AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/8711		
Aircraft Registration	**ZS-SRV**	**Date of Accident**	26 November 2009		**Time of Accident**	0803Z	
Type of Aircraft	Robinson R22 Beta		**Type of Operation**		Training		
Pilot-in-command Licence Type	Commercial (Helicopter)		**Age**	39	**Licence Valid**	Yes	
Pilot-in-command Flying Experience	Total Flying Hours		234		Hours on Type	141.7	
Last Point of Departure	Rand Aerodrome (FAGM)						
Next Point of Intended Landing	Rand Aerodrome (FAGM)						
Location of the Accident Site with Reference to Easily Defined Geographical Points (GPS readings if possible)							
West of Runway 35 at Rand Airport							
Meteorological Information	Wind direction 260º at 14knots; Temperature: 28º; Visibility>10km; No significant cloud.						
Number of People on Board	1 + 1	**No. of People Injured**	1 + 1	**No. of People Killed**	0		

Synopsis

The flight instructor and a student were engaged on a training flight when the accident occurred. After the take-off, the instructor flew to the training area where the student took control of the helicopter. The student started flying a circuit and was supposed to reposition the helicopter for the exercise. The flight instructor noticed that the helicopter was loosing height and instructed the student not to descend. The student raised the collective to rectify the loss of height. After the student raised the collective, the low rotor revolutions per minute (RPM) warning light illuminated. The flight instructor took control and lowered the collective while rolling the throttle to restore RPM, but was not successful. The flight instructor turned the helicopter to the right in an attempt to avoid colliding with a fence that was in front of the helicopter. Due to insufficient height, the helicopter's left-hand skid dug into the ground and the helicopter rolled over onto its left side.

The helicopter lost height due to the tailwind that was uncompensated for by the student and the raising of the collective while the engine was not producing adequate power, which led to the low RPM light illuminating. It is most likely that when the flight instructor took control of the helicopter, the angle of attack was increased, which resulted in more drag and which further slowed the rotor speed. Excessive main rotor RPM decay occurred rapidly and recovery at low altitude was virtually impossible.

Both the instructor and the student sustained minor injuries. The helicopter was substantially damaged.

Probable Cause

The helicopter lost main rotor RPM during a training flight.

Contributory remarks:

1. The instructor turned right to avoid colliding with a fence, and while turning right the left skid dug into the ground and the helicopter rolled over onto its left side.
2. A tailwind during downwind was not compensated for by the student.

IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Henley Air (Pty) Ltd
Manufacturer : Robinson Helicopter Company
Model : R22 BETA
Nationality : South African
Registration Marks : ZS-SRV
Place : Rand Airport
Date : 26 November 2009
Time : 0803Z

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 two hours.

Purpose of the Investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997), this report was compiled in the interests 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 On 26 November 2009, the flight instructor and a student were engaged on a training flight when the accident occurred.

1.1.2 The flight instructor was cleared to proceed to the training area (car park) to commence with the exercise and noticed a drop in engine RPM. According to the flight instructor, there was no horn or low rotor RPM indication. The flight instructor lowered the collective and rolled on the throttle to restore the RPM. After the RPM was restored, the flight instructor continued with the take-off towards the training area.

1.1.3 The instructor requested the student to familiarise himself with the helicopter as he hadn't flown for about 2 weeks, and instructed the student to take over to fly a left-hand circuit, and to reposition for the exercise. The flight instructor stated that while the student was flying downwind, they had a tailwind of 14 kts. Before the student could turn from downwind, the flight instructor noticed that the student had descended the helicopter a couple of feet. The flight instructor asked the student not to descend. The student raised the collective and the low rotor RPM light illuminated.

1.1.4 The instructor took control of the helicopter, lowered the collective and rolled on the throttle but to no avail. The low rotor RPM horn did not deactivate. Due to the 3 ft fence in front of the helicopter, the instructor decided to turn the helicopter to the

right to avoid colliding with the fence. Due to insufficient height, the left-hand skid dug into the ground during the turn and the helicopter rolled over onto its left side.

1.1.5 The helicopter sustained substantial damage to the main rotor blades and the tail boom. Both the flight instructor and the student sustained minor injuries.

