	Ministry of Works and Transport	**ACCID/080719/02-13**
	DIRECTORATE OF AIRCRAFT ACCIDENT AND INCIDENTINVESTIGATIONS **ACCIDENT REPORT – EXECUTIVE SUMMARY**	

Aircraft Registration	ZT-RBD	**Date of Accident**	07 August 2019		**Time of Accident**		08:42 UTC
Type of Aircraft	ROBINSON R44 HELICOPTER RAVEN II		**Type of Operation**		Game counting Operation		
Pilot-In-Command License Type	CPL - Helicopter	**Age**	29		**License Valid**		Yes
Pilot-In-Command Flying Experience	Total Flying Hours	1543.2			Hours on Type		719.5
Last point of departure	Wabi Game Lodge Private Airfield						
Next point of intended landing	Wabi Game Lodge Private Airfield						
Location of the incident site with reference to easily defined geographical points (GPS readings if possible)							
GPS position: 20º 20' 56.33" South 017º 28´ 29.00" East							
Meteorological Information	Surface Wind: Light and Variable, Visibility: CAVOK, Temperature: 25ºC,						
Number of people on board	1 + 2	**No. of people injured**	0		**No. of people killed**		0

Synopsis

On Wednesday, 7 August 2019 at around 08:42 UTC, an Emergency Locator Transmitter (ELT) signal identification code ZTRBD/0 was detected by Cospas Sarsat System. The signal was located at a geographical position 20º 20' 56.33" South 017º 28´ 29.00" which was approximately 45 km east of the town Otjiwarongo in Namibia. The appropriate authorities were notified by the Aeronautical Rescue Coordination Centre (ARCC) located in Johannesburg, South Africa. The Directorate of Aircraft Accident and Incident Investigation (DAAII) immediately instituted an investigation.

The helicopter was on a dry lease from an operator in South African to an operator in Namibia and was conducting a game counting operation on a game lodge on the Waterberg mountains when the accident happened. The flight originated from Nam CDS, a private hangar at the Dobra off ramp 12 nautical miles (nm) north of Eros Airport and flew for 1 hour and 18 minutes directly to Wabi Lodge. From Nam CDS hangar, the pilot had 4x25 liters jerricans of Avgas 100LL fuel and was with one passenger on board. The pilot stated that upon arrival at Wabi Lodge, he landed the helicopter; shut down the engine and uplifted (refueled) the helicopter with 3x25litres fuel from the jerricans. This brought the total amount of fuel on board to 210.3 lbs (35 US gallons) which is equal to 132.49 liters which has an approximate fuel endurance of 2 hours and 12 minutes. From Wabi Lodge, the pilot was accompanied by two passengers who were assisting him in game counting operation. According to the pilot, the main rotor RPM started to decay, and the engine RPM started to increase during level flight. The pilot further stated that a stable orange low main rotor RPM warning light illuminated on the instrument panel and the audible warning alarm sounded. Straight and level flight was no longer possible as the rotor RPM have decayed to below 85%. A hard landing followed, and the helicopter bounced once followed by a slight yaw to the right.

Nobody was injured in the accident. The helicopter tail rotor assembly including the tail rotor gearbox broke off and the lower section of the vertical stabilizer was compressed.

The pilot was a holder of a South African Commercial Pilot License. His aviation medical certificate was valid with no restrictions.

The helicopter was in possession of a valid Certificate of Airworthiness and the last Mandatory Periodic Inspection (MPI) was certified on 13 June 2019 at 953.2 airframe hours. At the time of the accident, the helicopter has flown a further 74.6 hours.

Probable Cause

Emergency landing due to the decaying of the main rotor RPM.

Contributing factors

None could be determined.

