Aviation Safety Investigation Report 199300693

Robinson Helicopter Co R22

24 January 1993

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Aviation Safety Investigation Report

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Occurrence Number: 199300693 **Occurrence Type:** Accident
Location: 5km ESE Helenslee
State: QLD **Inv Category:** 3
Date: Sunday 24 January 1993
Time: 0650 hours **Time Zone** EST
Highest Injury Level: Fatal
Injuries:

	Fatal	Serious	Minor	None	Total
Crew	1	0	0	0	1
Ground	0	0	0	0	0
Passenger	0	0	1	0	1
Total	**1**	**0**	**1**	**0**	**2**

Aircraft Manufacturer: Robinson Helicopter Co
Aircraft Model: R22 BETA
Aircraft Registration: VH-AHT **Serial Number:** 1965
Type of Operation: Commercial Aerial Mustering
Damage to Aircraft: Destroyed
Departure Point: Helenslee QLD
Departure Time: 0630 EST
Destination: Helenslee QLD

Crew Details:

Role	Class of Licence	Hours on Type	Hours Total
Pilot-In-Command	Commercial	1034.0	1119

Approved for Release: Wednesday, July 21, 1993

The pilot was mustering cattle. The helicopter's gross weight was estimated at 602 kilograms which was 20 kilograms below maximum allowable. The terrain was approximately 1000 feet above sea level and the outside air temperature was about 25 degrees Celsius.

The surviving passenger recalled that the helicopter was about 35 feet above ground level when he first heard the low rotor warning horn and saw a warning light on the instrument panel. There were trees ahead which were about 25 feet high. The pilot said "whoops", pulled up, nosed over and veered slightly left towards a gap in the trees. At the time the helicopter had very little forward airspeed. He subsequently described a weightless feeling which is consistent with the pilot having applied a large forward cyclic input to achieve the "nose over". He recalled that the pilot was "fighting" the cyclic control for a short time as the helicopter rolled to the right into a tree. The survivor also remembers leaves flying about but he has no recollection of a rotor blade hitting a limb.

Damage sustained by the helicopter indicated that the main rotor struck a tree limb and that one rotor blade was severed about one metre inboard from its tip. When the section of rotor was severed, the remaining rotor blade flapped up causing a severe mast bump which resulted in overload failure of the mast at the main rotor head. The main rotor assembly departed and the unsevered rotor blade impacted the first section of the tail boom immediately aft of the engine. The main rotor did not sever the tail boom or the tail rotor drive shaft or the tail rotor control tube. The tail rotor drive shaft within the tail boom was severed in torsional/bending overload when the boom separated probably as the helicopter impacted the tree and fell through its limbs.

The right side of the helicopter, in the area of the fuel tank to the pilot's upright seat cushion, was pushed inwards probably when the helicopter impacted the tree. The right side of the landing skid was severely deformed and broken. No such damage was found on the left skid. It is probable that, after the tree impact, the helicopter impacted the ground right side low and bounced on to its left side where it was found at rest. There was no post crash fire. Damage to the tail rotor assembly indicated that the tail rotor was still rotating but probably not being driven by the engine when the tail rotor blades impacted foliage.

The helicopter was found with both the drive belts off the pulleys associated with the drive system from the engine to the main gearbox. There was no evidence of previous damage or wear on the drive belts, the pulleys or bearings; nor has any fault been found with the clutch or free wheeling unit. However, marks were found on the inside opposing faces of the flexible coupling between the main gearbox output shaft and the tail rotor drive shaft, forward of the upper pulley assembly. This indicates that the upper pulley assembly had moved forward abruptly thereby misaligning the belts enough for them to jump off the pulleys. There is no known inflight manoeuvre which could compress the forward coupling to the extreme as found. However, a severe tree impact or ground impact could dislodge the upper pulley assembly enough to damage the coupling and cause the belts to come off. It is most likely that the drive belts came off after the initial tree strike by the main rotor and not before. Engineers have found no significant fault with the engine or airframe which might have contributed to the accident. A magnetic particle inspection of engine components proved that the engine had not suffered a significant overspeed.

Subsequent trials in a Robinson R22 helicopter were conducted by a very experienced flying instructor in conditions similar to the day of the accident. His helicopter successfully hovered out of ground effect at 35 feet above the ground with rotor revolutions per minute (RPM) as low as 96% at which time the low rotor RPM horn was audible and the low rotor warning light was illuminated. During a simulated engine failure from a low hover it was noted that the cyclic still responded normally with rotor RPM as low as 75%.

The survivor's description of the accident is consistent with the pilot having inadvertently achieved low rotor RPM, possibly losing height, and trying to recover while avoiding nearby trees. His description suggests that the "nosing over/bunting manoeuvre" managed to unload the main rotor to the extent that tail rotor thrust rolled the helicopter to the right. It is a known fact that a pilot may not be able to counteract this uncommanded roll to the right with left cyclic input. It is probable that an uncommanded roll to the right caused the helicopter to collide with a tree; this is consistent with the survivor's description of the helicopter being "pulled into the tree".

SIGNIFICANT FACTORS

The following factors were considered relevant to the development of the accident:

1. The pilot inadvertently allowed the rotor RPM to decay.

2. During the attempted recovery from low rotor RPM, the pilot's flight control inputs induced an inflight manoeuvre which resulted in an uncommanded roll to the right.

3. The helicopter collided with a tree.