AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

		Reference:		CA18/2/3/10590	
Aircraft Registration	ZS-HFH	**Date of Accident**	22 June 2025	**Time of Accident**	0202Z
Type of Aircraft	Robinson R44, Raven II	**Type of Operation**		Agricultural Operations (Part 137)	
Pilot-in-command Licence Type	Commercial Pilot Licence	**Age**	39	**Licence Valid**	Yes
Pilot-in-command Flying Experience	**Total Flying Hours**		1 908.0	**Hours on Type**	Unknown
Last Point of Departure	Metsi Berries Farm, Modimolle-Mookgopong, Limpopo Province				
Next Point of Intended Landing	Metsi Berries Farm, Modimolle-Mookgopong, Limpopo Province				
Damage to Aircraft	Destroyed				
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)					
In a flooded ditch, approximately 600 metres (m) from the berries field at Global Positioning System (GPS) co-ordinates determined to be S24° 16´.40” E28° 39´.38”, at an elevation of approximately 4 067ft					
Meteorological Information	Wind direction: NNE; Wind speed: 0 knots; Temperature: 2.57°C; Dew point: 1.3ºC				

Number of People On-board	1 + 0	**Number of People Injured**	0	**Number of People Killed**	1	**Other (On Ground)**	0
Synopsis							

On Sunday morning, 22 June 2025, a pilot on-board a Robinson R44 Raven II helicopter with registration ZS-HFH took off on a frost-protection operation flight from a 30.2-hectare blueberry field at Metsi Berries Farm in Modimolle-Mookgophong Local Municipality, Limpopo province, with the intention to land at the same farm.

The farm manager who was on standby at the time stated that at 0120Z, he received an alert on his mobile phone that the temperature in the berry field had dropped below freezing point, and that the berries were susceptible to frost damage and, thus, spoilage. The use of the helicopter to defrost the crops was required to correct the temperature in that area. The manager notified the pilot who was also at the farmstead at the time; thereafter, the duo drove to the area where the helicopter was parked overnight.

The pilot performed a pre-flight inspection of the helicopter, and no anomalies were identified, which he documented in the flight folio. The helicopter had 180 litres (L) of Avgas LL100 in the fuel tanks. Before the pilot could start the engine, the manager drove to the field, approximately 50 metres (m) from where the helicopter was parked. After a few minutes, he heard the helicopter engine being started. The helicopter lifted off and flew south-easterly. In less than two minutes after take-off, the helicopter lights disappeared from his line of sight behind some tall trees. Thereafter, he heard a loud bang approximately 600m from the lift-off point. The manager instantly drove towards the direction of the bang. Upon reaching the area, he used his torch and spotted the helicopter almost fully submerged in a flooded ditch.

The pilot was fatally injured, and the helicopter was destroyed. Post-accident examination of the engine and flight controls did not reveal mechanical malfunctions or failures that would have precluded normal operation.

Probable Cause			
Loss of control of the helicopter after lift-off from a farm that was likely due to spatial disorientation caused by frost on the windshield which restricted the pilot's ability to maintain outside visual references. **Contributing Factor** Inadequate pre-flight planning.			
SRP Date	14 April 2026	Publication Date	16 April 2026

Occurrence Details

Reference Number	**:** CA18/2/3/10590
Occurrence Category	**:** Accident (Category 1)
Type of Operation	**:** Agricultural Operations (Part 137)
Name of Owner/Operator	**:** Limair
Aircraft Make and Model	**:** Robinson Helicopter Company; R44 Raven II
Nationality	**:** South African
Registration Marks	**:** ZS-HFH
Place	**:** Approximately 600m from the berries field in Metsi Berries Farm, Limpopo province
Date and Time	**:** 22 June 2025 at 0202Z
Injuries	**:** Fatal
Damage	**:** Destroyed

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****.*

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.

Investigation Process:

The Accident and Incident Investigations Division (AIID) was notified of the occurrence on 22 June 2025 at 0202Z involving a Robinson R44 Raven II helicopter, approximately 600 metres (m) from the departure area in Metsi Berries Farm in Modimolle-Mookgopong Local Municipality, Limpopo province. The occurrence was classified as an accident according to the CAR 2011 Part 12 and the International Civil Aviation Organisation (ICAO) STD Annex 13 definitions. Notification was sent to the State of Registry, Operator, and Design and Manufacturer in accordance with the CAR 2011 Part 12 and the ICAO Annex 13 Chapter 4. Investigators were dispatched to the accident site.

Notes:

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

- *Accident – this investigated accident*
- *Helicopter – the Robinson R44 Raven II 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 obtained 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 the addition of text boxes, arrows or lines.

The AIID reports are made available to the public at:
http://www.caa.co.za/Pages/Accidents%20and%20Incidents/Aircraft-accident-reports.aspx

Disclaimer:

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ABBREVIATION	DESCRIPTION
°	Degrees
°C	Degrees Celsius
AD	Airworthiness Directive
AIID	Accident and Incident Investigations Division
AMM	Aircraft Maintenance Manual
AME	Aircraft Maintenance Engineer
AMO	Aircraft Maintenance Organization
AOC	Aircraft Operating Certificate
ARCC	Aeronautical Rescue and Coordination Centre
CAR	Civil Aviation Regulations
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CPL	Commercial Pilot Licence
CRS	Certificate of Release to Service
CVR	Cockpit Voice Recorder
ELT	Emergency Locator Transmitter
EMS	Emergency Medical Services
FATP	New Tempe Aerodrome
FAWB	Wonderboom Aerodrome
FAPP	Polokwane Gateway Airport
FAA	Federal Aviation Administration
FDR	Flight Data Recorder
FO	Flight operations
Ft	Feet
GPS	Global Positioning System
JHB	Johannesburg
HP	Horsepower
hPa	Hectopascal
Kt	Knots
M	Metres
MCP	Maximum Continuous Power
METAR	Meteorological Aerodrome Report
MPI	Mandatory Periodic Inspection
POH	Pilot Operating Handbook
RPM	Revolution per Minute
PPC	Pilot Proficiency check
PPL	Private Pilot Licence
PIC	Pilot in Command
QNH	Altitude Above Mean Sea Level
SACAA	South African Civil Aviation Authority
SAPS	South African Police services
SB	Service Bulletin
SL	Service Letter
TOR	Take-off Power
TAF	Terminal Aerodrome Forecast
TSI	Technical Service Instructions
VMC	Visual Meteorological Conditions
VML	Valid only with correction for defective distant, intermediate and near vision
Z	Zulu (Term for Universal Co-ordinated Time - Zero Hours Greenwich)

1. FACTUAL INFORMATION

1.1. History of Flight

1.1.1 On Sunday morning, 22 June 2025, a pilot on-board a Robinson R44 Raven II light utility helicopter with registration ZS-HFH took off on a frost-protection operation flight from Metsi Berries Farm in Modimolle-Mookgophong Local Municipality, Limpopo province. The pilot was planning to land back at the same farm. Visual meteorological conditions (VMC) by night prevailed at the time of the flight which was conducted under the provisions of Part 137 of the Civil Aviation Regulations (CAR) 2011, as amended.

