

**LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL**

<b>Reference Number</b>	CA18/2/3/10354						
<b>Classification</b>	Accident		<b>Date</b>	16 July 2023		<b>Time</b>	1206Z
<b>Type of Operation</b>	Private (Part 91)						
<b>Location</b>							
<b>Place of Departure</b>	Plot 31, Wheatlands, Randfontein, Gauteng Province		<b>Place of Intended Landing</b>	Plot 31, Wheatlands, Randfontein, Gauteng Province			
<b>Place of Occurrence</b>	Plot 31 in Wheatlands, Randfontein, Gauteng Province						
<b>GPS Co-ordinates</b>	<b>Latitude</b>	26° 10' 41.06" S	<b>Longitude</b>	27° 37' 20.71" E	<b>Elevation</b>	5 735 feet	
<b>Aircraft Information</b>							
<b>Registration</b>	ZS-RTN						
<b>Make; Model; S/N</b>	Robinson; R44 Raven I (Serial Number: 0873)						
<b>Damage to Aircraft</b>	Substantial		<b>Total Aircraft Hours</b>	8 066.2			
<b>Pilot-in-command</b>							
<b>Licence Type</b>	Private Pilot Licence (PPL)		<b>Gender</b>	Male		<b>Age</b>	43
<b>Licence Valid</b>	No		<b>Total Hours</b>	491.7		<b>Total Hours on Type</b>	491.7
<b>Total Hours 30 Days</b>	0.1		<b>Total Flying on Type Past 90 Days</b>	5.9			
<b>People On-board</b>	1+3		<b>Injuries</b>	0		<b>Fatalities</b>	0
					<b>Other (on ground)</b>	0	
<b>What Happened</b>							
<p>On Monday afternoon at approximately 1200Z, a pilot and three passengers on-board a Robinson helicopter R44 Raven I with registration ZS-RTN were involved in an accident after take-off from Plot 31 in Wheatlands, Randfontein, Gauteng province. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended.</p> <p>According to the pilot, he conducted a pre-flight inspection with no anomalies noted. Thereafter, he boarded the helicopter with the three passengers with the intention to conduct a private flight in the vicinity. After engine start, the pilot initially conducted a hover to complete the power check procedure. Thereafter, he initiated a forward transition to continue with the flight. However, the helicopter experienced low rotor revolutions per minute (RPM), followed by the warning horn. Soon after, the helicopter sank and impacted the ground hard with the left skid gear, which broke off. The helicopter came to a stop a few metres from the first contact point. The pilot turned off the master switch and requested the passengers to disembark from the helicopter. The helicopter sustained damage to the left skid gear and the vertical tail fin, which was substantial. No injuries were reported during the accident.</p>							

Following the occurrence, the pilot removed the skid gear before loading the helicopter onto the trailer to transport it to an aircraft maintenance organisation (AMO) facility based in Wonderboom Airport (FAWB). Upon reaching the AMO facility, the pilot was advised to report the occurrence to the Accident and Incident Investigations Division (AIID) before commencing with the repairs.



**Figure 1:** The helicopter after delivery to the AMO facility. (Source: AMO)



**Figure 2:** Damaged skid attachment.



**Figure 3:** Broken left skid gear.

25 RTN

Sample R44 II (Robinson R44 II)

Item	Entered Load	Weight lb	Long Arm	Long Moment in-lbs	Lat Arm	Lat Moment in-lbs
Basic Empty Weight		1510.0	106.50	160815	0.50	755
Pilot P1	85.0 kg	187.4	49.50	9276	12.20	2286
Fwd Left Pax	43.0 kg	94.8	49.50	4593	-10.40	-986
Right Aft Pax	65.0 kg	143.3	79.50	11392	12.20	1748
Left Aft Pax	74.0 kg	163.1	79.50	12970	-12.20	-1980
Removable Controls	yes	0.0	40.29	0	-16.22	-0
Right Front Door	yes	0.0	49.40	0	24.00	0
Left Front Door	yes	0.0	49.40	0	-24.00	-0
Right Rear Door	yes	0.0	75.40	0	23.00	0
Left Rear Door	yes	0.0	75.40	0	-23.00	-0
Left Pod	0.0 lb	0.0	100.00	0	-33.00	-0
Right Pod	0.0 lb	0.0	100.00	0	33.00	0
<b>Zero Fuel</b>		<b>2098.6</b>	<b>94.89</b>	<b>199146</b>	<b>0.86</b>	<b>1813</b>
<small>Weight and CG OK (Long limits: Fwd:92.00" Aft:103.50")</small>						
Zero Fuel		2098.6	94.89	199146	0.86	1813
Main Fuel Tank	25.0 usq	150.2	106.00	15923	-13.50	-2028
Aux Fuel Tank	15.0 usq	90.1	102.00	9193	13.00	1172
<b>All Up</b>		<b>2339.0</b>	<b>95.88</b>	<b>224262</b>	<b>0.41</b>	<b>957</b>
<small>Weight and CG OK (Long limits: Fwd:92.19" Aft:103.51")</small>						