AIRCRAFT INCIDENT REPORT

Name of Owner	**:** Bushveld Game Capture CC
Operator	**:** Super Game Dealers CC
Manufacturer	**:** Robinson Helicopter Company
Type	**:** R44Raven II
Model	**:** 2016
Nationality	**:** South African
Registration Marks	**:** ZT-RBD
Place	**:** Wabi Game Lodge, 45 km east of Otjiwarongo
Date	**:** 07 August 2019
Time	**:** 08:40 UTC

All times given in this report are Co-ordinated Universal Time (UTC).

Disclaimer:

This report is given without prejudice to the rights of the Directorate of Aircraft Accident Investigations, which are reserved.

Purpose of the Investigation:

In terms of the Civil Aviation Act (Act No. 6 of 2016) 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 establish legal liability****.*

This report contains fact relating to aircraft accidents or incidents which have been determined at the time of issue. The report may therefore be revised should new and substantive facts be made available to the investigator(s).

1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 On Wednesday, 7 August 2019 at around 08:42 UTC, an Emergency Locator Transmitter (ELT) signal identification code ZTRBD/0 was detected by Cospas Sarsat System. The signal was detected at a geographical position 20º 20' 56.33" South 017º 28´ 29.00" East which was approximately 45 km east of the town Otjiwarongo in Namibia. The Aeronautical Rescue Coordination Centre (ARCC) located in Johannesburg was notified on the ELT signal. As per the ELT database, the owner of the helicopter was contacted by the ARCC to confirm the whereabouts of the helicopter, which was confirmed to be at Wabi Game Lodge in Namibia. The ARCC then informed the Namibian Search and Rescue Point of Contact (SPOC), who notified the Namibian Police and the Directorate of Aircraft Accident and Incident Investigations (DAAII). DAAII dispatched two investigators at the accident site and commenced with an on-site investigation.

1.1.2 The helicopter was on a dry lease to an operator in Namibia at the time of the accident. The purpose of the flight was to conduct an aerial survey, more specifically a game counting operation on a game lodge. The pilot was accompanied by two passengers to assist him with game counting. The flight lasted for approximately 1 hour and 45 minutes. The pilot stated that while flying at a speed of approximately 30-40 knots and 150 feet above the ground level (AGL), he heard a sudden increase in the engine RPM and the main rotor RPM started to decay. The low main rotor RPM warning light illuminated on the instrument panel and an audible low rotor audio warning started sounding.

1.1.3 The pilot also stating that he lowered the collective and manually manipulated the throttle in an attempt to recover the rotor RPM which recovered to more than 97% while the engine RPM was still at a high level of above 110%. The recovering rotor RPM however did not last long as it started decreasing to an alarming rate. The pilot stated that he spotted a suitable landing zone and subsequently started to gradually descent. He then decided to execute a forced landing in a bush type terrain as straight and level flight was no longer possible. The helicopter touched down hard and bounced with a slight yaw to the right, resulting in a tail rotor striking a bush and broke off.

1.1.4 Weight and balance was within the prescribed limit.

1.1.5 The flight was conducted under Visual Flight Rules (VFR) and there was no flight plan filed. The accident occurred during a daylight conditions at a geographical position that was determined to be 20º 20' 56.33" South 017º 28´ 29.00" East at an elevation of 5058 feet (1542 m) above mean sea level (AMSL).

1.2 Injuries to Persons

Injuries	Pilot	Crew	Pass.	Other
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	1	-	2	-

1.3 Damage to Aircraft

1.3.1 The entire tail rotor assembly broke off from the tail boom structure, which resulted in substantial damage.

1.4 Other Damage

1.4.1 There were no other damages was caused.

1.5 Personnel Information

Nationality		South African	Gender	Male	Age	29
Licence No	027 239 2853	Licence Type			Commercial	
Licence Valid		Yes	Type endorsed		Yes	
Ratings		Instrument, Game Cull/Livestock, Flight Instructor Grade II				
Medical expiry date		31 August 2019 (Class 1)				
Restrictions		None				
Previous accidents		11 June 2019 (while on a game capture operation with ZT-RBX in Namibia)				

Flying Experience :