1.1.2 The farm production manager stated that around 0120Z, he received an alert on his mobile phone of imminent frost conditions; he was on standby at the farmstead. The alert was about a drop in temperature to below freezing point in the berry field that was covered in shade netting. He stated that the berries were susceptible to frost damage and, thus, spoilage, in such conditions. The alert was generated by a mobile phone application (app) that was linked to the temperature probes fitted to the berry shrubs. He stated that “the use of the helicopter was required which was to be flown approximately 10 feet (ft) above the berries field netting to enable the downdraft from its rotors to push the warmer air from above, down towards the ground”. After the alert, the manager notified the pilot who was also at the farmstead, sleeping at the time. After the pilot had woken up, the duo drove to the refuelling area where the helicopter had been parked overnight. Upon arrival at the refuelling area, the pilot removed the fabric windshield cover off the helicopter and performed a pre-flight inspection; no anomalies were noted. The manager recalled the pilot informing him that the helicopter’s fuel gauges indicated full (180 litres [L] of Avgas LL100); however, the flight folio’s last page with serial number 5005 showed no recording of fuel upliftment the previous day (Saturday, 21 June 2025). The last fuel upliftment entry was recorded on Saturday, 14 June 2025 at 1 313.9 total airframe hours, during which the helicopter was refuelled to capacity.

Figure 1: One of the temperature probes fitted to the berry crops (berries not ripe yet).
(Source: Farm production manager)

1.1.3 The manager did not recall the pilot cleaning or removing the frost off the windshield. Before the pilot started the engine, the manager had already driven off to the field where the crops needed to be defrosted, which was approximately 50 metres (m) from where the helicopter was parked. The pilot and the manager each used a portable two-way radio to communicate. The manager described the night around the accident flight as dark with no moon. After a few minutes, the manager heard the engine being started as he waited for the helicopter to arrive. The helicopter lifted off and all appeared normal because the pilot did not report any defects or technical difficulties. To his surprise, the helicopter did not fly north towards the 30.2-hectare berries field where defrosting was required; it flew south-easterly. According to the manager, in less than two minutes, the helicopter lights were out of his line of sight and behind some tall trees. He then heard a loud bang, approximately 600m from where the helicopter had lifted off. He immediately ran to his vehicle and drove towards the direction from which the loud bang had come. Upon arrival, he used his torch to scan the area, and he spotted the helicopter that was almost fully submerged in a flooded ditch; the tail boom was tilted up. He then called out to the pilot, but there was no response. Furthermore, there was no movement around the accident site.

1.1.4 The manager drove back to where the helicopter had initially lifted off as there was no mobile phone signal around the accident site. Thereafter, he called the emergency services in Limpopo province and the Aeronautical Rescue Coordination Centre (ARCC) in Johannesburg (JHB), Gauteng province. A full-scale emergency response was initiated. The Limpopo Emergency Medical Services (EMS), the search and rescue team and the South African Police Service (SAPS) water-wing officers responded to the accident scene on Sunday morning around 0845Z. Upon their arrival, they examined the surrounding area and noticed some of the helicopter seats and a few pages of the Pilot’s Operating Handbook (POH) floating in the water. The SAPS divers swam to the wreckage and found the pilot still harnessed to his seat; he was fatally injured. The pilot’s body was retrieved from the wreckage and handed over to the pathology services in Limpopo province. The helicopter was destroyed by post-impact forces during the accident sequence.

1.1.5 The accident occurred in a flooded ditch which stretched through the borders of Metsi Berries Farm in Modimolle-Mookgopong at Global Positioning System (GPS) co-ordinates determined to be S24°16´45.86´´ E28°40´17.32´´, at an elevation of 4 067 feet (ft).

Figure 2: An aerial view of the berries field that needed to be defrosted, the departure point, and the approximate accident site (red mark). (Source: Google Earth)

Figures 3 and 4: A picture of the helicopter taken whilst still dark (left picture). Another picture of the helicopter taken in the morning showing the helicopter almost fully submerged in a flooded ditch with the tail boom tilted high (right picture). (Source: Farm manager)

1.2. Injuries to Persons

Injuries	Pilot	Crew	Pass.	Total On-board	Other
Fatal	1	-	-	1	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
None	-	-	-	-	-
Total	**1**	**-**	**-**	**1**	**-**

Note: Other means people on the ground.

