

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10543						
Classification	Accident		Date	12 January 2025		Time	1410Z
Type of Operation	Private (Part 91)						
Location							
Place of Departure	Witklip Farm near Vaalwater, Limpopo Province		Place of Intended Landing	Leeudrift Farm near Vaalwater, Limpopo Province			
Place of Occurrence	On a field at Witklip Farm, 5 nautical miles north-east of Vaalwater at GPS 24°15'51" South 028°13'30" East at an elevation: 3 112 ft						
GPS Co-ordinates	Latitude	24° 15' 51.00" S	Longitude	28° 13' 30.00" E	Elevation	3 112ft	
Aircraft Information							
Registration	ZS-RMD						
Make; Model; S/N	Robinson; R44 Raven I (Serial number: 0812)						
Damage to Aircraft	Substantial			Total Aircraft Hours	1 829.5		
Pilot-in-command							
Licence Type	Commercial Pilot Licence (CPL) H		Gender	Male		Age	35
Licence Valid	Yes	Total Hours	4 586.8		Total Hours on Type	3 742.9	
Total Hours 30 Days	0.2		Total Flying on Type Past 90 Days	28.2			
People On-board	1+2	Injuries	0	Fatalities	0	Other (on ground)	0
What Happened							
On Sunday afternoon, 12 January 2025, a pilot and two passengers on-board a Robinson R44 helicopter with registration ZS-RMD took off on a private flight from Witklip Farm to Leeudrift Farm near Vaalwater, both located in Limpopo province. Visual meteorological conditions (VMC) by day prevailed at the time of the flight which was conducted under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended. The pilot reported that they took off from Leeudrift Farm at approximately 1340Z to refuel at Witklip Farm, which is located approximately 5 nautical miles (nm) north-east of Vaalwater. The flight to Witklip Farm took 6 minutes, and it was uneventful. At around 1405Z, the helicopter's main and auxiliary fuel tanks were refuelled to a little less than half the capacity on each tank. The pilot stated that the helicopter lifted off and headed north-easterly. At approximately 300 feet (ft) above ground level (AGL) at a speed of 20 knots (kts) whilst transitioning, the pilot turned the aircraft to face east. As the helicopter transitioned, it lost revolutions per minute (RPM) and he decided to conduct a precautionary landing. During landing, the helicopter impacted the muddy ground hard and skidded forward for about 5 metres. The left landing gear skid impacted a 30cm high tree stump; as a result, the helicopter's nose lowered and the tail boom lifted with the main rotor still turning at a high speed. As a result, the main rotor severed the tail boom. Subsequently, the helicopter yawed approximately 90 degrees counterclockwise before the pilot could shut down the engine and pull the main rotor brake. The occupants were uninjured; they evacuated the helicopter without assistance. The helicopter sustained damage to the left skid, main rotor and tail boom.							



Figure 1: The helicopter post-accident. (Source: Pilot)

R44 Raven - Weight & Balance

Select if installed: ☐ Dual Controls ☒ Front Left Door ☒ Front Right Door
☒ Rear Left Door ☒ Rear Right Door

	Weight (lbs)	Long Arm	Long Mom	Lat Arm	Lat Mom
Empty Weight	1515	104.57	158423.55	0.71	1075.65
Front Right (Pilot)	275	49.5	13612.5	12.2	3355
Front Right Baggage	0	44	0	11.5	0
Front Left (Passenger)	139	49.5	6880.5	-10.4	-1445.6
Front Left Baggage	0	44	0	-11.5	0
Rear Right (Passenger)	181	79.5	14389.5	12.2	2208.2
Rear Right Baggage	0	79.5	0	12.2	0
Rear Left (Passenger)	0	79.5	0	-12.2	0
Rear Left Baggage	0	79.5	0	-12.2	0
Zero Fuel	2110	91.61	193306.05	2.46	5193.25
Main Tank (gal) 15	90	106	9540	-13.5	-1215
Aux Tank (gal) 8.97	53.82	102	5489.64	13	699.66
Total Takeoff	2253.82	92.44	208335.69	2.08	4677.91

Table 1: Weight and balance sheet. (Source: Pilot)

The pilot stated that the calculated weight of the helicopter was 1 035.7 kilograms (2 253.82 pounds). According to the Pilot's Operating Handbook (POH), the maximum take-off weight (MTOW) is 1 088.62 kg. Therefore, the MTOW of ZS-RMD was within limits.