Total Hours	1543.2
Total Past 90 Days	96.2
Total on Type Past 90 Days	96.2
Total on Type	719.5

1.6 Aircraft Information

Airframe :

Type	Robinson Helicopter R44 Raven II	
Manufacturer	Robinson Helicopter Company	
Aircraft Serial Number	13930	
Year of Manufacture	2016	
Total Airframe Hours (At time of Accident)	1027.87 Hrs	
Last Annual Inspection (Date & Hours)	13 June 2019	953.2 Hrs
Hours since Last Annual Inspection	74.67 Hrs	
C of A (Issue Date)	27 May 2016	
C of A (Expiry Date)	31 May 2020	
C of R (Issue Date) (Present owner)	18 May 2016	
Operating Categories	Standard Normal Category (Rotorcraft)	

Engine:

Type	Lycoming IO-540-AE1A5
Engine Serial Number	L-36265-48E
Hours since New	1027.87
Hours since Overhaul	TBO was not yet reached.

Weight and Balance

Item	Weight (lbs)	Arm (inches)	Moment (in, -lbs)
Helicopter empty weight	1 553.7	106.4	165 469
Pilot (90 kg)	198.4	49.5	9 821
Front passenger (70 kg)	154.3	49.5	7 637
Aft passenger (75 kg)	168.5	79.5	13 396
Zero useable fuel weight	**2 074.9**	**94.6**	**196 322**
Useable fuel main tank	120	106.0	12 720
Useable fuel aux tank	90	102.0	10 800
Take-off Gross weight	**2284.9**	**96.2**	**219 843**

According to the pilot's operating handbook, the maximum certified take-off weight for this helicopter type is 2500 pounds (lbs).

For the purpose of this calculation, a fuel specific weight of 6 lbs = 1 US gallon was used. The weight of the pilot and the two passengers was obtained from the pilot questionnaire, as well as an official weight and balance report that was requested from the pilot.

1.7 Meteorological Information

1.7.1 The following weather information was obtained from the pilot's incident questionnaire.

Wind direction	Variable	Wind speed	Light	Visibility	+10 km
Temperature	25ºC	Cloud cover	Nil	Cloud base	Nil
Dew point	Unknown				

1.7.2 Density Altitude

According to the density altitude chart in section 5 of the Pilot Operating Handbook (POH). The density altitude at the time of the accident was approximately 7 200 feet AMSL.

1.8 Aids to Navigation

1.8.1 The helicopter was equipped with standard navigation equipment and no difficulties with navigation aids were reported.

1.9 Communications.

1.9.1 There was no communication problem reported. The pilot was transmitting on unmanned frequency 124.8 MHZ.

1.10 Aerodrome Information

1.10.1 The accident occurred in a remote part of the country and not close to an aerodrome.

1.11 Flight Recorders

1.11.1 The helicopter was not equipped with Flight Data Recorders (FRD) or Cockpit Voice Recorder (CVR) nor was it required by the regulation.

1.12 Wreckage and Impact Information

1.12.1 Following a low rotor RMP condition in flight, the pilot had opted to perform a forced landing while flying over bush type of terrain. Prior to ground contact, the tail rotor blades made contact with some vegetation (dry thorn bush) and fractured. Due to a loss in tail rotor effectiveness, the helicopter yawed slightly to the right before coming to rest as displayed in Figure 1.