1.2 Injuries to Persons

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

1.3 Damage to Aircraft

1.3.1 The helicopter sustained substantial damage.

Figure 1: Damage to the helicopter

1.4 Other Damage

1.4.1 None.

1.5 Personnel Information

1.5.1 Flight Instructor:

Nationality	South African	Gender	Male	Age	39
Licence Number	**********	Licence Type	Commercial (Helicopter)		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night rating				
Medical Expiry Date	31/10/2010				
Restrictions	None				

Previous Accidents	None

1.5.2 Flight Instructor Flying Experience:

Total Hours (Helicopter)	234
Total Hours (Aeroplane)	7 331
Total Past 90 Days (Helicopter)	34.5
Total Past 90 Days (Aeroplane)	161.1
Total on Type Past 90 Days	30
Total on Type	141.7

1.5.3 Student Pilot:

Nationality	South African	Gender	Male	Age	33
License Valid	Yes	Type Endorsed		Yes	
License Number	**********	License Type		Student	
Restrictions	None				
Medical Expiry Date	30/11/2011				

1.5.4 Student Pilot Experience:

Total Hours (Helicopter)	10

1.6 Aircraft Information

1.6.1 Airframe:

Type	Robinson R22 BETA	
Serial Number	3300	
Manufacturer	Robinson Helicopter Company	
Date of Manufacture	2002	
Total Airframe Hours (At Time of Accident)	1 634.6	
Last MPI (Date & Hours)	13/11/2009	1 623.3
Hours Since Last MPI	11.3	
C of A (Issue Date)	29/05/2008	
C of R (Issue Date) (Present Owner)	31/07/2008	
Operating Categories	Standard	

1.6.2 Engine:

Type	Lycoming 0-360-J2A
Serial Number	L-38407-36A
Hours Since New	1 634.6
Hours Since Overhaul	TBO not reached

1.6.3 Weight and balance for ZS-SRV:

The table below shows the maximum take-off weight for ZS-SRV:

	Weight (lb)	Arm (in)	Moment (in.lb)
A/C Empty Weight	866.42	100.0	86 642
Pilot + Pax 106 kg + 81 kg	418.87	79.0	33 090.73
Baggage 0 kg	0	79.0	0
Fuel Main Tank (7.9 US gal)	47.4	108.6	5 147.64
Auxiliary Tank (2.64 US gal)	15.84	103.8	1 644.19
Total T/O Weight	1 348.53	93.8	126 524.50

The maximum certified mass as stipulated on the Pilot's Operating Handbook (POH) is 1 370 lb. The helicopter was within limits.

Note: 1 US gal = 6 lb

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	260º	Wind Speed	14 kts	Visibility	>10 km
Temperature	28º	Cloud Cover	NSC	Cloud Base	Nil
Dew Point	None				

1.8 Aids to Navigation

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

1.9.2 The pilot was broadcasting his intentions on frequency 118.7 MHz.

1.10 Aerodrome Information

Aerodrome Location	Rand Aerodrome	
Aerodrome Co-ordinates	S26º14’31.1” E28º09’04.8”	
Aerodrome Elevation	5 483 ft AMSL	
Runway Designations	35/17	29/11
Runway Dimensions	1 493 m x 15 m	1 660 m x 15 m
Runway Surface	Tar	
Approach Facilities	VOR, DME, NDB	

1.11 Flight Recorders

1.11.1 The helicopter was not fitted with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was either required by the regulator.

1.12 Wreckage and Impact Information

1.12.1 During a right turn to avoid colliding with a wire fence, the left skid dug into the grass surface, causing the helicopter to roll over onto its left side and impact the ground. As a result, the helicopter was substantially damaged.

1.12.2 The fuselage sustained damage on the left side only. The damage caused to the tail boom was limited to areas where it is fitted to the fuselage in front and tail rotor gearbox. Both left and right windshields broke and were separated from the airframe. The main and tail rotors also impacted the ground and sustained damage.

Figure 2: The wire fence that the flight instructor avoided

1.13 Medical and Pathological Information

1.13.1 The pilot was in possession of a valid medical certificate.

1.14 Fire

1.14.1 There was no evidence of a pre- or post-impact fire.

1.15 Survival Aspects

1.15.1 The accident was considered survivable because there was no major damage to the cabin area. Both the pilot and the student used the helicopter's safety harnesses and they survived with minor injuries.

1.16 Tests and Research

1.16.1 None.

1.17 Organisational and Management Information

1.17.1 This was a training flight.

1.17.2 The training school was in possession of a valid aircraft training organisation (ATO) certificate at the time of the accident.

1.17.3 The helicopter was properly maintained by an approved aircraft maintenance organisation (AMO), which had a valid certificate at the time of the accident.

1.18 Additional Information

1.18.1 The helicopter had two different registration markings: ZS-SRV and ZS-RVS. According to the SACAA documentation the correct registration is ZS-SRV.

Figure 3: Registration marking of ZS-SRV

Figure 4: Registration marking of ZS-RVS

1.18.2 The following information was summarised from the Rotorcraft flying handbook:

1.18.2.1 Tailwinds

Flying in tailwinds may require the use of more tail rotor thrust to maintain directional control. This increased tail rotor thrust absorbs power from the engine, which means there is less power available to the main rotor for the production of lift. Some helicopters even have a critical wind azimuth or maximum safe relative wind chart. Operating the helicopter beyond these limits could cause loss of tail rotor effectiveness.