Please note: "Empty Weight" should include all doors but NOT dual controls.

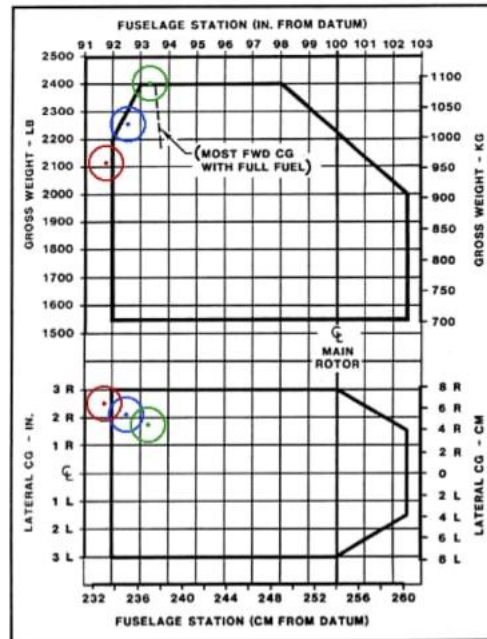


Chart 1: Centre-of-gravity chart. (Source: Pilot)

Fuel Calculation:

According to the pilot, the aircraft had approximately 98.3 litres (L) of Aviation Gasoline (Avgas) at the beginning of the flight; the fuel consumption was 29.5L per hour. Approximately 93.4L of fuel remained in the tanks after the accident. The helicopter had sufficient fuel for the flight.

According to the pilot questionnaire, the weather around Witklip Farm at 1400Z was as follows:

Wind Direction	300°	Wind Speed	8kts	Visibility	10km
Temperature	24°C	Cloud Cover	Scattered	Cloud Base	1500m
Dew Point	20°	QNH	Unknown		

DEMONSTRATED CONDITIONS:
SMOOTH HARD SURFACE
WIND CALM
GOVERNOR ON

AVOID OPERATION IN SHADED AREAS

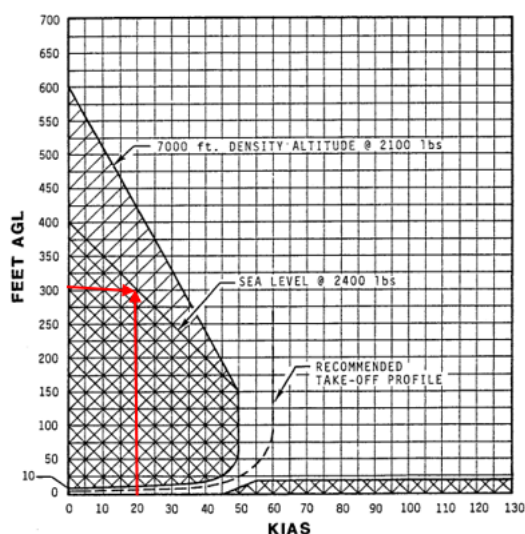


Chart 2: Height vs Velocity diagram. (Source: R44 POH)

According to the POH, the shaded area in Diagram 2 should be avoided. The chart indicates that the helicopter must achieve 50kts and above, before any turn or manoeuvre is executed. The shaded area (Diagram 1) indicates velocity and height at which the helicopter was turned at 300ft AGL and at a speed of 20kts.

The pilot stated that he turned the helicopter early at low speed and altitude after lift-off.

Downwind Turns (Source: Robinson Helicopter Flying Handbook, FAA-H-8083-21B)

Downwind shortly after take-off poses several risks for helicopter pilots:

1. *Loss of Translational Lift:*

When making a downwind turn, the helicopter may lose translational lift, which can result in increased power demand and a higher antitorque requirement. This can lead to a loss of control if the tail rotor cannot produce sufficient thrust.

2. *Increased Power Demand:*

Downwind turns can require more power than the helicopter can provide, especially if the helicopter is already operating at high-power settings. This can lead to overpitching and a subsequent loss of rotor RPM, which is critical for maintaining lift.

3. *Tail Rotor Effectiveness:*

Tail rotor effectiveness can be compromised during downwind turns due to altered airflow patterns. This can result in loss of tail rotor thrust and an uncommanded yaw, making it difficult to maintain directional control.

4. *Increased Workload:*

Downwind turns shortly after take-off increases the pilot's workload significantly, requiring precise control inputs to manage the helicopter's attitude, airspeed and heading. This can be challenging, especially for less experienced pilots.

To mitigate these risks, pilots should avoid making downwind turns immediately after take-off and ensure they have sufficient altitude and airspeed before attempting such manoeuvres.

The pilot stated that he turned downwind too soon whilst at low speed and altitude. There was nothing amiss with the helicopter that could have contributed to the accident.

Findings

1. The pilot had a Commercial Pilot Licence (CPL) Helicopter that was issued on 30 September 2011. The licence was renewed on 11 April 2024 with an expiry date of 30 April 2025. The pilot had the helicopter type endorsed on his licence.
2. The pilot had a Class 1 aviation medical certificate that was issued on 13 March 2024 with an expiry date of 31 March 2025 with no restrictions. The pilot was medically fit to conduct the flight.
3. The last mandatory periodic inspection (MPI) of the helicopter was conducted on 28 March 2024 at 1 661.9 hours after which a Certificate of Release to Service (CRS) was issued with an expiry date of 27 March 2025 or at 1 761.9 Hobbs hours, whichever occurs first. The helicopter had accrued 164.0 hours since the last MPI.
4. The helicopter had a valid Certificate of Airworthiness (C of A) that was initially issued on 27 July 2000 with an expiry date of 31 July 2025. The C of R was issued to the owner on 22 June 2022.
5. The aircraft maintenance organisation (AMO) which was responsible for the maintenance of the helicopter had a valid certificate of approval that was issued on 19 November 2024 with an expiry date of 30 November 2025.
6. The helicopter was within its weight limit, and it had enough fuel for the flight.
7. The helicopter turned whilst within the shaded area of the Velocity vs Height chart (see Diagram 1) above.
8. The pilot turned the helicopter downwind shortly after lift-off at low speed and low altitude, and the engine lost RPM. The pilot decided to land the helicopter, however, it landed hard on the muddy ground and skidded for 5m. The left skid impacted a tree stump. The tail boom went up and was severed by the main rotor.

Probable Cause(s)
The helicopter landed hard after loss of RPM due to being turned too soon after lift-off at a low speed and altitude.
Contributing Factor(s)
None.
Safety Action(s)
None.
Safety Message and/or Safety Recommendation/s
None.
About this Report
<i>The decision to conduct a limited investigation is based on factors including whether the cause is known and the evidence supporting the cause is clear, the level of safety benefit likely to be obtained from an investigation and that will determine the scope of an investigation. For this occurrence, a limited investigation has been conducted, and the Accident and Incident Investigations Division (AIID) has relied on the information submitted by the affected person/s and organisation/s to compile this limited report. The report has been compiled using information supplied in the initial notification, as well as from follow-up desktop enquiries to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as possible safety action/s that the industry might want to consider in preventing a recurrence of a similar occurrence.</i> <i>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.</i>
Purpose
<i>In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011 and ICAO Annex 13, 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.</i>
Disclaimer
<i>This report is produced without prejudice to the rights of the AIID, which are reserved.</i>

This report is issued by:

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