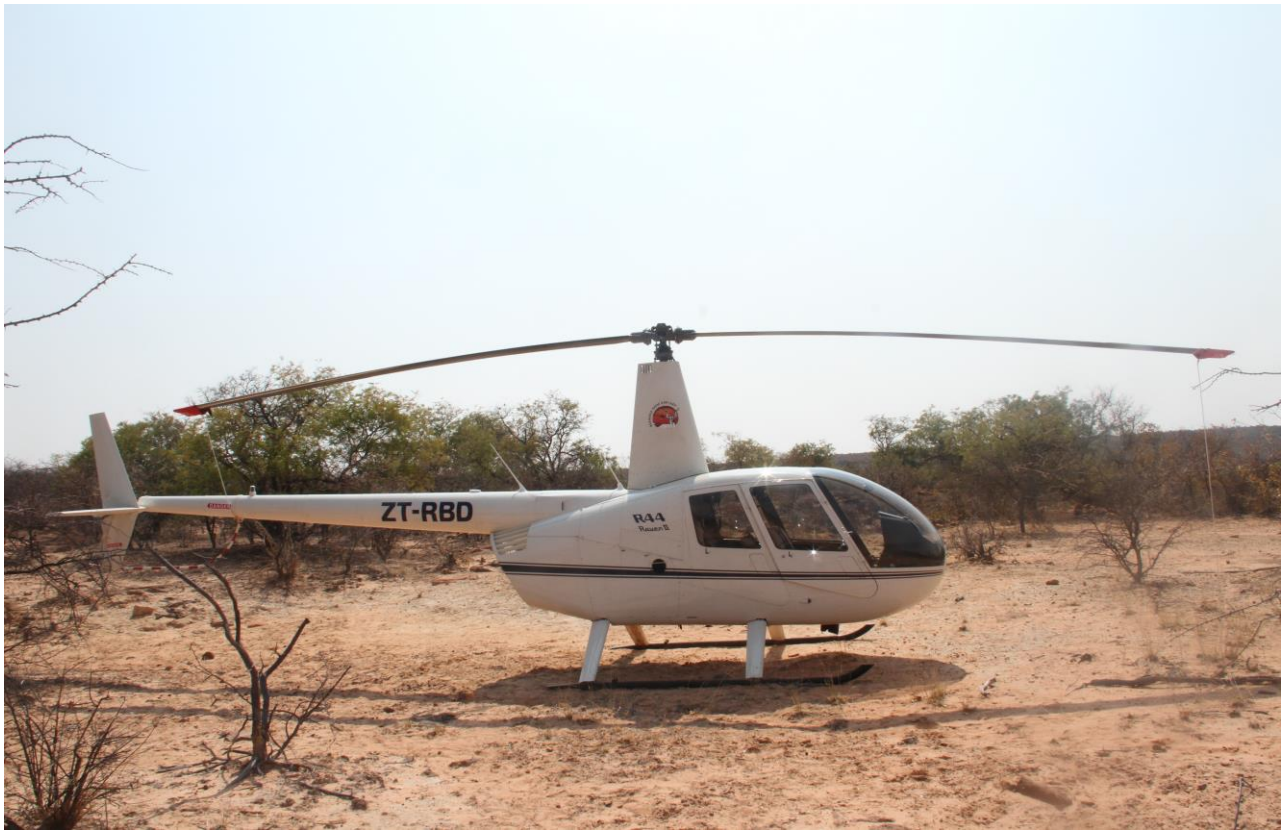

Figure 1. The helicopter as it came to rest.

Figure 2. Several fractured branches of the thorn bush indicate contact with the tail rotor blades.

