HELICOPTER ACCIDENT REPORT AND EXECUTIVE SUMMARY

			Reference:	CA18/2/3/9886	
Helicopter Registration	**ZS-RDI**	**Date of Accident**	1 August 2020	**Time of Accident**	1030Z
Type of Helicopter	Robinson R44 Raven II		**Type of Operation**	Aerial Work (Part 137)	
Pilot-in-command Licence Type	Commercial	**Age**	35	**Licence Valid**	Yes
Pilot-in-command Flying Experience	Total Flying Hours	2548.9	Hours on Type	2520.1	
Last Point of Departure	De Poort Private Farm near Colesberg, Northern Cape Province				
Next Point of Intended Landing	De Poort Private Farm near Colesberg, Northern Cape Province				

Location of the accident site with reference to easily defined geographical points (GPS readings if possible)

Cypherkuil Private Farm, 10nm south-west of Colesberg, Northern Cape Province, at GPS co-ordinates determined to be 30°46'45.54'' S 024°39'27.85'' E at an elevation of 4583ft

Damage to Helicopter	Substantially damaged				
Meteorological Information	Wind velocity: 140°/02kt; Visibility: >10km; Temperature: 17°C; Dew Point: -7°C; Cloud base and cover: CAVOK				
Number of People On-board	1 + 1	**No. of People Injured**	0	**No. of People Killed**	0

Synopsis

On 1 August 2020, two occupants on-board a Robinson R44 helicopter with registration ZS-RDI took off from De Poort private farm near Colesberg, routing to Cypherkuil private farm, with the intention to land back at De Poort private farm. The flight was conducted under Visual Flight Rules (VFR) by day and in Visual Meteorological Conditions (VMC). The pilot reported that he was flying at low altitude, below 500 feet above ground level (AGL), while tracking game (springbok) on Cypherkuil farm when the helicopter lost tail rotor effectiveness (LTE) during a right turn. The helicopter started to spin in a clockwise direction. In an attempt to recover, the pilot pulled too much power and lost control of the helicopter. The helicopter landed hard on the ground with the skids first. The main rotor blades severed the tail boom and the helicopter rolled to the left before coming to a stop. The helicopter was substantially damaged during the landing sequence and the two occupants on-board were unharmed.

It is likely that during a right turn, with the helicopter flying at a low altitude, its airspeed decayed which resulted in the pilot abruptly increasing engine power to increase the helicopter's airspeed. However, the increase in power required by the main rotor exceeded the increase in power available or produced by the engine, causing the main rotor rpm to decrease if collective pitch is increased excessively. Because the tail rotor revolutions per minute (rpm) is tied to the main rotor rpm, the tail rotor speed also decreased. Although the engine was still providing maximum torque to the main rotor, the tail rotor was unable to provide adequate counter-torque as the thrust was greatly reduced due to the low rpm; this caused the loss of tail rotor effectiveness. As a result, the helicopter started to spin and the pilot lost control of the helicopter and crashed.

Probable Cause and/or Contributory Factors

Loss of control due to loss of tail rotor effectiveness induced by the low main rotor rpm. The low main rotor rpm was caused by an abrupt increase in engine power following a reduction in the helicopter's airspeed.

Contributory factor:
Improper recovery technique.
Low-level flight resulting in insufficient height to recover.

SRP Date	9 March 2021	Publication Date	10 March 2021

ABBREVIATION	DEFINITION
AGL	Above Ground Level
AMO	Aircraft Maintenance Organisation
°C	Degree Celsius
CPL	Commercial Pilot Licence
FAA	Federal Aviation Authority
ft	Feet
GPS	Global Positioning System
IFR	Instrument Flight Rules
LTE	Loss of Tail Rotor Effectiveness
NM	Nautical mile
PIC	Pilot-in-command
SAWS	South African Weather Service
SACAA	South African Civil Aviation Authority
SB	Service Bulletin
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

Reference Number	**:** CA18/2/3/9886
Name of Owner/Operator	**:** WP Smith
Manufacturer	**:** Robinson Helicopter Company
Model	**:** Robinson R44 Raven II
Nationality	**:** South African
Registration Marks	**:** ZS-RDI
Place	**:** Cypherkuil Private Farm near Colesberg, Northern Cape Province
Date	**:** 1 August 2020
Time	**:** 1030Z

