AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Ref No.	CA18/2/3/8596		
Aircraft Registration	**ZS-RNU**	**Date of Accident**	17 December 2008		**Time of Accident**	1600Z	
Type of Aircraft	Robinson R22 Helicopter		**Type of Operation**		Private		
Pilot-in-command Licence Type	Private (Helicopter)		**Age**	38	**Licence Valid**	Yes	
Pilot-in-command Flying Experience	Total Flying Hours		63.3		Hours on Type	63.3	
Last point of departure	Junctionspruit farm, Free State						
Next point of intended landing	Killarney farm, Free State						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
Killarney farm, 20 nm south of Winburg (GPS position: S28°44' 34.42" E027°00' 34.00")							
Meteorological Information	**Surface wind:** Calm; **Temperature:** 30℃; **Visibility:** CAVOK						
Number of people on board	1 + 1	**No. of people injured**	0		**No. of people killed**	0	

Synopsis

The pilot, accompanied by a passenger, took off from Junctionspruit farm on a local private flight. He had 10 US gallons of fuel on board and intended returning to the farm.

After flying for about 50 minutes, he experienced a slight loss of altitude whilst flying at around 5 000 ft AMSL. At approximately 200 ft above ground level (AGL), the low RPM warning light illuminated, followed by the aural warning. He pushed the cyclic forward and lowered the collective at an indicated air speed of 40-50 kts, but there was a further loss of altitude and the aural warning sounded again. He then attempted to turn the helicopter to the right in order to land on level ground and keep the tail section away from rocks. On touchdown, however, the right skid landed on a rock, causing the aircraft to bounce and roll over onto its left side. The pilot immediately shut down the engine and he and the passenger exited without any injuries.

Probable Cause

The pilot used the incorrect technique to recover from a low rotor RPM condition.

IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : PM Theron
Manufacturer : Robinson Helicopter Company
Model : R22
Nationality : South African
Registration Marks : ZS-RNU
Place : Killarney farm, 20 nm south of Winburg
Date : 17 December 2008
Time : 1600Z

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997). this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to establish legal liability****.*

Disclaimer

This report is given without prejudice to the rights of the CAA, which are reserved.

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 The pilot, accompanied by a passenger, took off from Junctionspruit farm on a local private flight. He had 10 US gallons of fuel on board and intended returning to the farm.

1.1.2 After flying for about 50 minutes, he experienced a slight loss of altitude whilst flying at around 5 000 ft AMSL. At approximately 200 ft above ground level (AGL), the low RPM warning light illuminated, followed by the aural warning. He pushed the cyclic forward and lowered the collective at an indicated air speed of 40-50 kts, but there was a further loss of altitude and the aural warning sounded again. He then attempted to turn the helicopter to the right in order to land on level ground and keep the tail section away from rocks.

1.1.3 On touchdown, however, the right skid landed on a rock, causing the aircraft to bounce and roll over onto its left side. The pilot immediately shut down the engine and he and the passenger exited without any injuries.

1.2 Injuries to Persons:

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-		-
None	1	-	1	-

Figure 1. The helicopter after rolling over onto its left side.

Figure 2. Damage to the main rotor.

1.3 Damage to Aircraft

1.3.1 The main rotor blades, hub, tail rotor blades and fuselage were substantially damaged, and the right skid was fractured

1.4 Other Damage

1.4.1 None.

1.5 Personnel Information

1.5.1 Pilot-in-command

Nationality	South African	Gender	Male	Age	38
Licence Number	----------	Licence Type	Private (Helicopter)		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	16 December 2010				
Restrictions	None				
Previous Accidents	None				

Flying Experience

Total Hours (Helicopters)	63.3
Total Past 90 Days	35.8
Total on Type Past 90 Days	35.8
Total on Type	63.3

1.6 Aircraft Information

1.6.1 Airframe

Type	Robinson R22 Beta II	
Serial Number	3356	
Manufacturer	Robinson Helicopter Company	
Year of Manufacture	2002	
Total Airframe Hours (At time of Accident)	3 687.1	
Last MPI (Hours & Date)	3 600.7	22 August 2008
Hours since Last MPI	86.4	
C of A (Issue Date)	13 September 2002	
C of A (Expiry Date)	12 September 2009	
C of R (Issue Date) (Present Owner)	16 August 2007	
Operating Categories	Standard	

1.6.2 Engine

Type	Lycoming O 360 J2A
Serial Number	L38656-36A
Hours since New	1 485.8
Hours since Overhaul	TBO not yet reached

1.6.3 Weight and Balance

With the pilot and passenger on board and with only approximately 7 US gallons (42 lbs) of fuel remaining, it is considered that the aircraft weight was well within limits.