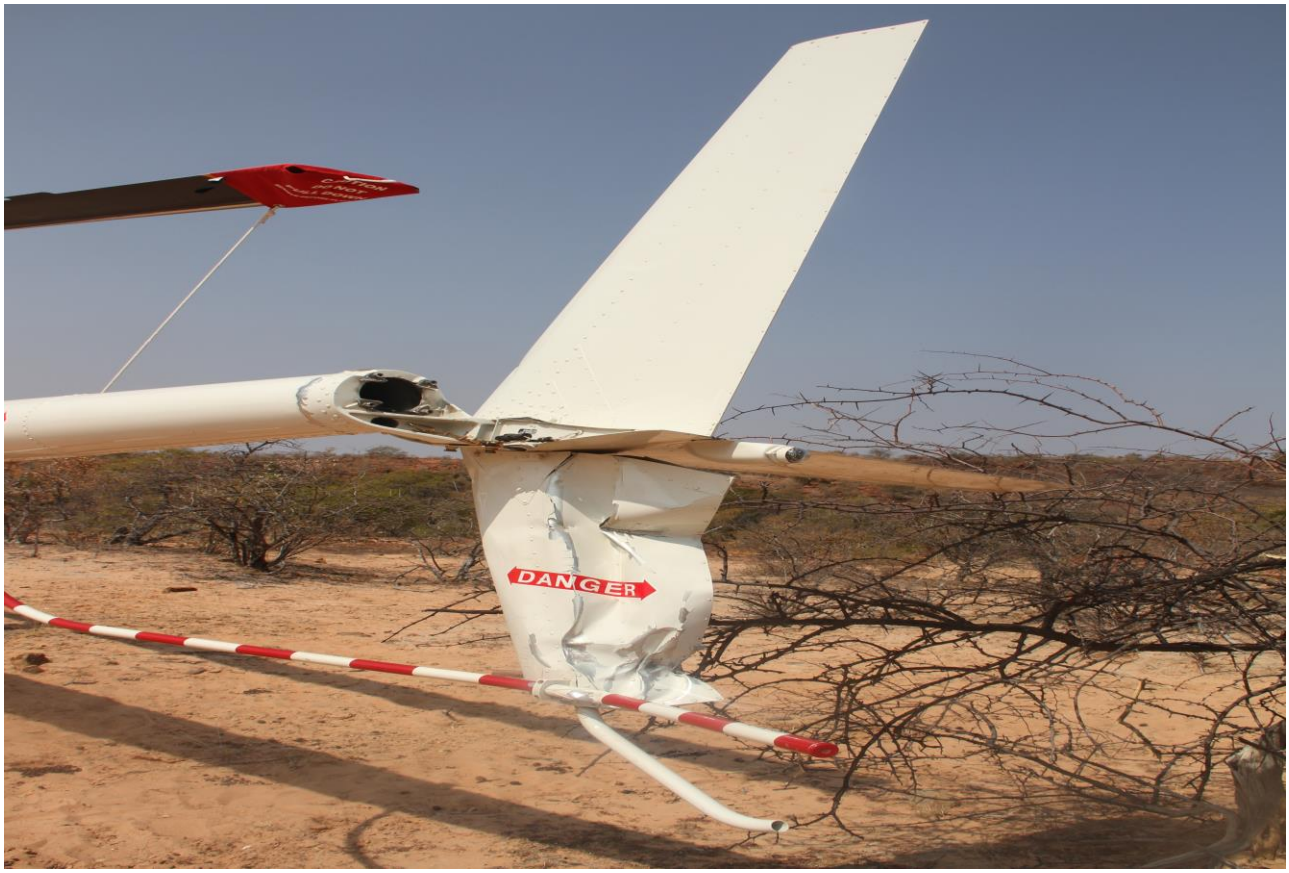

Figure 3. Closer view of the aft tail boom structure with the tail rotor assembly absent.