1.3 Damage to Aircraft

1.3.1 The helicopter was destroyed during the accident sequence.

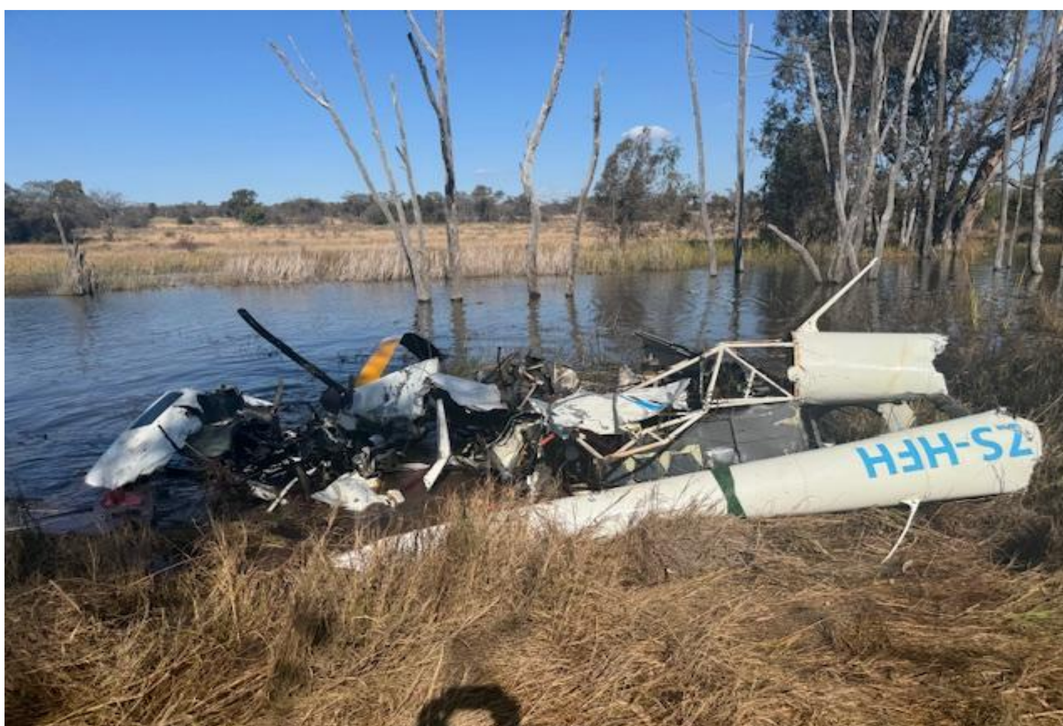

Figure 5: The wreckage after it was recovered from the flooded ditch.

1.4 Other Damage

1.4.1 No damage was caused to the private property, persons or third party on the ground. There was no noticeable environmental effect caused during the accident.

1.5 Personnel Information

Nationality	Dutch	Gender	Male	Age	39
Licence Type	Commercial Pilot Licence (CPL) Helicopter				
Licence Valid	Yes	Type Endorsed	Yes		
Ratings	Night rating (H)				
Medical Expiry Date	31 October 2025				
Restrictions	None				
Previous Accidents	None				

Note: Previous accidents refer to past accidents the pilot was involved in, when relevant to this accident.

Flying Experience:

Total Hours	1 908.0
Total Past 24 Hours	1.2
Total Past 7 Days	1.2
Total Past 90 Days	45
Total on Type Past 90 Days	45
Total on Type	Unknown

1.5.1 The pilot conducted his Private Pilot Licence (PPL) training in a Robinson R22 helicopter in New Tempe Aerodrome (FATP), Free State province, from September 2015 to January 2016. He was initially issued a PPL (helicopter) on 5 January 2016. Records indicated that the pilot had a Commercial Pilot Licence (CPL) that was issued by the Regulator (SACAA) on 29 November 2019. The CPL was reissued on 28 October 2024 with an expiry date of 30 November 2025. The pilot had a Class 1 medical certificate that was issued on 9 October 2024 with an expiry date of 31 October 2025. The pilot had no medical restrictions listed in his licence; the helicopter type was endorsed in his licence. The pilot completed his conversion to the R44 model in November 2016. In January 2018, he completed the required night training necessary for a night rating for which he qualified on 7 May 2019.

1.5.2 The pilot's night flight experience and recency were investigated, and the pilot logbook (blue book) was requested from the operator. Copies of the logbook were forwarded to the investigator-in-charge (IIC). Upon examining them, the IIC noted that the last flight recorded was on 16 February 2025. The check pilot, who is also a chief pilot and operations manager for the operator, reported that the pilot had recently recorded his hours in an electronic logbook. The pilot's electronic logbook was forwarded to the IIC, and it showed entries from 19 December 2024 to 7 June 2025 during which zero-night flight hours were recorded as pilot-in-command (PIC) dual. The entry dated 7 June 2025 showed the pilot's proficiency check (PPC) dual as completed during which 2.2 hours were logged. The information regarding the area or place where the PPC was conducted was not recorded. The Enstrom EN480 helicopter with registration ZT-RDM was reported to have been used on the day. The helicopter registration was recorded as "ZS-RDM", not ZT-RDM.

2025/07/06	EN480	ZS-RDM	SELF	FAWB-TOBEGO										0,9	0,7		
2025/07/06	EN480	ZS-RDM		PPC TRAINING													2,2

Item 1: Pilot proficiency check entry with the check pilot's name filled in (but blotted out).

1.5.3 The ZT-RDM helicopter's scanned flight folio page serial number 4952 sent by the check pilot and attached below (Item 2) was examined and visible alterations on the hours and duration of flight time blocks were noticed on entries dated 10 and 11 June 2025. Moreover, there was a capital letter "T" (in red below) recorded on 11 June 2025 to indicate the date at which the PPC was conducted, which contradicted the PPC date (7 June 2025) recorded on the pilot's electronic logbook. The total amount of fuel was also recorded as 188L (Item 3).

1.5.4 The IIC visited the operator to examine the actual flight folio logbook; he noticed that the original page with serial number 4952 did not have a letter "T" to indicate the conducted PPC training, compared to the scanned copy that was initially forwarded to the IIC. Moreover, the block with the total amount of fuel carried on-board indicated that the helicopter had a total amount of 188L. The IIC noticed that the original flight recorded on 10 June 2025 was altered from 0.7 hours to 0.9 hours (1396.5 – 1397.2 = 0.7). Also, the duration of the flight recorded on 11 June 2025 was 1.8 hours (1397.2 – 1399.2 = 1.8), yet it was altered to 2.2 hours to falsify a PPC recency/compliance (Part 91.02.4 of the CAR) that never happened. The IIC informed the check pilot about the discrepancies noted, and her response was: "*I can take no responsibility for how the pilot had filled in the flight folio, nor can I ask him to correct it.*"

10/06/25	FAWB	TP30GA	1396,5	1397,2	0,9	858,6	F	1	1	15:00	11:00	–	97L	450	150L
11/06/25	TEBOGA	TEBOGA	1397,2	1399,0	2,2	0608	T	1	3	07:00	07:00	–		300	

Item 2: A snapshot of a scanned flight folio page sent by the check pilot with serial number 4952.

10/06/25	FAWB	TP30GA	1396,5	1397,2	0,9	858,6	F	1	1	15:00	11:00	–	97L	450	150L
11/06/25	TEBOGA	TEBOGA	1397,2	1399,0	2,2	0608		1	3	07:00	07:00	–		300	188

Item 3: A snapshot of the original flight folio page with serial number 4952.

