm house to the south. The approach to the farmyard is dependant on the wind direction. On this occasion the pilot approached from the west into a large sloping field. His plan was to transition into the hover over the field, turn to the east and then continue forward to land in the farmyard.

Weight and balance

The maximum permitted gross weight for the helicopter is 622 kg. The basic weight for G-UNYT was 400 kg. The pilot reported his weight was 82 kg, the passenger weight to have been 80 kg and the weight of the fuel to have been 33 kg, giving a total weight of 595 kg.

Low rotor rpm warning and governor system

Normal rotor rpm is between 97 and 104%. If the rotor rpm should fall to 95% or below, a low rotor rpm horn will sound and a light will illuminate. A governor system is fitted to assist the pilot to control rotor rpm within the normal operating range. The governor controller, a solid-state analogue circuit box, is mounted behind the left seat. An electrical rpm signal from the right hand magneto is sent to the governor controller, which compares the signal against a datum and applies corrective input forces to the throttle via a friction clutch which can be easily overridden by the pilot. The governor is only active above 80% engine rpm and can be switched on or off via a toggle switch on the right seat collective control.

The collective pitch control lever is positioned to the left of the pilot and on the forward end of the lever is a motorcycle type twist grip throttle. The collective pitch control lever is connected to the main rotor blade pitch change mechanism by a system of control rods that change the main rotor blade pitch collectively. A mechanical linkage correlates the rotor blade collective pitch angle to the engine throttle. As the collective lever is raised more engine power is provided by opening the throttle automatically via the linkage.

Wreckage examination

The engine governor system was inspected by the helicopter manufacturer's representative in the presence of an AAIB Inspector. Information from the maintenance manual indicated that the majority of governor problems are caused by the magneto tachometer contact assembly being out of adjustment or faulty. The sensor connection to the right magneto was checked and appeared satisfactory.

The throttle connection was checked over the full range of movement and found to be functioning correctly. The maintenance manual requirements are for a minimum of 4 lb throttle friction, a minimum moving governor friction of 8 lb with a breakaway friction of 0 to 0.5 lb greater and a minimum 2:1 ratio of governor to throttle linkage friction. The frictions were checked and were within the maintenance manual limits. The pilot, who often flew this helicopter, stated that he had experienced no previous problems with the governor system.

External examination of the engine showed evidence of power at impact. As found, the governor system was selected 'ON', and carburettor heat was selected partially towards the 'HOT' position, and the mixture control was fully rich.

Discussion

The pilot described hearing the lower rotor rpm warning. However no cause could be found for a loss of rotor rpm. No faults were found in the governor system. The helicopter manufacturer and other operators of the

type have stated that the governor system is extremely reliable and there is no history of 'partial governor failures'. No previous governor problems had been experienced on G-UNYT and therefore a failure, although though not impossible, appears unlikely.

When the helicopter enters the hover, the pilot raises the collective lever and the governor system responds by opening the throttle to maintain the rotor rpm. It is necessary to remain relaxed on the twist grip control to allow the governor to operate. It is possible that if the throttle is gripped too tightly then the governor actuator can be prevented from moving the throttle.

In a still-air hover the amount of power required is reduced due to the effect of increased air pressure or 'ground cushion' below the rotor disk. This effect reduces as airflow, or wind, increases. At the time of the accident G-UNYT would have been close to its maximum weight. In the hover, with a wind of 20-25 kt, it is possible that, at this weight, there would have been a negligible margin of power. Thus the low rotor rpm warning could have been triggered if the collective lever had been raised in response to a descent and, without any more power available, the rotor rpm would start to decay.