ACCIDENT

Aircraft Type and Registration:	Robinson R44 Astro, G-HEPY
No & Type of Engines:	1 Lycoming O-540-F1B5 piston engine
Year of Manufacture:	1999
Date & Time (UTC):	4 February 2006 at 1230 hrs
Location:	Downton on the Rock, Hereford and Worcester
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - None Passengers - None
Nature of Damage:	Minor damage to rotor blades, tail pylon and cockpit area
Commander's Licence:	Private Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	328 hours (all on type) Last 90 days - 15 hours Last 28 days - 9 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and AAIB inquiries

Synopsis

The engine stopped as a result of water in the fuel system. During the subsequent landing run the helicopter sustained minor damage when it collided with a fence and farm gate.

History of the flight

The pilot and his two passengers were on a private flight from Redditch to Bedstone. Approximately 15 minutes into the flight, and whilst at 1,000 ft agl, the pilot felt what he described as a couple of kicks in yaw, which he believed might have been turbulence from a ridge that he had just flown over. In order to move away from the ridge he commenced a gentle turn to the right and lowered the collective lever. About the same time as he took this action the low rpm horn sounded, the low rpm warning light illuminated and the pilot became aware that the engine noise had stopped. The pilot, therefore, entered an autorotation and selected what he believed to be the only suitable landing site on a ridge covered in woods and isolated trees. The main rotor blades clipped a number of trees on the approach to the landing site where the helicopter made a fast run-on landing before colliding with a fence and metal farm gate. The pilot and passengers were uninjured and the helicopter suffered minor damage to the rotor blades, landing skids, canopy and cockpit area.

Meteorological conditions

The synoptic situation at 1200 hrs on the day of the accident showed an area of high pressure covering the British Isles. This 'high' had been over the British Isles for at least five days prior to the accident giving a period of generally dry weather. In the area of the accident the wind at 1,000 ft was from 350º at 5 to 10 kt with a temperature of 4.5ºC, dew point of 0.6ºC and relative humidity of approximately 80%. The night time temperature during this period dropped to around -1ºC.

Description of fuel system

The aircraft fuel is stored in a main and auxiliary fuel tank, which have a combined capacity of 190 ltr. The auxiliary fuel tank is mounted on the right side of the main transmission and feeds directly into the main fuel tank, which is mounted on the left side of the transmission. The unusable capacity of the main and auxiliary fuel tanks is 4 ltr and 1 ltr respectively. Each fuel tank has its own water drain point and a refuelling orifice, the sides of which are raised above the surface of the tank. From the main fuel tank the fuel is fed, under gravity, to the gascolator then on to the carburettor fuel bowl. The gascolator is also equipped with a water drain point.

Engineering aspects

The owner stated that there had been no previous problems with the engine and apart from the carburettor air temperature gauge, which under-read, the helicopter was serviceable prior to the engine failure.

An engineering inspection was undertaken, in the presence of the owner, which revealed that there was nothing obviously wrong with the engine. On checking the fuel system it was discovered that the gascolator and carburettor fuel bowl were full of water and, subsequently, approximately 1 ltr of water was drained from the main fuel tank and ½ ltr water was drained from the auxiliary fuel tank. The seals on the fuel tank refuelling caps were assessed as being in good condition and both caps fitted securely to their respective tanks.

The owner stated that he was the sole user of the helicopter and normally refuelled it towards the end of each day's flying at Wellsbourne Mountford Airfield before flying to his house where the helicopter was either parked in his garden, or in an adjacent field. The owner normally tried to ensure that the helicopter was parked overnight with the fuel tanks full; however he would occasionally leave it with a fuel load as low as 90 ltr. On this occasion the helicopter had been parked for the two days since it was last flown with a fuel load of approximately 115 ltr.

The airport manager at Wellsbourne Mountford Airfield stated, with regard to the fuel installation, that not only were all the recent water sediment checks clear, but on the day that the pilot uplifted the fuel they had already dispensed over 1,000 ltr of Avgas to other aircraft, none of which had reported any subsequent problems.

Accumulation of water in fuel tanks

Condensation within the fuel tanks can result in the accumulation of water in the fuel system. For light aircraft condensation normally results from large variations in the day and night-time temperatures. During the day the tank heats up causing the air in the tank to expand and escape through the vents. At night the air in the tank cools down allowing moist air to be drawn into the tank with the result that condensation forms on the tank walls. The problem is most likely to occur with large fuel tanks when the aircraft is parked outside for a period of time with a partial fuel load. A specialist aviation fuels adviser has indicated that with the meteorological conditions at the time of this accident, condensation could, at most, account for the generation of a teaspoon of water in each of the fuel tanks since the previous flight.

Fuel water sediment checks

The owner stated that he normally undertook fuel/water sediment checks during the pre-flight checks just prior to flying the helicopter, but on this occasion had carried out the fuel checks the night before the accident flight. When the fuel sample was taken from the gascolator after the accident the owner had initially thought that as the fluid was clear the sample was free of water. However, it was not until the engineer pointed out that Avgas is blue that the owner realised that the sample jar was full of water. The owner confirmed that he did not normally check the colour of the fuel as he believed that the presence of water in fuel would be apparent by the presence of globules of water in the base of the sample tube or a meniscus between the water and fuel.

Comments

The use of engine governing systems in helicopters and the correlation of the carburettor butterfly valve with the collective lever mean that helicopter pilots might not be aware of the build up of carburettor icing, which could result in the sudden stopping of the engine, or severe reduction in power when the collective lever is lowered. It is, therefore, important that carburettor air temperature gauges are maintained in a serviceable condition and are regularly monitored throughout the flight.

Whilst the meteorological conditions meant that there was a serious risk of carburettor icing, the presence of a large quantity of water in the carburettor fuel bowl and gascolator indicates that it is most probable that it was water contamination of the fuel which caused the engine to stop.

Just prior to the engine failure the pilot felt a slight kick in yaw, which he believed was caused by turbulence, but given the light wind conditions was most probably an early indication that water was starting to enter the engine. It is normally assumed that an engine failure in a light helicopter will initially be apparent by a sudden yaw to the left or right, depending on the direction of rotation of the main rotor. However, on this occasion the pilot lowered the collective lever and, therefore, unloaded the main rotor just prior to the engine failure and it was the activation of the low rotor rpm warning horn and lack of engine noise, which prompted him to enter an autorotation.

Not only had there been no recent rain, but the condition of the fuel tanks meant that it was unlikely that water would have entered the fuel tanks by leaking through the fuel caps; moreover there was no evidence of water contamination of the fuel supply at the local airfield. It is possible that the source of the water was condensation accumulating in the unusable portion of the fuel tanks over a period of time. It is also possible that the owner did not detect the presence of water during the fuel water sediment checks as he did not consider the colour of the fluid, or appreciate that the sample might only contain water and would, therefore, contain neither globules nor a meniscus between the two fluids.