1.5.5 The IIC inspected the operator's PPC form with reference number LM-001 and noticed that the pilot's licence number was incorrectly captured. The last two digits of the pilot's licence number were swopped around. The check pilot information was correctly captured. The IIC noted that the information on the pilot and check pilot blocks was recorded by hand by the check pilot and with what appeared to be the pilot's forged electronic signature on the pilot signature block. The operator/check pilot issued the PPC Certificate on 11 June 2025 with an expiry date of 10 December 2025.

1.5.6 On Thursday, 20 November 2025 at 0736Z, the IIC sent a WhatsApp message to the check pilot requesting the contact details of Tebogo Berries Farm, where the PPC was conducted. On the same day at 0747Z, mobile phone numbers of the farm production manager who was also

responsible for the flight operations at the farm were sent the IIC. On Friday morning, 21 November 2025, the IIC contacted the farm manager to enquire about the actual night the PPC flight was reported to have been conducted on their farm on 11 June 2025; his response was: "*I confirm no training flight was done on the night of 11 June 2025.*" The check pilot was informed about the farm manager's feedback, and her response was: "*I can take no responsibility for the lack of knowledge from my client's side on what night proficiency training, any training or a PPC is. And neither do I inform them of when, what, where or how as it has nothing to do with them – they require a service only.*"

1.5.7 On Friday morning, 9 January 2026, the IIC visited the operator's facility at FAWB to examine the check pilot's logbook. The check pilot physical and electronic logbooks were presented to the IIC. Upon inspecting the physical logbook entries, the IIC noticed that the check pilot was consistent in recording all the conducted flights in the logbook. The check pilot's physical logbook indicated no PPC entry recorded on 11 June 2025. The check pilot's electronic logbook indicated a falsified entry recorded between 29 March and 11 June 2015 which indicated that a PPC was conducted. The investigation revealed that the pilot lacked the required night rating recency; however, the operator/check pilot unlawfully issued the PPC Certificate after the accident with the forged dates. Copies indicating a few entries that were regarded as relevant to the investigation dated from 23 March 2025 to 22 June 2025 are attached as Item 4. On Item 4 left block is the record from the physical logbook indicating zero (0) flight/s logged on 11 June 2025. On Item 4 right block is the electronic logbook showing a falsified entry of a PPC flight that never took place on 11 June 2025.

23/03/2025	AW119	ZS-HDM	Self
14/05/2025	AW119	ZS-HDM	Self
16/05/2025	EN480	ZT-REZ	Self
29/05/2025	AS350B2	ZS-OKX	Self
22/06/2025	AS350B2	ZS-OKX	Self

2025/03/23	AW119	ZS-HDM	Self
2025/05/14	AW119	ZS-HDM	Self
2025/05/16	EN480	ZT-REZ	Self
2025/05/29	AS350B2	ZS-OKX	Self
2025/[illegible]/11	EN480	ZT-RDM	Self
2025/06/22	AS350B2	ZS-OKX	Self

Item 4: Entries from the check pilot's physical logbook (left). Falsified entry on the check pilot's electronic logbook.

1.6 Aircraft Information

1.6.1 Helicopter Description (Source: Pilot's Operating Handbook [POH])

The Robinson R44 Raven II is a single engine, light helicopter with semi-rigid, two-bladed main rotor, a two bladed tail rotor and skid landing gear. It has an enclosed cabin with two rows of side-by-side seating for a pilot and three passengers. The helicopter is equipped with a Lycoming IO-540-AE1A5 six-cylinder fuel injected engine and fitted with hydraulic servos-actuators providing hydraulic power assistance to main rotor, flight control system. The engine take-off power (TOP) is rated at 260 horsepower (hp) at 2800 revolutions per minute (RPM), which can be maintained up to a pressure altitude of 800ft. Maximum continuous power (MCP) of 235hp can be maintained up to a pressure altitude of 4 000ft. Robinson provides pilots with the de-rated figures of 225hp

and 205hp for TOP and MCP respectively at 2 718 RPM. This allows the helicopter to maintain engine performance on a climb from sea level to several thousand feet before the power available starts to decay below their published TOP. A pulley sheave on the horizontal engine output shaft drives 4 vee-belts which transmit power to an upper sheave when the belts are tensioned. The drive system reduces the engine RPM of 2 718 to the main rotor RPM of 408. The engine and rotor RPM are both presented to the pilot as a percentage on the cockpit Tachometer gauges so that they are matched under normal operating conditions. An engine governor system is installed to provide automatic control of engine RPM, which will control the rotor RPM via the associated drivetrain.

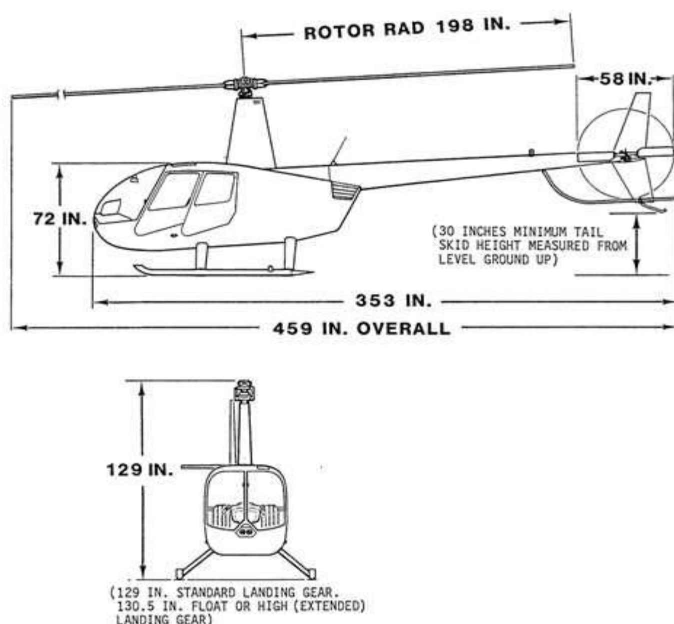

Figure 6: A three-dimensional view of the Robinson R44 helicopter. (Source: POH)

Airframe:

Manufacturer/Model	Robinson Helicopter Company/R44, Raven II	
Serial Number	10392	
Year of Manufacture	1981	
Total Airframe Hours (At Time of Accident)	3 785.5	
Last Inspection (Date & Hours)	18 December 2024	3 704.7
Airframe Hours Since Last Inspection	80.8	
CRS Issue Date	18 December 2024	
C of A (Issue Date & Expiry Date)	19 November 2018	30 November 2025
C of R (Issue Date) (Present Owner)	19 November 2018	
Operating Category	Agricultural Operations (Part 137)	
Type of Fuel Used	Avgas 100LL	
Previous Accidents	None	

Note: Previous accidents refer to past accidents the aircraft was involved in, when relevant to this accident.