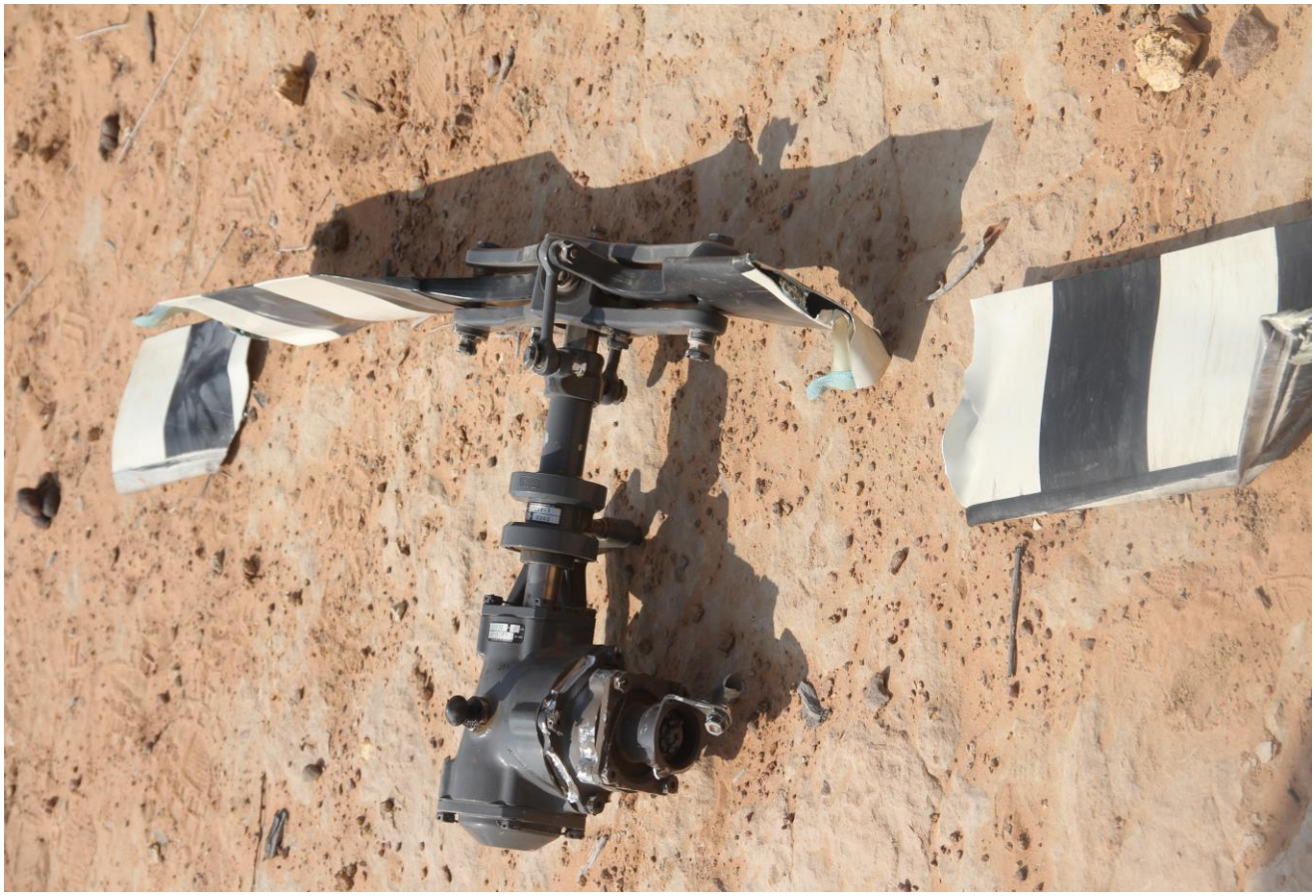

Figure 4. The tail rotor assembly that broke off with both rotor blades being fractured.

1.13 Medical and Pathological Information

1.13.1 The pilot's was in possession of a valid aviation medical certificate (Class 1) with an expiry date of 31 August 2019.

1.14 Fire

1.14.1 There was no pre or post impact fire.

1.15 Survival Aspects

1.15.1 This was a survivable incident as the helicopter structure, including the cabin area remained intact and all three occupants were properly restraint by making use of the helicopter equipped three-point safety harness.

1.15.2 The helicopter was equipped with Kannad Integra AF, emergency locator transmitter (ELT), with Serial No. LX1100227153. Following the hard landing, the ELT activated a distress signal (406 MHz) which was detected by the Cospas Sarsat System. The necessary authorities in Namibia were informed accordingly by the ARCC in South Africa after they had been in contact with the helicopter owner who confirmed that the helicopter was operating in Namibia.

1.15.3 There was no cell phone coverage at the accident site, and the pilot and his passengers had to walk for some distance before they were able to obtain signal and call the relevant people to inform them accordingly.

1.16 Tests and Research.

1.16.1 The pilot stated that the engine RPM increased in contradiction to the main rotor RPM that decayed during flight. The components bellows were examined following this statement.