1.18.2.2 Low RPM warning system

Due to the low inertia rotor system, the rotor RPM tends to drop very fast at decreased throttle or quick raising of the collective. If the rotor RPM drops below 97%, a warning light and horn are activated. The horn and light are deactivated when the collective is fully down (run up and shut down). This system needs power, and is inoperable when the master battery and alternator switches are off.
The main rotor of a helicopter with a low inertia rotor system can lose energy quickly when the collective is raised and the power required exceeds the power available. This can lead to an aerodynamic stall of the rotor blades and loss of lift if the pilot fails to initiate immediate corrective action. Air rushing upward through the blades further increases their angle of attack, resulting in more drag and further slowing the rotor speed. Excessive main rotor RPM decay can occur rapidly and recovery at low altitude is virtually impossible.

1.18.3 The following information was extracted from the R22 POH SN-10:

1.18.3.1 Fatal accidents caused by low RPM rotor stall

A primary cause of fatal accidents in light helicopters is failure to maintain rotor RPM. To avoid this, every pilot must have his reflexes conditioned so he will instantly add throttle and lower collective to maintain RPM in any emergency.
The R22 and R44 have demonstrated excellent crashworthiness as long as the pilot flies the aircraft all the way to the ground and executes a flare at the bottom to

reduce his airspeed and rate descent. Even when going down into rough terrain, trees, wires or water, he must force himself to lower the collective to maintain RPM until just before impact. The ship may roll over and be severely damaged, but the occupants have an excellent chance of walking away from the accident without injury.

Power available from the engine is directly proportional to RPM. If the RPM drops 10%, there is 10% less power. With less power, the helicopter will start to settle, and if the collective is raised to stop it from settling, the RPM will be pulled down even lower, causing the ship to settle even faster. If the pilot not only fails to lower the collective, but instead pulls up the collective to keep the ship from going down, the rotor will stall almost immediately. When it stalls, the blade will either 'blow back' and cut off the tailcone or it will just stop flying, allowing the helicopter to fall at an extreme rate. In either case, the resulting crash is likely to be fatal.

No matter what causes the low rotor RPM, the pilot must first roll on throttle and lower collective simultaneously to recover RPM **before** investigating the problem. It must be a conditioned reflex. In forward flight, applying aft cyclic to bleed off airspeed will also help recover lost RPM.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1 The instructor and the student were on a training flight when the accident occurred. The helicopter was serviceable prior to the accident and no malfunction was reported by either the flight instructor or the student prior to the accident. The helicopter weight and balance was within the limits.

2.2 After the student took over control of the helicopter to fly a left-hand circuit, the instructor noticed that the helicopter was descending during downwind. The instructor asked the student not to descend. The student raised the collective to recover from the descent, whereafter the low main rotor RPM light illuminated.

2.3 The helicopter did not have enough power to sustain height because of the 14 kts tailwind, which increased the tail rotor thrust. Increased in tail rotor thrust absorbs more power from the engine, which means less power available to the main rotor for the production of lift – hence the descent. It is most likely that the student did not compensate for the tailwind. The student had only 10 hours of training on the helicopter. It is possible that the student raised the collective quickly, and as the engine was not producing adequate power, the low RPM light illuminated.

2.4 After low rotor RPM warning light illuminated, the flight instructor took control of the helicopter. He then lowered the collective and rolled on the throttle to recover from low main rotor RPM but to no avail. Due to a fence in front of the helicopter, the instructor turned right to avoid colliding with the fence. During the right turn, the left-hand skid dug into the ground and the helicopter rolled onto its left-hand side.

2.5 It is most likely that when the flight instructor took control of the helicopter the angle of attack was increased, resulting in more drag, which further slowed the rotor speed. Excessive main rotor RPM decay occurred rapidly, and recovery at low altitude was virtually impossible.

3. CONCLUSION

3.1 Findings

3.1.1 The helicopter had a valid Certificate of Airworthiness and a valid Certificate of Registration.

3.1.2 The pilot was the holder of valid commercial helicopter pilot's licence and the helicopter type was endorsed in the licence.

3.1.3 The pilot was in possession of a valid medical certificate.

3.1.4 During downwind, the helicopter experienced a tailwind of 14 kts.

3.1.5 The last mandatory periodic inspection (MPI) prior to the accident was certified on 13 November 2009 at 1 623.3 hours.

3.1.6 The helicopter had flown a further 11.3 hours after the last MPI was certified.

3.1.7 The helicopter had two different registration markings.

3.2 Probable Cause/s

3.2.1 The helicopter lost main rotor RPM during a training flight.

3.2.2 Contributory remarks:

1. The instructor was avoiding hitting a fence, and while turning right the left skid dug into the ground and the helicopter rolled over onto its left side.
2. A tailwind during downwind was not compensated for by the student.

4. SAFETY RECOMMENDATIONS

4.1 None.

5. APPENDICES

5.1 None.

Report reviewed and amended by the Advisory Safety Panel on18 May 2010

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