Engine:

Manufacturer/Model	Textron Lycoming/IO-540-AE1A5
Serial Number	L-31782-48A
Part Number	PC-615-AE1A5
Hours Since New	1 204.4
Hours Since Overhaul	1 204.4

1.7 Meteorological Information

1.7.1 The weather information below was recorded by the farm's automatic weather station; the weather was recorded every hour including around the time of the accident flight at 0200Z.

Date	Time	Temperature °C	Maximum Temperature °C	Minimum Temperature °C	Relative humidity %	Dew point temperature	Wind (km/h)	Wind Degrees	Wind direction	Min WSpd km/h	Barometric Pressure
22 Jun 2025	01:00	2.73	2.79	2.65	86.7	0.7	0.00	48	NE	0.00	1,026.0
22 Jun 2025	02:00	2.83	2.97	2.70	89.5	1.3	0.00	29	NNE	0.00	1,026.1
22 Jun 2025	03:00	2.78	3.09	2.69	90.6	1.4	0.00	29	NNE	0.00	1,026.1
22 Jun 2025	04:00	2.57	2.72	2.39	91.6	1.3	0.00	29	NNE	0.00	1,026.4
22 Jun 2025	05:00	2.20	2.35	2.06	92.4	1.1	0.00	29	NNE	0.00	1,026.5
22 Jun 2025	06:00	3.41	3.88	2.35	94.7	2.6	0.00	29	NNE	0.00	1,026.9
22 Jun 2025	07:00	4.76	5.38	3.78	95.3	4.1	0.00	29	NNE	0.00	1,027.5

Wind Direction	NNE	Wind Speed	0 knots	Visibility	Limited
Temperature	2,57ºC	Cloud Cover	Nil	Cloud Base	Nil
Dew Point	1.3ºC	QNH	1.026.4		

1.8 Aids to Navigation

1.8.1 The helicopter was equipped with standard navigational equipment as approved by the Regulator (SACAA). There were no records indicating that the navigational equipment was unserviceable prior to the flight.

1.9 Communication

1.9.1 The helicopter was equipped with a standard communication system as approved by the Regulator. There were no recorded defects with the communication system prior to the flight. There was a two-way radio communication between the pilot and the manager.

1.10 Aerodrome Information

1.10.1 The accident occurred in a flooded ditch which stretched through the borders of Metsi Berries Farm in Modimolle-Mookgopong at GPS co-ordinates determined to be S24°16´45.86´´ E28°40´17.32´´, at an elevation of 4 067ft.

1.11 Flight Recorders

1.11.1 The helicopter was neither equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR), nor was it required by regulation to be fitted to the helicopter type.

1.12 Wreckage and Impact Information

1.12.1 The accident occurred in a flooded ditch on the border of Metsi Berries Farm in Modimolle-Mookgophong, approximately 600m from the lift-off point which was at an elevation of 4 067ft. The wreckage was contained within a relatively small area, and all the helicopter's major components were identified at the accident site. Evidence at the accident site showed that the helicopter was in a nose-down attitude before the accident. The helicopter first clipped the top of a tree which was approximately 6m high with the main rotor blade before it crashed into the water on the side of the flooded ditch and at a heading of approximately 147°. The skid landing gears broke during the accident sequence. It was evident that a significant amount of energy at impact was absorbed by the skid landing gears. The stabiliser was severed by one of the main rotor blades during the accident sequence and was found close to a tree that was struck by the main rotor blade.

1.12.2 The main rotor mast and rotor head were still attached to the main gearbox. One of the main rotor blades was bent downward and approximately 33 inches from the coning bolt. The opposite main rotor blade was not located during the on-site investigation. It appeared to have been submerged into the water. The main rotor elastomeric teeter stops were severely damaged, and the brackets were bent. The main rotor drive shaft displayed scuff marks where the teeter stops. The hydraulic control servos sustained substantial damage, and pitch links were found broken.

1.12.3 The cockpit cabin area was submerged, and the tail boom was tilted up. The tail boom structure showed compression damage just aft of the main fuselage attachment point. The engine compartment revealed no sign/s of catastrophic failures. It was clean and free of oil and hydraulic fluid. The drive V-belts were all intact with no sign of rolling or chafing. The upper and lower sheaves were displaced longitudinally, and the belts were not in place in the sheave grooves. The belt tension actuator had broken into several pieces. The clutch centring strut had rotational scoring running in the direction of rotation of the upper sheave.

Figure 7: The approximate first impact area and a tree that the helicopter clipped with the main rotor (yellow circle).

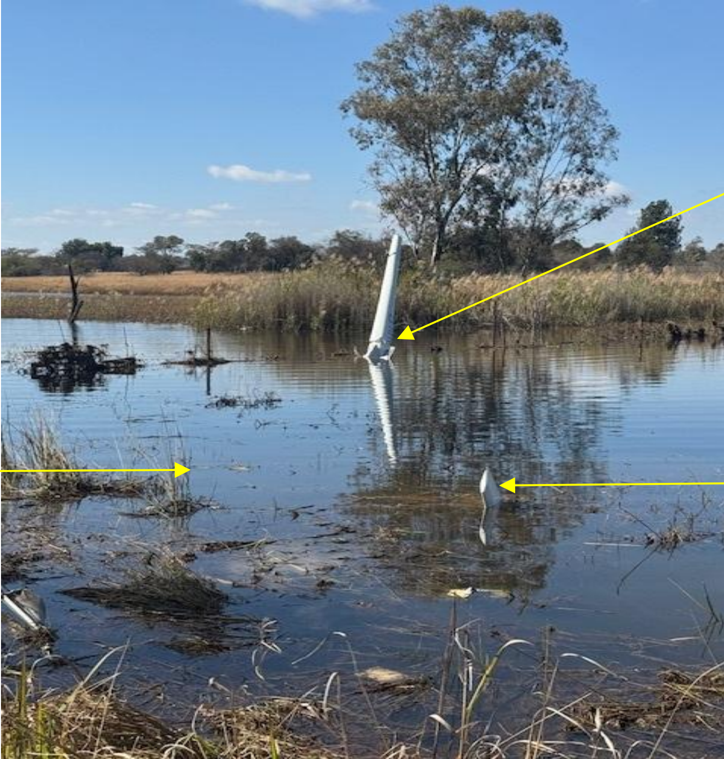

Figure 8: The approximate first point of impact, the main wreckage and the stabiliser that separated during the accident sequence.