1.16.2 Following the recovery of the helicopter back to the an aircraft maintenance organisation (AMO) in South Africa, the helicopter was inspected on 22 August 2019 by an Accredited Representative from the Accident and Incident Investigation Division (AIID) of the South African Civil Aviation Authority (SACAA).

1.16.3 A functional test was conducted on the clutch assembly, which was undamaged. Electrical power was applied to the helicopter and the clutch unit was activated and deactivated and did not display any defect. The clutch unit could be rotated in both directions (i) taking the load whereby the main rotor blades turned, (ii) and when turned in opposite direction it decoupled taking away the load from the main rotor system.

1.16.4 The clutch assembly with Part No. C166-4 and Serial No. 9622, as well as the sprag clutch with Part No. C-188-3 and Serial No. 10439 was then removed from the helicopter and was send to a maintenance facility which was appropriately rated and accredited to conduct a functional examination on these units. The examination report concludes that the inner and outer contact faces were found to be undamaged. There was no metal contamination in the lubricating oil and the oil level was correct. Both units were declared or found to be serviceable.

1.16.5 The Continental Motors S6LSC-204T type right-hand magneto, with Part No. 66B21783 and Serial No. E15AA170 was removed from the engine and found to be undamaged. The unit was inspected by an approved electrical maintenance facility and the timing was checked and found to be within the operational limits. The magneto was then subjected to a bench test and was found functioning satisfactorily. The reason for the test being limited to the right-hand magneto only, was due to the fact that the unit provide engine RPM as reflected on the engine RPM instrument in the cockpit.

1.17 Organizational and Management Information

1.17.1 This was a private operation.

1.17.2 The helicopter was registered in South Africa and was on a dry lease to a Namibian operator.

1.17.3 The pilot was in possession of a valid working permit that was issued by the Ministry of Home Affairs and Immigration in Namibia, for a period of months.

1.17.4 The last mandatory periodic inspection (MPI) that was carried out on the helicopter prior to the accident flight was certified by an approved AMO facility in South Africa on 13 June 2019 at 953.2 airframe hours.

1.18 Additional Information

1.18.1 ZT-RBD entered Namibia from South Africa on the 14th of June 2019 as a replacement of ZT-RBX which involved in an incident on 11 June 2019 during the game capture operation while being flown by the same pilot.

1.19 Useful or Effective Investigation Techniques

1.19.1 No new methods were used.

2 ANALYSIS

2.1 The pilot was appropriately rated and licensed to conduct the flight. At the time of the accident, he had accumulated 719.5 hours on the helicopter type.

2.2 While the pilot was flying straight and level at a speed of approximately 30 knots and at a height of 150 feet above ground level (AGL), he noticed an orange low rotor RPM warning light that came on and the audible warning alarm sounded. The main rotor RPM also decayed to below 85%.

2.3 The pilot tried to restore the main rotor RPM by lowering the collective pitch lever, but the available altitude was however insufficient to unload the main rotor disc and restore the main rotor RPM, therefore committed to execute a forced landing.

2.4 During a forced landing, the tail rotor made contact with vegetation (a thorn bush), which caused the entire tail rotor assembly to separate from the tail boom structure and caused the helicopter to start yawing to the right it touched down hard and bounced once before coming to rest in an upright position.

2.5 The helicopter was maintained in accordance with the approved maintenance schedule. It was flown from South Africa to Namibia on the 14th of June 2019 with no defects reported, as a replacement of another helicopter (ZT-RBX) which was involved in an incident on 11 June 2019 with the same pilot during a game capture operation in one of the game farms in Namibia.

2.6 At the time of the hard landing, there was approximately 8 US gallons (30 liters) of fuel on board the helicopter. No pre-existing failure could be found on the helicopter during the on-site as well as the post field investigation, which could have contributed or have caused the accident.