1.7 Meteorological Information

1.7.1 According to the pilot's questionnaire, the weather conditions at the time of the accident were as follows:

Wind direction	N/A	Wind speed	Calm	Visibility	Good
Temperature	30˚C	Cloud cover	None	Cloud base	None
Dew point	N/A				

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with the standard navigational equipment as per the minimum equipment list approved by the regulator. No defects were reported prior to the accident.

1.9 Communications

1.9.1 The aircraft was equipped with one VHF radio approved by the regulator.

1.9.2 The accident occurred outside a control zone (CTR) area.

1.10 Aerodrome Information

1.10.1 The helicopter took off from a private aerodrome at Junctionspruit farm in the Free State.

1.11 Flight Recorders

1.11.1 The helicopter was not fitted with a cockpit voice recorder (CVR) or a flight data recorder (FDR). Neither was required by regulations to be fitted to this type of aircraft.

1.12 Wreckage and Impact Information

1.12.1 The pilot was flying from the east to the south-west over the farm when he experienced visual and aural warnings of low RPM. During the landing that followed, the right skid touched down onto a rock, causing the helicopter to bounce back into the air and roll over onto its left side. The main rotor blades, hub and tail rotor blades were substantially damaged, and the left skid failed on impact.

1.13 Medical and Pathological Information

1.13.1 The pilot and passenger escaped unharmed.

1.14 Fire

1.14.1 There was no pre- or post-impact fire.

1.15 Survival Aspects

1.15.1 The accident was survivable. The pilot and passenger were properly restrained with three-point safety harnesses and impact forces were low.

1.16 Tests and Research

1.16.1 None.

1.17 Organisational and Management Information

1.17.1 This was a private flight. The pilot was also the owner of the helicopter.

1.17.2 The last maintenance carried out on the aircraft prior to the accident was certified by an aircraft maintenance organisation (AMO) at 3 600.7 airframe hours on 22 August 2008. The AMO was in possession of a valid AMO Approval Certificate with an expiry date of 31 October 2009.

1.18 Additional Information

1.18.1 Robinson Helicopter Company R22 Helicopter Safety Notice SN-24

LOW RPM ROTOR STALL CAN BE FATAL:

1. *Rotor stall due to low RPM is still involved in more helicopter accidents, both fatal and non-fatal, than any other contributing factor. Frequently misunderstood, rotor stall is not to be confused with retreating tip stall which occurs only at high forward speeds when stall occurs over a small portion of the retreating blade tip. Retreating tip stall causes vibration and control problems, but the rotor is very capable of providing sufficient lift to support the weight of the helicopter. Retreating tip stall has not been a problem with the R22.*

2. *Rotor stall on the other hand can occur at any airspeed and when it does, the rotor stops producing the lift required to support and the aircraft literally falls out of the sky. Fortunately, rotor stall most often occurs close to the ground during take off or landing and the helicopter only falls four or five feet. The helicopter is wrecked but the occupants survive. However, rotor stall can also and does occur at higher altitudes and when it happens at heights above 40 of 50 feet it is most likely to be fatal.*

3. *Rotor stall is very similar to the stall of an aeroplane wing at low airspeeds. As the airspeed of an aeroplane gets lower and lower, the nose-up angle or angle of attack of the wing must be higher and higher for the wing to produce the lift required to support the weight of the aeroplane. At a critical angle, (around 15˚ or so) the airflow over the wing will separate and stall causing a sudden loss of lift and a very large increase in drag. The pilot recovers by adding power and diving the aeroplane to recover the lost airspeed.*

4. *The same thing happens during rotor stall with a helicopter except it occurs due to low rotor RPM instead of low airspeed. As the RPM of the rotor gets lower and lower, the nose-up angle of attack of the rotor blades must be higher and higher to generate the lift required to support the weight of the helicopter. Even if the collective is not raised by the pilot to provide the higher blade angle, the helicopter will start to descend until the upward movement of air through the rotor blades provides the necessary increase in blade angle-of-attack. Again at a critical angle, as with the aeroplane wing, the blade airfoil will stall, resulting in a sudden loss of lift and a large increase in drag. The increased drag on the blades acts like a huge rotor brake, causing the rotor RPM to quickly decrease even more, further increasing the rotor stall. As the helicopter begins to fall, the upward rushing air continues to increase the angle-of-attack on the slowly rotating blades making recovery virtually impossible even with full down collective.*