1.12.4 The tail rotor drive shaft separated from the tail rotor and the gearbox/transmission was found still attached to it. The tail rotor gearbox rotated freely with no abnormal noise, and the gear output shaft indicated normal operation and was undamaged. The tail rotor blades showed signs of rotation. None of the flex plates on the tail rotor drive shaft failed. The pitch change bellcrank broke off during the accident sequence. The flight controls had several disconnects between the cyclic, collective pitch control levers and swashplate. All fractures exhibited signatures consistent with overload. The tail rotor flight controls had several disconnects from the pedals and tail rotor, and all separations exhibited overload signatures.

Figures 9 and 10: The separated tail rotor drive shaft and blades (left picture); and the broken pitch change bellcrank (right picture).

1.12.5 The cockpit cabin area was crushed. The upper and lower instrument panels separated from their mountings due to overload. Several instruments separated from their respective panels and the wires and hose connections were all aggressively disconnected from the lights and instruments, leaving the terminals and connectors damaged. Examination of the cockpit instrumentation could not establish their pre-impact indications. The instrument panel illumination, warning and indication light bulbs showed that at impact, the illumination lighting was on, which was consistent with a flight conducted at nighttime; this also indicated that the electrical system was functional. The acrylic windshield was found shattered; the rear doors and the left-side front door had ejected, leaving only the pilot's door still attached to its frame. Fragmented sections of acrylic windshield were spotted around the accident area. The fuel tanks (main and auxiliary bladder tanks) caps were in place; the tanks contained sufficient Avgas 100LL. The doors that ejected during the accident sequence were found at the accident site; each door handle was in a closed and locked position, and with the latch pin protruding. The position of the doors was consistent with them

being in a closed position. The pilot was still harnessed to his seat (right side). The anti-toque pedals had broken off from their respective mounting points. The pilot (sight-side) cyclic control lever was examined, and no anomalies were noted. The hydraulic switch was in the ON position (see Figure 11). The ignition key was in the OFF position, and the pilot (right side) throttle twist grip was in the ON / fully open position. The collective pitch control lever was near the full UP position, and the engine governor was in the ON (UP) position (see Figure 12). The friction locks for the cyclic and collective pitch control levers were ON. The circuit breakers (CB) on the floor below the left front seat were depressed.

Figure 11: The cyclic pitch control lever indicating the hydraulic switch in the ON position.

Figure 12: The collective pitch control lever near the full UP position and the engine governor in the ON (UP) position (yellow arrow).

1.13 Medical and Pathological Information

1.13.1 A post-mortem examination of the pilot was performed. At the time of release of this report, the results of the post-mortem and the toxicology tests were not available. Should the results have substantive impact on the outcome of this investigation and considered new evidence, the Accident and Incident Investigations Division (AIID) will reopen the investigation.

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 not survivable due to the impact forces. The impact compromised the structural integrity of the cockpit area of the helicopter, which resulted in a fatal injury.

1.16 Tests and Research

1.16.1 The investigating team examined the wreckage at the accident site, and the following was summarised regarding the technical aspect:

i. The probability of engine failure, malfunction of governor, ignition, fuel supply or transmission defect that contributed to the accident was ruled out.

ii. There was no evidence of primary flight controls failure during the flight, hence, the failure of the helicopter systems such as hydraulics, flight controls and other major components was ruled out.

iii. The investigation team examined the technical documentation/maintenance history of the helicopter and found that all the applicable Airworthiness Directives (ADs), mandatory Service Bulletins (SBs) and the Service Instructions (SI) had been complied with as per the maintenance requirements within the prescribed time frame. Records indicated that the helicopter was certified, equipped and maintained in accordance with the existing regulation and approved procedures. The helicopter had no known deficiencies before the accident flight and was operated within its load and centre-of-gravity limits. No technical defects were reported in the logbooks prior to the flight.

1.16.2 The wreckage was recovered and transported to an aircraft maintenance organisation (AMO) facility in Wonderboom Aerodrome (FAWB), Gauteng province, for further examination with the participation of a team of aircraft maintenance engineers (AMEs) rated on the helicopter model. All fuselage fractures, engine, fuel and hydraulic system lines and components, and flight controls were examined to determine continuity and modes of failure. No pre-existing defects were found.

1.16.3 The engine's crankshaft was rotated by hand, and continuity of the crankshaft to the rear gears and to the valve train were confirmed. Thumb compression and suction were observed from all six cylinders as the engine was rotated. The accessory section components rotated normally. All ignition harnesses produced spark when the crankshaft was rotated by hand. The rocker covers were removed and each valve moved normally with crankshaft rotation. There was no evidence of oil leakage on the engine or cowling. The fuel injector nozzles and filter screen were inspected and were found to be unobstructed. Disassembly of both magnetos revealed nothing abnormal. The sparkplugs were tight within their respective cylinders, and their harnesses were in a satisfactory condition.

1.16.4 All spark plugs were removed and inspected, each displaying normal combustion signatures. The engine-driven mechanical fuel pump rotated by hand without anomalies, and fuel was present in the pump. Fuel samples taken from the drums used to top up the helicopter at the farm revealed nothing abnormal. It was the correct grade of Avgas 100LL. Examination of the airframe and engines revealed no evidence of any pre-impact anomalies, and the helicopter was deemed airworthy at the time of the flight.

1.16.5 The flight was conducted in a dark night with minimal illumination from the ground light sources. The automated weather station at the farm indicated the outside air temperature of 2.57º Celsius (C). Atmospheric conditions were favourable for the development of widespread fog at the farm. The investigation discovered that the pilot had removed the helicopter's windshield cover before starting the engine. The amount of time the pilot took before he could start the engine with the windshield covers removed is not known. After lift-off, the helicopter routed south-east instead of north where the berries needed to be defrosted. It is possible that as the pilot was manoeuvring the helicopter, he could not maintain outside visual references due to the windshield that was covered with frost, which resulted in spatial disorientation. Consequently, control was lost, rendering impact inevitable in a flooded ditch south-east of the departure point.