2.7 The helicopter sustained substantial damage as the entire tail rotor assembly broke off following a tail rotor strike. The aft tail boom structure as well as the lower vertical stabilizer was also deformed following the tail rotor assembly separation which required a major repair.

2.8 The prevailing wind at the time of the accident was reported to be light and variable with the temperature at 25°C and the density altitude which was calculated making use of the elevation at the accident site, amounted to 7 200 feet.

2.9 The helicopter's engine RPM increased as the main rotor RPM decreased, which indicated that the engine was running at the time of the accident, and there were adequate fuel on board to allow the engine to function.

2.10 The helicopter airborne for a period of 1 hour and 45 minutes, which allowed for a substantial decrease in fuel load as the fuel was consumed at approximately 15 US gallons (57 litres) per hour depending on the power setting.

3 CONCLUSION

3.1 Findings

3.1.1 The pilot was in possession of a valid commercial pilot licence, and the helicopter type was endorsed in his it.

3.1.2 The pilot was in possession of a valid aviation medical certificate (Class 1), which expired on 31 August 2019.

3.1.3 The pilot was accompanied by two (2) passengers during the game counting operation flight.

3.1.4 The flight time according to the pilot questionnaire was 1 hour and 45 minutes and approximately 27 US gallons of fuel was used.

3.1.5 The last Mandatory Periodic Inspection (MPI) that was carried out on the helicopter prior to the accident flight was certified on 13 June 2019 at 953.2 airframe hours. At the time of the accident, the helicopter had flown a further 74.6 hours.

3.1.6 The helicopter was in possession of a valid Certificate of Airworthiness (C of A) with an expiry date of 31 May 2020.

3.1.7 The helicopter was in possession of a valid Certificate of Release to Service (CRS), which was issued on 13 June 2019, which will lapse at 1 053.2 airframe hours or on 12 June 2020 whichever came first.

3.1.8 The orange low rotor RPM warning light illuminated on the instrument panel and the audible warning alarm sounded as the main rotor RPM decayed to 85% as stated by the pilot.

3.1.9 The helicopter impacted the ground hard after striking vegetation (thorn bush) with the tail rotor, causing the tail rotor assembly to break off.

3.1.10 The weight and balance during the flight was within the design limitations of the helicopter as stipulated in the helicopter POH.

3.1.11 Fine weather conditions with a good visibility prevailed at the time of the accident.

3.1.12 The ELT activated following an impact and the 406 MHz signal was detected by Corsat Sasrat System. The ARCC based in Johannesburg, South Africa was accordingly informed of the ELT signal and they informed the Namibia Search and Rescue Point of Contact (NSRPC) that a helicopter was involved in an accident.

3.1.13 The clutch assembly including the sprag clutch were subjected to a functional test prior to it being removed from the helicopter and were examined by a maintenance facility that overhaul these units and no anomalies were found.

3.1.14 The magneto as referred to in sub-heading 1.16.5 of the report was also tested and was found to function satisfactorily.

3.1.15 No evidence of pre-existing failures could be found on the helicopter during the on-site investigation and the wreckage examination post of the accident.

3.1.16 The operator in Namibia that leased the helicopter was not in possession of an Air Operator Certificate (AOC).

3.2 Probable Cause/s

3.2.1 Emergency landing due to the decaying of the main rotor RPM.

3.3 Contributing Factors

3.3.1 None could be determined.

4. SAFETY RECOMMENDATIONS

4.1 NCAA 01/2020

Since there were several incidents involving South African registered Robinson R44 helicopters in Namibia and in particular this same operator, DAAII recommends that the Regulatory Authority (NCAA) should do a review of these companies' operation to check if indeed they are operating as per the approved scope granted to them.

4.2 NCAA 02/2020

DAAII also recommends that the Regulatory Authority (NCAA) should review the issuance of the Over flight Clearance to these operators as they are taking chances in using them to carry out illegal operations instead of applying for an AOC.

5. APPENDICES

5.1 N/A

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Date : 15/10/2020

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