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 (CAR) 2011, 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 apportion blame or liability****.*

Investigation Process:

The accident was notified to the Accident and Incident Investigations Division (AIID) on 1 August 2020 at about 1300Z. This was a desktop investigation and no investigator was dispatched to the accident site. The investigator/s co-ordinated with all authorities on site by initiating the accident investigation process according to CAR Part 12 and investigation procedures. The AIID of the South African Civil Aviation Authority (SACAA) is leading the investigation as the Republic of South Africa is the State of Occurrence.

Notes:
1. Whenever the following words are mentioned in this report, they shall mean the following:

- *Accident – this investigated accident*
- *Aircraft – the Robinson R44 Raven II helicopter involved in this accident*
- *Investigation – the investigation into the circumstances of this accident*
- *Pilot – the pilot involved in this accident*
- *Report – this accident report*

2. Photos and figures used in this report were taken from different sources and may be adjusted from the original for the sole purpose of improving clarity of the report. Modifications to images used in this report are limited to cropping, magnification, file compression; or enhancement of colour, brightness, contrast; or addition of text boxes, arrows or lines.

Disclaimer:

FACTUAL INFORMATION

1.1. History of Flight

1.1.1. On 1 August 2020 at 1020Z, the pilot and a passenger on-board a Robinson R44 helicopter with registration ZS-RDI took off from De Poort private farm near Colesberg, in the Northern Cape province, routing to a neighbouring farm, Cypherkuil, situated 25 kilometres (km) away, with the intention to land back at De Poort private farm after engaging in a game culling (springbok shooting) operation. The flight was conducted under Part 137 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.1.2 The pilot reported that he was flying the helicopter at low altitude, below 500 feet (ft) above ground level (AGL), while tracking game (springbok) over Cypherkuil farm when the helicopter lost its tail rotor effectiveness (LTE) during a right turn.

1.1.3 The pilot further reported that the helicopter started to spin in a clockwise direction and, in an attempt to recover, he pulled the collective too much but lost control of the helicopter. The helicopter landed hard on the ground with both skids first; the main rotor severed the tail boom. The helicopter rolled on its left-side and came to rest in that position. It sustained damages to the skids, fuselage, main rotor and tail boom. The two occupants reported no injuries; they disembarked from the helicopter without assistance. There was no evidence of a pre- or post-impact fire.

1.1.5 The helicopter accident occurred at Cypherkuil private farm, south-west of Colesberg in the Northern Cape province at Global Positioning System (GPS) co-ordinates determined to be 30°46'45.54''S 024°39'27.85''E at an elevation of 4583ft.

Figure 1: An aerial view of the accident site. (Source: Google Earth)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other on Ground
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	1	-	1	2	-
Total	1	-	1	2	-

1.3. Damage to Helicopter

1.3.1 The helicopter sustained substantial damage during the accident sequence.

Figure 2: The wreckage post-accident.

1.4. Other Damage

1.4.1 None.

1.5. Personnel Information

Nationality	South African	Gender	Male	Age	35
Pilot Licence Number	0271065229	Licence Type	Commercial Pilot Licence		
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Instrument and culling				
Medical Expiry Date	31 October 2020				
Restrictions	None				
Previous Accidents	None				

Flying Experience:

Total Hours	2548.9
Total Past 90 Days	89.3
Total on Type Past 90 Days	89.3
Total on Type	2520.1

1.5.1 The pilot was issued an initial licence on 26 August 2011 with an expiry date of 25 August 2013. The pilot had undergone his skills test for the renewal of his Commercial Pilot Licence (CPL) on 26 November 2019 and was issued a Commercial Pilot Licence on 9 December 2019 with an expiry date of 30 November 2020. The pilot had last flown the accident helicopter on 31 July 2020 for a duration of 1.7 hours as pilot-in-command. The pilot was in possession of a Class 1 medical certificate which was issued on 11 October 2019 with an expiry date of 31 October 2020.