Figure 13: An example of the Robinson R44 helicopter with the windshield cover on. (Source: https://encryptedtbn0.gstatic.com/images?q=tbn:ANd9GcSkjXKaE75LIUYYVz5czVYg9QJMV63VBJmdfQ&usqp=CAU)

1.17 Organisational and Management Information

1.17.2 This was a commercial flight conducted under the provisions of Part 137 of the CAR 2011, as amended.

1.17.2 The operator had an Air Operator Certificate (AOC) that was issued by the Regulator on 31 December 2024 with an expiry date of 30 December 2025.

1.17.3 The operator had an Operating Specifications Certificate that was issued by the Regulator on 31 October 2024. The accident helicopter (ZS-HFH) was listed on the certificate.

1.18 Additional Information

1.18.1 Recency (Source: SACAA Regulations)

91.02.4 *(1) A pilot shall not act as PIC of an aircraft, or second-in-command (SIC) of an aircraft required to be crewed by more than one pilot, carrying passengers by day, unless such pilot has personally, within the 90 days immediately preceding the flight, carried out either by day or by night at least three take-offs and three landings in the same class or, if a type-rating is required, type or variant of aeroplane, and in the case of a helicopter three circuits including three take-offs and three landings in the same type of helicopter as that in which such flight is to be undertaken. The landings required by this sub-regulation may be completed in a FSTD approved for the purpose. In the case of a tail-wheel aeroplane, each landing shall be carried out to a full stop.*

(2) A pilot shall not act as PIC of an aircraft, or SIC of an aircraft required to be crewed by more than one pilot, carrying passengers by night, unless the pilot has personally, within the 90 days immediately preceding the flight, carried out at least three take-offs and three landings by night in the same class or, if a type-rating is required, type or variant of aeroplane, and in the case of a helicopter three circuits including three take-offs and three landings in the same type of helicopter as that in which such flight is to be undertaken. The landings required by this sub regulation may be completed in a FSTD approved for the purpose. In the case of a tail-wheel aeroplane, each landing shall be to a full stop.

(3) Where the take-off and landing requirement referred to in sub-regulations (1) and (2) have been satisfied in a multi-engine aircraft, the requirement shall be deemed to have been met in respect of single-engine aircraft as well.

(4) A pilot shall not act as PIC or SIC of an aircraft on an instrument approach to an aerodrome in IMC unless the pilot has, within the 90 days immediately preceding such approach procedure or procedures established by the Director or an appropriate authority –

(a) executed at least two approaches in an aircraft or a FSTD approved for the purpose or a combination of aircraft and FSTD approved for the purpose, either under actual or simulated

conditions, with reference to flight instruments only; or (b) undergone the appropriate skill test as prescribed in regulation 61.15 of Part 61 of these Regulations.

1.18.2 Flight Folio (Source: SACAA Regulations)

91.03.5 *(1) The owner or operator of a South African registered aircraft shall ensure that the aircraft carries a flight folio or any other similar document which meets the requirements of and contains the information as prescribed in Document SA-CATS 91, at all times.*

(2) The flight folio shall be kept up-to-date and maintained in a legible manner by the PIC.

(3) All entries shall be made immediately upon completion of the occurrence to which they refer.

(4) In the case of maintenance being undertaken on the aircraft, the entry shall be certified by the person taking responsibility for the maintenance performed.

(5) The owner or operator shall retain the flight folio for a period of five years calculated from the date of the last entry therein.

1.18.3 Spatial Disorientation (Source: *Federal Aviation Administration [FAA]*)

Spatial Disorientation can be defined as 'A state of confusion concerning the subject's true position in space in relation to the surface of the earth. The FAA's General Aviation Joint Steering Committee Safety Enhancement Topic leaflet on Spatial Disorientation (AFS-850 16-05) states: 'Sight, supported by other senses, allows a pilot to maintain orientation while flying. However, when visibility is restricted (i.e. no visual reference to the horizon or surface detected) the body's supporting senses can conflict with what is seen. When this spatial disorientation occurs, sensory conflicts and optical illusions often make it difficult for a pilot to tell which way is up.

Contributing to these phenomena are the various types of sensory stimuli: visual, vestibular (organs of equilibrium located in the inner ear), and proprioceptive (receptors located in the skin, muscles, tendons and joints). Changes in linear acceleration, angular acceleration, and gravity are detected by the vestibular system and the proprioceptive receptors and then compared in the brain with visual information.

In a flight environment, these stimuli can vary in magnitude, direction, and frequency, resulting in a "sensory mismatch" that can produce illusions and lead to spatial disorientation'. There are certain features of the way helicopters fly and the way in which they are operated that lead to specific types of disorientation. Helicopter operations are generally carried out at low level and although this does not of itself increase the likelihood of disorientation, it may leave little time to recover from an unexpected attitude.

Unlike a fixed-wing aircraft, a helicopter has no motive power in the longitudinal axis of the fuselage. In order to transition from the hover to forward flight, the nose of the helicopter is pitched down, so that a component of the lift provided by the main rotor now accelerates the helicopter in the forward direction. As ever, forward acceleration of an aircraft causes it to feel more pitched up than it really is. Initially, before significant aerodynamic drag builds up, the pitch-up sensation of forward flight exactly balances the actual pitch-down of the aircraft, so that it continues to feel

level, just as it did in the hover.

Likewise, in order to transition from forward flight into the hover, the pilot brings the nose of the aircraft up so that a component of the rotor lift now acts in the rearward direction and decelerates the aircraft. A decelerating aircraft feels more nose-down than it actually is, and this sensation exactly balances the effect of the actual nose-up tilt and again causes the aircraft to feel level. The situation is not significantly different in the roll axis. A helicopter tilted in roll will tend to side-slip with increasing lateral velocity and as a result will continue to feel level.

1.19 Useful or Effective Investigation Techniques

1.19.1 None.

2. ANALYSIS

2.1 General

From the available evidence, 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 Pilot

Examination of the pilot's file held at the SACAA facility indicated that the pilot was appropriately licensed to conduct the flight on the day of the accident. The pilot was fit and well rested; he also had a valid Class 1 aviation medical certificate that was issued on 9 October 2024 with an expiry date of 31 October 2025. The pilot had no restrictions listed on his aviation medical certificate.