5. *When the rotor stalls, it does not do so symmetrically because any forward airspeed of the helicopter will produce a higher airflow on the advancing blade than on the retreating blade. This causes the retreating blade to stall first allowing it to dive as it goes aft while the advancing blade is still climbing as it goes forward. The resulting low aft blade and high forward blade become a rapid aft tilting of the rotor disc, sometimes referred to as "rotor blow-back". Also, as the helicopter begins to fall, the upward flow of air under the tail surfaces tends to pitch the aircraft nose-down. These two effects, combined with aft cyclic by the pilot attempting to keep the nose from dropping will frequently allow the rotor blades to blow back and chop off the tail boom as the stalled helicopter falls. Due to the magnitude of the forces involved and the flexibility of rotor blades, hub flapping stops will not prevent the boom chop. The resulting boom chop, however, is somewhat academic, as the aircraft and its occupants are already doomed by the stalled rotor before the chop occurs.*

6. *To prevent rotor stall and its catastrophic results, the pilot must always do whatever is required to maintain a safe rotor RPM. It must take precedence over all other considerations, even if it means landing short in a swamp instead of trying to stretch your glide to the dry road beyond.*

7. *It must be remembered that the power output of the engine is proportional to RPM and when the RPM is low you have less power available from the engine with which to regain the lost RPM. The power-on low RPM recovery procedure of simultaneously rolling on throttle while lowering collective must be practised until it becomes an automatic reaction to any indication of low RPM. Low airspeeds combined with high sink rates must always be avoided and full collective must never be pulled until the helicopter is within one foot of the ground.*

8. *RECOVERY FROM LOW ROTOR RPM:*

   Under certain conditions of high weight, high temperature or high density altitude, you might get into a situation where the RPM is low even though you are using maximum throttle. This is usually the result of the main rotor blades having an angle-of-attack that has created so much drag that engine power is not sufficient to maintain or attain normal operating RPM.

   If you are in a low RPM situation, the lifting power of the main rotor blades

can be greatly diminished. As soon as you detect a low RPM condition, immediately apply additional throttle, if available, while slightly lowering the collective. This reduces main rotor pitch and drag. As the helicopter begins to settle, smoothly raise the collective to stop the descent. At hovering altitudes, you may have to repeat this technique several times to regain normal operating RPM. This technique is sometimes called "milking the collective". When operating at altitude, the collective may have to be lowered only once to regain rotor speed. The amount the collective can be lowered depends on altitude.

1.19 Useful or Effective Investigation Techniques

1.19.1 None considered necessary.

2. ANALYSIS

2.1 The pilot and passenger departed from a farm on a private local flight, with the intention of returning to the farm.

2.2 After flying for approximately 50 minutes, the pilot experienced a slight loss of altitude whilst flying at an elevation of about 5 000 ft AMSL. At around 200 ft above ground level (AGL), the low RPM warning light illuminated, followed by the aural warning. The pilot pushed the cyclic forward and lowered the collective at an IAS of 40-50 kts, but there was a further loss of altitude and the aural warning sounded again. He then attempted to turn the helicopter to the right in order to land on level ground and keep the tail section away from rocks. On touchdown, however, the right skid landed on a rock, causing the helicopter to bounce and roll over onto its left side. The main rotor, hub, tail rotor and fuselage were damaged.

3. CONCLUSION

3.1 Findings

3.1.1 The pilot was the holder of a valid private pilot's licence for helicopters and the helicopter type was endorsed in his logbook.

3.1.2 The last MPI prior to the accident was certified on 22 August 2008 by an approved AMO at 3 600.7 airframe hours.

3.1.3 The helicopter had flown a further 86.4 hours since its last MPI.

3.1.4 According to the pilot's questionnaire, the weather conditions were fine with no clouds. The surface temperature was approximately 30˚C and the surface wind was calm.

3.1.5 The pilot and passenger were on board and there were only about 7 US gallons (42 lbs) of fuel remaining. It is therefore considered that the aircraft weight was well within limits.

3.1.6 This was a private flight flown by the pilot, who was also the owner of the aircraft.

3.1.7 The last maintenance carried out on the aircraft prior to the accident was certified by an approved aircraft maintenance organisation (AMO).

3.1.8 The pilot allowed a low rotor RPM condition to develop and responded by pushing the cyclic forward and lowering the collective to restore the rotor RPM. However, he was unable to recover from this condition.

3.2 Probable Cause/s

3.2.1 The pilot used an incorrect technique to recover from a low rotor RPM condition.

3.3 Contributory factor/s

3.3.2 None.

4. SAFETY RECOMMENDATIONS

4.1 None

5. APPENDICES

5.1 None

Report reviewed and amended by the Advisory Safety Panel on 19 January 2010

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