1.6. Helicopter Information

Airframe:

Type	Robinson R44	
Serial Number	2393	
Manufacturer	Robinson Helicopter Company	
Date of Manufacture	2015	
Total Airframe Hours (At time of Accident)	1687.2	
Last MPI (Date & Hours)	27 June 2020	1642.6
Hours Since Last MPI	44.6	
C of A (Issue Date)	21 July 2016	
C of A (Expiry Date)	31 July 2021	
C of R (Issue Date) (Present Owner)	1 July 2018	
Operating Categories	Part 91	
Type of Fuel Used	Avgas100 LL	

1.6.1 The Robinson R44 Raven II is a four-seat light two-bladed helicopter driven by a Lycoming six reciprocating piston engine based on the smaller two seat R22. The helicopter is of metal construction with hydraulically assisted flight controls. The light utility helicopter first received the Federal Aviation Authority (FAA) certification in December 1992.

Engine:

Type	Lycoming O-540-F1B5
Serial Number	L-27528-40E
Hours Since New	1722.9
Hours Since Overhaul	TBO not yet reached

Main Rotor:

Type	C016-7
Serial Number	5352 and 5362
Hours Since New	1722.9
Hours Since Overhaul	TBO not yet reached

Tail Rotor:

Type	C029-3
Serial Number	4080 and 4082
Hours Since New	1722.9
Hours Since Overhaul	TBO not yet reached

1.7. Meteorological Information

1.7.1 The weather report was sourced from the South African Weather Service (SAWS) for 1 August 2020 at 1030Z for Gariep Dam Airport (FAHV).

Wind Direction	140°	Wind Speed	02 kts	Visibility	≥ 10 km
Temperature	17° C	Cloud Cover	Nil	Cloud Base	Nil
Dew Point	-07°C	QNH	1031		

1.8. Aids to Navigation

1.8.1 The helicopter was equipped with standard navigational equipment as approved by the Regulator (SACAA) for the helicopter type. There was no record indicating that the navigation system was unserviceable prior to the accident.

1.9. Communication

1.9.1 The helicopter was equipped with standard communication equipment as approved by the Regulator for the helicopter type. There was no record indicating that the communication system was unserviceable prior to the accident.

1.10. Aerodrome Information

1.10.1 The helicopter accident took place at De Poort private farm, south-west of Colesberg in the Northern Cape province at GPS co-ordinates determined to be 30°46'45.54''S 024°39'27.85''E at an elevation of 4583ft.

1.11. Flight Recorders

1.11.1 The helicopter was not equipped with a flight data recorder (FDR) or a cockpit voice recorder, (CVR) and neither was required by regulation to be fitted to this helicopter type.

1.12. Wreckage and Impact Information

1.12.1 The helicopter landed hard on its skids following loss of tail rotor effectiveness and loss of control. The main rotor blades severed the tail boom and the helicopter rolled on its left-side before coming to a stop. The main wreckage was confined in one place with the tail boom found approximately 30 metres from the main wreckage.

Figure 3: The helicopter wreckage as it came to rest.

1.12.2 The helicopter was inspected and all the control surfaces were accounted for and continuity of the cables was confirmed. All damage was attributed to the accident sequence.

1.13. Medical and Pathological Information

1.13.1 None.

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 helicopter accident was considered survivable as the cabin/cockpit structure had no damage which could have caused injuries to the occupants. Both occupants had made use of the helicopter equipped safety harnesses.

1.16. Tests and Research

1.16.2 None.

1.17. Organisational and Management Information

1.17.1 This was a game culling (shooting) flight which was conducted under the provisions of Part 137 of the Civil Aviation Regulations (CAR) 2011 as amended.

1.17.2 The operator was in possession of a valid Air Operator Certificate (AOC), which was issued on 22 May 2020 by the SACAA with an expiry date of 31 March 2021. The helicopter was duly authorised to operate under the AOC.

1.17.3 The last mandatory periodic inspection (MPI) that was carried out on the helicopter prior to the accident flight was certified on 27June 2020 at 1642.6 airframe hours. The aircraft maintenance organisation (AMO) was issued an AMO certificate by the SACAA on 25 February 2020 with an expiry date of 28 February 2021.