2.2.2 Aircraft

Examination of the helicopter logbooks and flight folio indicated that the helicopter was properly maintained in accordance with the existing regulations. The last 100-hour mandatory periodic inspection (MPI) of the helicopter was conducted on 18 December 2024 at 3 704.7 total airframe hours. The Certificate of Release to Service (CRS) was issued by the aircraft maintenance organisation (AMO) on 18 December 2024 with an expiry date of 17 December 2025 or at 3 804.7 airframe hours, whichever comes first. The AMO that performed the last inspection of the helicopter had an AMO Certificate that was issued on 19 November 2024 with an expiry date of 30 November 2025.

2.2.3 Post-accident examination of the engine and flight controls revealed no mechanical malfunctions or failures that would have precluded normal operation. The accident occurred at nighttime. There were no clouds, but also no visible horizon. The automated weather station at Metsi Berries Farm indicated an outside air temperature of 2.57ºC. Atmospheric conditions were favourable for the development of widespread fog at the farm. The investigation discovered that the pilot had

removed the helicopter's windshield cover before he could start the engine.

2.2.4 The amount of time the pilot took before he could start the engine with the windshield covers removed is not known. After lift-off, the helicopter routed south-east instead of north where the berries needed to be defrosted. It is possible that as the pilot was manoeuvring the helicopter, he could not maintain outside visual references due to the windshield that was covered with frost, which resulted in spatial disorientation; thus, becoming disorientated. Consequently, control was lost, rendering impact inevitable in a flooded ditch south-east of the departure point.

2.2.5 The investigation also revealed that the pilot did not have a night recency; however, the following was noticed: false entries were recorded in the Enstrom EN480 (ZT-RDM) flight folio, pilot's physical and electronic logbooks indicated efforts made by the check pilot/operator to fabricate information to show a PPC that was never conducted, and a false certificate that was issued on 11 June 2025 with an expiry date of 10 December 2025.

3 CONCLUSIONS

3.1. General

From the available evidence, 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 or incident occurring, or mitigated the severity of the consequences of the accident or incident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

3.2. Findings

<u>Personnel</u>

3.2.1 The pilot had a Commercial Pilot Licence (CPL) that was initially issued by the Regulator (SACAA) on 29 November 2019. The CPL was reissued on 28 October 2024 with an expiry date of 30 November 2025.

3.2.2 The pilot had a Class 1 medical certificate that was issued on 9 October 2024 with an expiry date of 31 October 2025. The pilot had no medical restrictions on his licence. The pilot had both the Robinson R44, Raven II and Enstrom EN480 helicopter endorsed in his licence.

3.2.3 The pilot had a night rating endorsement in his licence; however, he did not have a night recency. Falsified entries were noticed in the Enstrom EN480 (ZT-RDM) flight folio, and the pilot's physical and electronic logbooks showed efforts made by the check pilot/operator to fabricate information to prove a PPC that never occurred after which a false certificate was issued on 11 June 2025 with an expiry date of 10 December 2025.

Aircraft

3.2.4 The last 100-hour mandatory periodic inspection (MPI) of the helicopter was conducted on 18 December 2024 at 3 704.7 hours. The Certificate of Release to Service (CRS) was issued on 18 December 2024 at 3 704.7 airframe hours with an expiry date of 17 December 2025 or at 3 804.7 airframe hours, whichever comes first.

3.2.5 The AMO that performed the last inspection of the helicopter had an AMO Certificate that was issued on 19 November 2024 with an expiry date of 30 November 2025.

3.2.6 The helicopter had a valid Certificate of Airworthiness (C of A) that was issued by the Regulator on 14 September 2014 with an expiry date of 30 September 2025.

3.2.7 The Certificate of Registration (C of R) was issued to the present owner on 19 November 2018.

3.2.8 Examination of the helicopter maintenance records at the operator's facility indicated that all applicable Service Letters (SL), Airworthiness Directives (AD), Service Bulletins (SB), Technical Service Instructions (TSI) and Supplementary Inspection Documents (SID) were complied with during maintenance activities.

3.2.9 The operator had the Air Operator Certificate (AOC) that was issued by the Regulator on 31 December 2024 with an expiry date of 30 December 2025.

3.2.10 The operator had the Operating Specifications Certificate that was issued by the Regulator on 31 October 2024. The accident helicopter (ZS-HFH) was listed on the certificate.

3.3 Probable Cause/s

3.3.1 Loss of control of the helicopter after lift-off from a farm that was likely due to spatial disorientation caused by frost on the windshield which restricted the pilot's ability to maintain outside visual references.

3.4 Contributing Factor/s:

3.4.1 Inadequate pre-flight planning.

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 organisations.

4.2 Safety Recommendation/s

4.2.1 It is recommended to the Director of Civil Aviation that enforcement action be taken against the check pilot/operator for illegally issuing the PPC Certificate (recency) after the accident to prove compliance on the PPC training that never happened.

5. APPENDICES

5.1 Appendix 1: Robinson Helicopter Safety Notice SN-8.

This report is issued by:

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

Safety Notice SN-18

Issued: Jan 85 Rev: Feb 89; Jun 94

LOSS OF VISIBILITY CAN BE FATAL

Flying a helicopter in obscured visibility due to fog, snow, low ceiling, or even a dark night can be fatal. Helicopters have less inherent stability and much faster roll and pitch rates than airplanes. Loss of the pilot's outside visual references, even for a moment, can result in disorientation, wrong control inputs, and an uncontrolled crash. This type of situation is likely to occur when a pilot attempts to fly through a partially obscured area and realizes too late that he is losing visibility. He loses control of the helicopter when he attempts a turn to regain visibility but is unable to complete the turn without visual references.

You must take corrective action before visibility is lost! Remember, unlike the airplane, the unique capability of the helicopter allows you to land and use alternate transportation during bad weather, provided you have the good judgement and necessary willpower to make the correct decision.

OVERCONFIDENCE PREVAILS IN ACCIDENTS

A personal trait most often found in pilots having serious accidents is overconfidence. High-time fixed-wing pilots transitioning into helicopters and private owners are particularly susceptible. Airplane pilots feel confident and relaxed in the air, but have not yet developed the control feel, coordination, and sensitivity demanded by a helicopter. Private owners are their own boss and can fly without discipline, enforced rules, or periodic flight checks and critique by a chief pilot. A private owner must depend on self-discipline, which is sometimes forgotten.

When flown properly and conservatively, helicopters are potentially the safest aircraft built. But helicopters are also probably the least forgiving. They must always be flown defensively. The pilot should allow himself a greater safety margin than he thinks will be necessary, just in case.