Aircraft config                    Unlocked  
 MaxTOW                            2500.0 lb  
 Loaded Fuel Weight                240.3  
 Total Pax Weight                   588.6  
 Total Cargo/Bag Weight            0.0  
 Computed by iBal Rotary 1.86 (build 1143): 2023-08-30 07:49:36 +0000

Figure 4: Weight and balance on the day of the accident. (Source: Pilot)

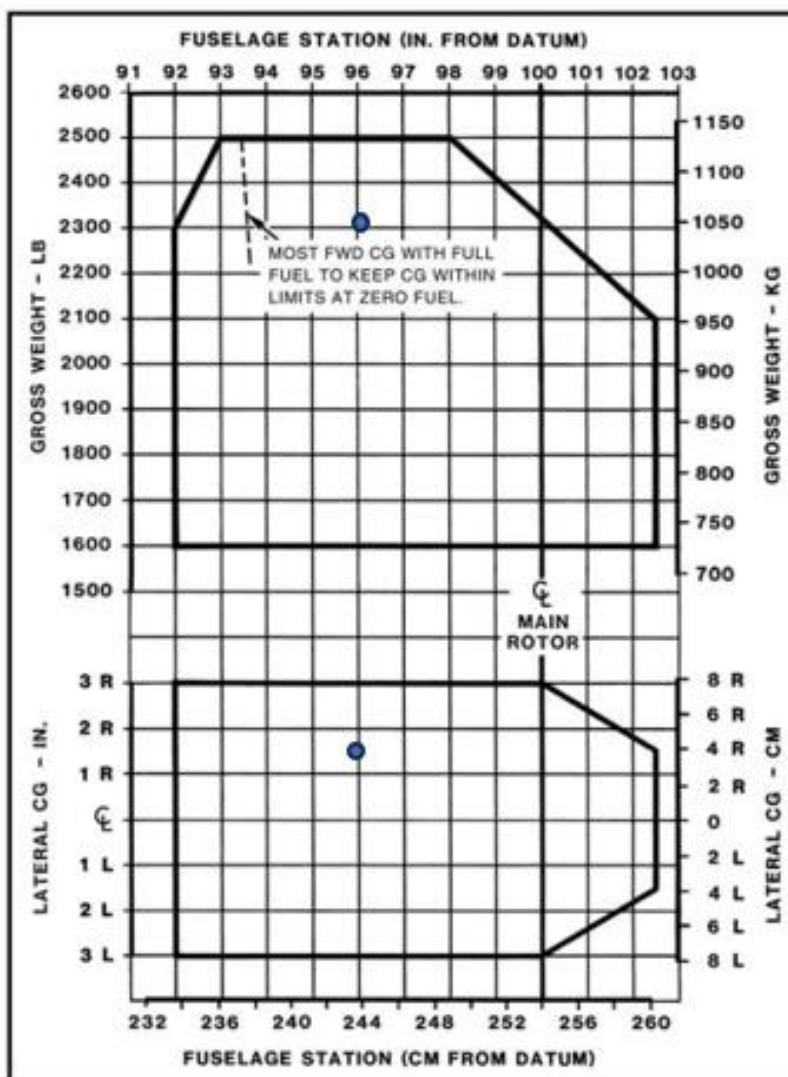


Chart 1: Centre of gravity chart. (Source: POH)

According to the South African Weather Service, the official weather at 1200Z issued for Krugersdorp Station 68368 (the closest station to the accident site) was as follows:

Visibility: 45km

Cloud: No clouds

Current temperature: 18.0°C

Dew point temperature: -1.2°C

Wind direction and speed: 250°13KT

Pressure reduced to mean sea level: Q1029hPa

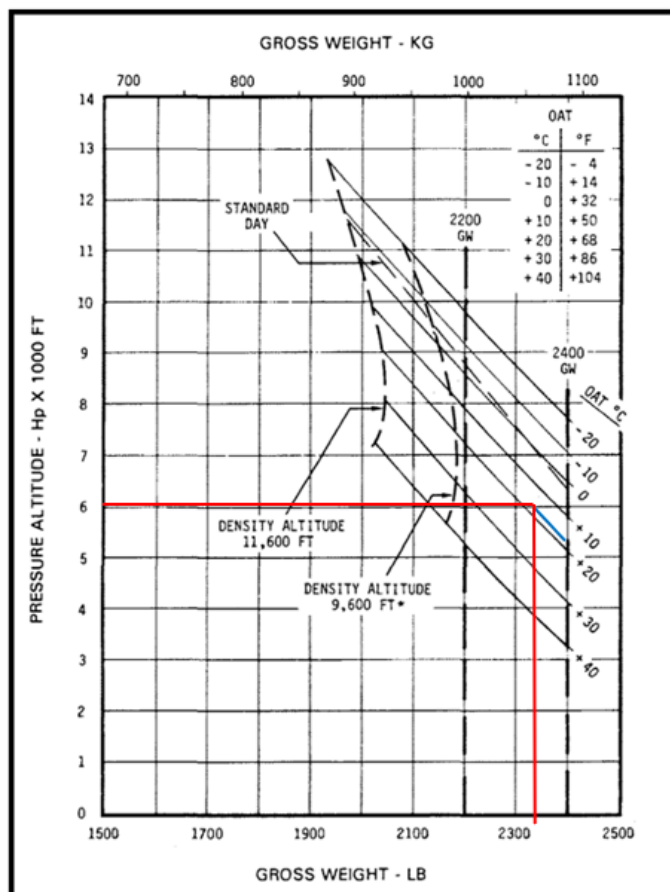


Chart 2: In ground effect (IGE) hover vs. gross weight.

According to the in-ground effect vs. gross weight in Chart 2, using the weight of the helicopter of 2339 pounds (lbs) as calculated by the pilot (Figure 4) and the temperature of 18°C at the time of the accident, the helicopter could hover at a pressure altitude of approximately 6000 feet.

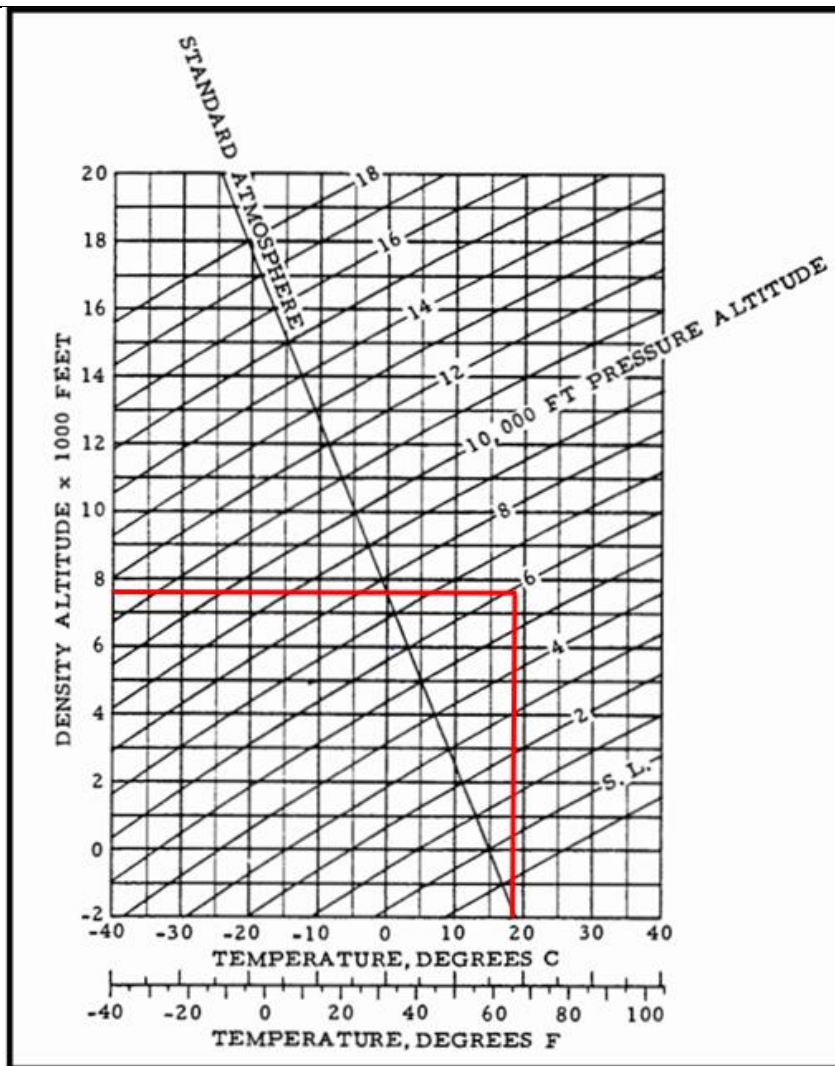


Chart 3: Density altitude chart.

Determination of density altitude:

Pressure was determined to be approximately 6 000 lbs. Using the density altitude chart in Chart 3, with the pressure altitude of 6 000 lbs and the temperature of 18°C, density altitude was determined to be approximately 7 600 ft.

LIMIT MANIFOLD PRESSURE - IN. HG									
MAXIMUM CONTINUOUS POWER									
PRESS ALT-FT	OAT-°C								
	-30	-20	-10	0	10	20	30	40	
SL	22.6	22.9	23.2	23.5	23.8	24.1	24.4	24.7	
2000	22.2	22.5	22.8	23.1	23.4	23.7	24.0	24.2	
4000	21.8	22.2	22.5	22.8	23.1	23.4	23.7	23.9	
6000	21.4	21.8	22.1	<b>FULL THROTTLE</b>					
<b>FOR MAX TAKEOFF POWER (5 MIN), ADD 1.6 IN.</b>									

Figure 5: Limit manifold pressure.

According to the Pilot's Operating Handbook (POH), the maximum allowable take-off weight is 2 400 lbs, and the weight and balance provided by the pilot was 2 339 lbs, which was within limits.

With the outside air temperature of 18°C and the elevation of 5 735 feet (Chart 2), the pressure altitude was determined to be 6 000 ft.

The limit manifold pressure chart indicated that at 18°C and at a pressure altitude of 6 000 ft, the maximum available manifold pressure was full throttle in inches of mercury (In Hg). For maximum take-off power (Figure 5), one needs to add 1.6 In Hg to the calculated full throttle.

The pilot stated that the pressure manifold during transition phase was 24 In Hg, meaning that the power required for transitioning exceeded the power available. Therefore, the helicopter did not have enough power to lift-off, which caused the helicopter to crash. For maximum take-off power, the helicopter required approximately 22 In Hg or below to enable the pilot to at least add 1.6 In Hg to the full throttle to reach the 24 In Hg for lift-off. Therefore, the helicopter had reached the limit whilst still hovering and did not have enough power for take-off.

## Findings

1. The pilot was initially issued a Private Pilot Licence (PPL) Helicopter on 21 June 2021 with an expiry date of 31 May 2022. The pilot applied for the licence renewal on 23 May 2022, however, there was a note which stated that the licence should not be reissued and that a query in this regards should be forwarded by the pilot to the Legal and Compliance Division of SACAA. The licence was not renewed; therefore, the pilot had an invalid PPL which had expired 13 months prior to the accident.

*The Civil Aviation Regulations, 2011, Part 61 Pilot Licensing, SUBPART 1 states:)*

*Note: **61.01.2 (1)** No person may act as a pilot of a South African registered aircraft, except in the case of dual instruction with an appropriately rated flight instructor, unless such person holds a valid pilot licence with applicable ratings issued, reissued, validated or revalidated by the Director or by an appropriate authority in terms of this Part or Part 62: Provided that a SPL may have been issued without a class rating or type rating*

The pilot had flown a total of 71.6 hours with an invalid licence, which meant that he had contravened the provisions of the South African Civil Aviation Regulations Part 61.01.2 (1).

2. The pilot had a Class 2 aviation medical certificate that was issued on 23 August 2022 with an expiry date of 31 August 2023, and had no restrictions. The pilot was medically fit to conduct the flight; however, his licence had expired on 31 May 2022.
3. The last Mandatory Periodic Inspection (MPI) on the helicopter was completed on 17 April 2023 at 1 092.1 Hobbs hours. The helicopter was issued a Certificate of Release to Service (CRS) on 17 April 2023 with an expiry date of 16 April 2024 or at 1 192.1 Hobbs hours, whichever occurs first. The helicopter was flown a further 7.5 hours since the last MPI.
4. The helicopter had a valid Certificate of Airworthiness (C of A) which was initially issued on 20 October 2000. The C of A was last renewed on 11 August 2022 with an expiry date of 31 October 2023. The helicopter's Certificate of Registration (C of R) was issued to the current owner on 23 June 2021.

5. The AMO responsible for the maintenance of the helicopter had a valid certificate of approval which was issued on 3 November 2022 with an expiry date of 30 November 2023.
6. According to Chart 2, for maximum take-off power, the helicopter was supposed to be at approximately 22 In Hg or below to allow for an additional 1.6 In Hg for the full throttle to reach the limit for lift-off. The helicopter reached the limit whilst still hovering and did not have enough power for take-off. The pilot stated that the pressure manifold during the transitioning phase was 24 In Hg, meaning that the power required for transitioning exceeded the power available; therefore, the helicopter did not have enough power for lift-off, hence the subsequent crash.

**Probable Cause(s)**

The helicopter experienced low RPM during transition due to operation in high pressure altitude.

**Contributing Factor(s)**

Inadequate or improper flight planning.  
Failure to consider the effects of high-density altitude.

**Safety Action(s)**

None.

**Safety Message**

Pilots who operate in areas of high altitude must always ensure that the effects of high-density altitudes are considered before commencing with a flight.

**About this Report**

*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 desk top 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.*

*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**

*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.*

**Disclaimer**

*This report is produced without prejudice to the rights of the AIID, which are reserved.*

**This report is issued by:  
Accident and Incident Investigations Division  
South African Civil Aviation Authority  
Republic of South Africa**