1.18 Additional Information

1.18.1 Robinson R44 Pilot Operating Handbook (POH) Section 3 (Emergency Procedure)

Safety Tips and Notices: Safety Notice-34

According to the helicopter manufacturer, "during low speed manoeuvring, a pilot can lose awareness of the helicopter power setting. If collective pitch is increased excessively, the power required by the main rotor exceeds the full-throttle power available, causing rotor rpm to decrease. Since tail rotor rpm is tied to main rotor rpm, the tail rotor speed also decreases. Although the engine is still providing maximum torque to the main rotor, the tail rotor is unable to provide adequate counter-torque since the thrust is greatly reduced due to the low rpm. This is effectively loss of tail rotor effectiveness (LTE), but loss of effectiveness due to low rpm is not typically considered when referring to LTE."

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2 ANALYSIS

2.1 General

From the evidence gathered, the following analysis was made with respect to this accident. This shall not be read as apportioning blame or liability to any particular organisation or individual.

2.2. Analysis

2.2.1 The pilot was issued the initial licence on 26 August 2011 with an expiry date of 25 August 2013. The pilot had last undergone his skills test for the renewal of his Commercial Pilot Licence (CPL) on 26 November 2019. He was issued a CPL on 9 December 2019 with an expiry date of 30 November 2020. The pilot had last flown the accident helicopter on 31 July 2020 for a duration of 1.7 hours as pilot-in-command. The pilot was in possession of a Class 1 medical certificate which was issued on 11 October 2019 with an expiry date of 31 October 2020. The pilot was in possession of proper qualifications at the time of the accident.

2.2.2 The helicopter Certificate of Registration was issued on 1 July 2018. The helicopter Certificate of Airworthiness was issued on 21 July 2016 with an expiry date of 31 July 2021. The helicopter type was endorsed on the pilot's licence. Records indicated that the pilot was licensed and qualified to undertake the flight. The helicopter was inspected post-accident and all the control surfaces were accounted for and continuity of the cables was established; all damage was attributed to the accident sequence. Reviewed records indicated that the helicopter was airworthy and there were no recorded defects prior to the flight.

2.2.3 Wind condition at the time of the accident was reported to be 02 knots (kts) and the helicopter was certified to operate at a maximum wind condition of 17kts, which meant that the wind at the time of the accident was less than the maximum for this helicopter type. Therefore, weather was not a contributory factor to the accident.

2.2.4 *Robinson R44 Pilot Operating Handbook (POH) Section 3 (Emergency Procedure)*

Safety Tips and Notices: Safety Notice- 34

According to the helicopter manufacturer, "during low speed manoeuvring, a pilot can lose awareness of the helicopter power setting. If collective pitch is increased excessively, the power required by the main rotor exceeds the full-throttle power available, causing rotor rpm

to decrease. Since tail rotor rpm is tied to main rotor rpm, the tail rotor speed also decreases. Although the engine is still providing maximum torque to the main rotor, the tail rotor is unable to provide adequate counter-torque since the thrust is greatly reduced due to the low rpm. This is effectively loss of tail rotor effectiveness (LTE), but loss of effectiveness due to low rpm is not typically considered when referring to LTE."

2.2.5 It is likely that during a right turn, with the helicopter flying at a low altitude, its airspeed decayed, resulting in the pilot abruptly increasing engine power to increase the helicopter's airspeed. However, the increase in power required by the main rotor exceeded the increase in power available or produced by the engine, causing the main rotor rpm to decrease if collective pitch is increased excessively. Because the tail rotor rpm is tied to the main rotor rpm, the tail rotor speed also decreased. Although the engine was still providing maximum torque to the main rotor, the tail rotor was unable to provide adequate counter-torque as the thrust was greatly reduced due to the low rpm; this caused the loss of tail rotor effectiveness (LTE). As a result, the helicopter started to spin and the pilot lost control of the helicopter and crashed.

3 CONCLUSION

3.1 General

From the evidence gathered, the following findings, causes and contributing factors were made with respect to this accident. These shall not be read as apportioning blame or liability to any particular organisation or individual.

To serve the objective of this investigation, the following sections are included in the conclusion heading:

- **Findings —** are statements of all significant conditions, events or circumstances in this accident. The findings are significant steps in this accident sequence, but they are not always causal or indicate deficiencies.
- **Causes —** are actions, omissions, events, conditions or a combination thereof, which led to this accident.
- **Contributing factors —** are actions, omissions, events, conditions or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident occurring, or mitigated the severity of the consequences of the accident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

3.2 Findings

3.2.1 The pilot was issued a CPL on 9 December 2019 with an expiry date of 30 November 2020. The pilot had last flown the accident helicopter on 31 July 2020 for a duration of 1.7 hours as pilot-in-command. The pilot had last undergone his skills test for the renewal of his CPL on 26 November 2019. The pilot was in possession of a Class 1 medical certificate which was issued on 11 October 2019 with an expiry date of 31 October 2020.

3.2.2 The helicopter Certificate of Airworthiness was originally issued on 31 July 2016 with an expiry date of 31 July 2021. The helicopter Certificate of Registration was issued on 1 July 2018.

3.2.3 The last mandatory periodic inspection (MPI) was conducted on 27 June 2020 at 1642.6 hours and the helicopter was flown a further 44.6 hours following the MPI.

3.2.4 The helicopter was maintained by an AMO that was in possession of an AMO certificate issued by the Regulator on 25 February 2020 and with an expiry date of 28 February 2021.

3.2.5 This was a game culling flight which was conducted under the provisions of Part 137 of the CAR 2011 as amended.

3.2.6 The operator was in possession of a valid Air Operator Certificate (AOC) which was issued on 22 May 2020 by the SACAA with an expiry date of 31 March 2021. The helicopter was duly authorised to operate under the AOC.

3.3.7 The pilot stated that he lost control of the helicopter and could not recover to normal flight; he landed hard and the helicopter was substantially damaged during the landing sequence with the main rotor severing the tail boom. The helicopter was inspected post-accident and all the control surfaces were accounted for and continuity of the cables was confirmed; all damage was attributed to the accident sequence.

3.2.8 The pilot reported that the purpose of the flight was to track game (springboks) on Cypherkuil private farm for game culling when he lost tail rotor effectiveness (LTE). The pilot lost control of the helicopter and landed hard with the main rotor severing the tail boom and then rolled over to the left. The helicopter was substantially damaged during the accident sequence and the occupants were not injured.

3.2.9 The flight was conducted under Visual Flight Rules (VFR) in fine weather conditions.

3.3.10 It is likely that during a right turn, with the helicopter flying at a low altitude, its airspeed decayed, resulting in the pilot abruptly increasing engine power to increase the helicopter's airspeed. However, the increase in power required by the main rotor exceeded the increase in power available or produced by the engine, causing the main rotor rpm to decrease if collective pitch is increased excessively. Because the tail rotor rpm is tied to the main rotor rpm, the tail rotor speed also decreased. Although the engine was still providing maximum torque to the main rotor, the tail rotor was unable to provide adequate counter-torque as the thrust was greatly reduced due to the low rpm; this caused the loss of tail rotor effectiveness (LTE). As a result, the helicopter started to spin and the pilot lost control of the helicopter and crashed.

3.3 Probable Cause/s

3.3.1 Loss of control due to a loss of tail rotor effectiveness as a result of the low main rotor rpm. The low main rotor rpm was caused by an abrupt increase in engine power following a reduction in the helicopter's airspeed.

3.3.2 **Contributory Factors**

3.3.2.1 Improper recovery technique

3.3.2.2 Low-level flight resulting in insufficient height to recover.

4 SAFETY RECOMMENDATIONS

4.1 General

The safety recommendations listed in this report are proposed according to paragraph 6.8 of Annex 13 to the Convention on International Civil Aviation and are based on the conclusions listed in heading 3 of this report; the AIID expects that all safety issues identified by the investigation are addressed by the receiving States and organisation.

4.2 Safety Recommendation/s

4.2.1 **Safety message:** Pilots are encouraged to be aware of the aerodynamics of the helicopter or aircraft they are operating to ensure that they are not taken by surprise (caught off guard) after a manoeuvre or power input.

5 APPENDICES

5.1 None.

This report is issued by:

Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa