



# AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9290	
<b>Aircraft Registration</b>	<b>ZS-PXP</b>	<b>Date of Accident</b>	12 February 2014		<b>Time of Accident</b>	0645Z
<b>Type of Aircraft</b>	Robinson R44 Raven II (Helicopter)		<b>Type of Operation</b>		Game Culling	
<b>Pilot-in-command Licence Type</b>		Commercial	<b>Age</b>	46	<b>Licence Valid</b>	Yes
<b>Pilot-in-command Flying Experience</b>		Total Flying Hours	698		Hours on Type	64
<b>Last point of departure</b>		Setlakgole aerodrome, North West province.				
<b>Next point of intended landing</b>		Setlakgole aerodrome, North West province.				
<b>Location of the accident site with reference to easily defined geographical points (GPS readings if possible)</b>						
Farm Stella in Mafikeng area at GPS position determined to be South 26°12.049' East 024°43.960', at an elevation of 4 115 feet above mean sea level (AMSL)'.  						
<b>Meteorological Information</b>		Temperature: 28 °C; Cloud cover: None; Wind speed: Very light breeze.				
<b>Number of people on board</b>	1 + 1	<b>No. of people injured</b>	0	<b>No. of people killed</b>	0	
<b>Synopsis</b>						
<p>The pilot, accompanied by a passenger, took off from Setlakgole aerodrome in Mahikeng early in the morning of 12 February 2014 on a game-capturing operation. A flight plan was filed. During the post-accident interview, the pilot stated that the helicopter had been airborne for approximately 35 minutes, flying at 40 knots indicated airspeed at a height of 60 metres above ground level, when the engine suddenly lost power and could not maintain height. The pilot further reported that he tried to recover the helicopter from the condition, but was unsuccessful. He was then left with no other option but to execute a forced landing in a dense bushy terrain, westerly direction. On touchdown, the helicopter landed hard on the skids and the main rotor blades severed the tail boom. The helicopter was substantially damaged, but no injuries were reported. The helicopter was operated under the provisions of Part 127 of the South African Civil Aviation Regulations at the time of the accident. Post-accident investigation did not identify any defects of the engine which could have contributed to the accident. It is considered that the pilot inadvertently switched the hydraulic system OFF during the flight.</p>						
<b>Probable Cause</b>						
<p>Poor Technique.</p>						
IARC Date				Release Date		

## AIRCRAFT ACCIDENT REPORT

**Name of Owner/Operator** : Maf Toy Auto CC  
**Manufacturer** : Robinson Helicopter Company  
**Model** : R44 II  
**Nationality** : South African  
**Registration Marks** : ZS-PXP  
**Place** : Farm Stella in the vicinity of Mahikeng area.  
**Date** : 12 February 2014  
**Time** : 0645Z

*All times given in this report is Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.*

### Purpose of the Investigation:

*In terms of Regulation 12.03.1 of the Civil Aviation Regulations (1997) 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 establish legal liability**.*

### Disclaimer:

*This report is given without prejudice to the rights of the CAA, which are reserved.*

## 1. FACTUAL INFORMATION:

### 1.1 History of Flight:

- 1.1.1 The pilot, accompanied by a passenger, took off from Setlakgole Aerodrome in Mahikeng, North West, early in the morning of 12 February 2014. The pilot first conducted a pre-flight inspection of the helicopter and filed a visual meteorological conditions (VMC) flight plan. The pilot then cleaned the windscreen with a chamois leather cloth before boarding the helicopter. The pilot first made sure that the passenger was correctly secured by the aircraft-equipped safety harness before starting and the helicopter took off and flew to Stella game farm, where they conducted a game-capturing operation.
- 1.1.2 In the post-accident interview, the pilot stated that the helicopter had been airborne for approximately 35 minutes, flying at 40 knots indicated airspeed at a height of 60 metres above ground level, when the engine suddenly lost power and could not maintain height. The pilot further reported that he tried to recover the helicopter from the condition (applying power with the throttle) but was unsuccessful. He was then left with no other option but to execute a forced landing in a westerly direction in dense, bushy terrain straight ahead of the aircraft.

- 1.1.3 On touchdown the helicopter landed hard on the skids and the main rotor blades severed the tail boom. The helicopter was substantially damaged and no injuries were reported. The pilot immediately switched OFF the electrics, unbuckled himself and the passenger and vacated the helicopter. No fire was reported. The pilot used his mobile phone to contact his superior and inform him of the occurrence and their condition. The operator dispatched a team of aircraft maintenance engineers to the accident site.
- 1.1.4 The helicopter was operated under the provisions of Part 127 of the South African Civil Aviation Regulations which caters for forest and wildlife conservation activities at the time of the occurrence. The accident occurred in the morning in a bushy terrain at geographical position determined to be South 26° 12,049 ' East 024° 43,964 ' at an elevation of 4 115 feet above mean sea level (AMSL)'.

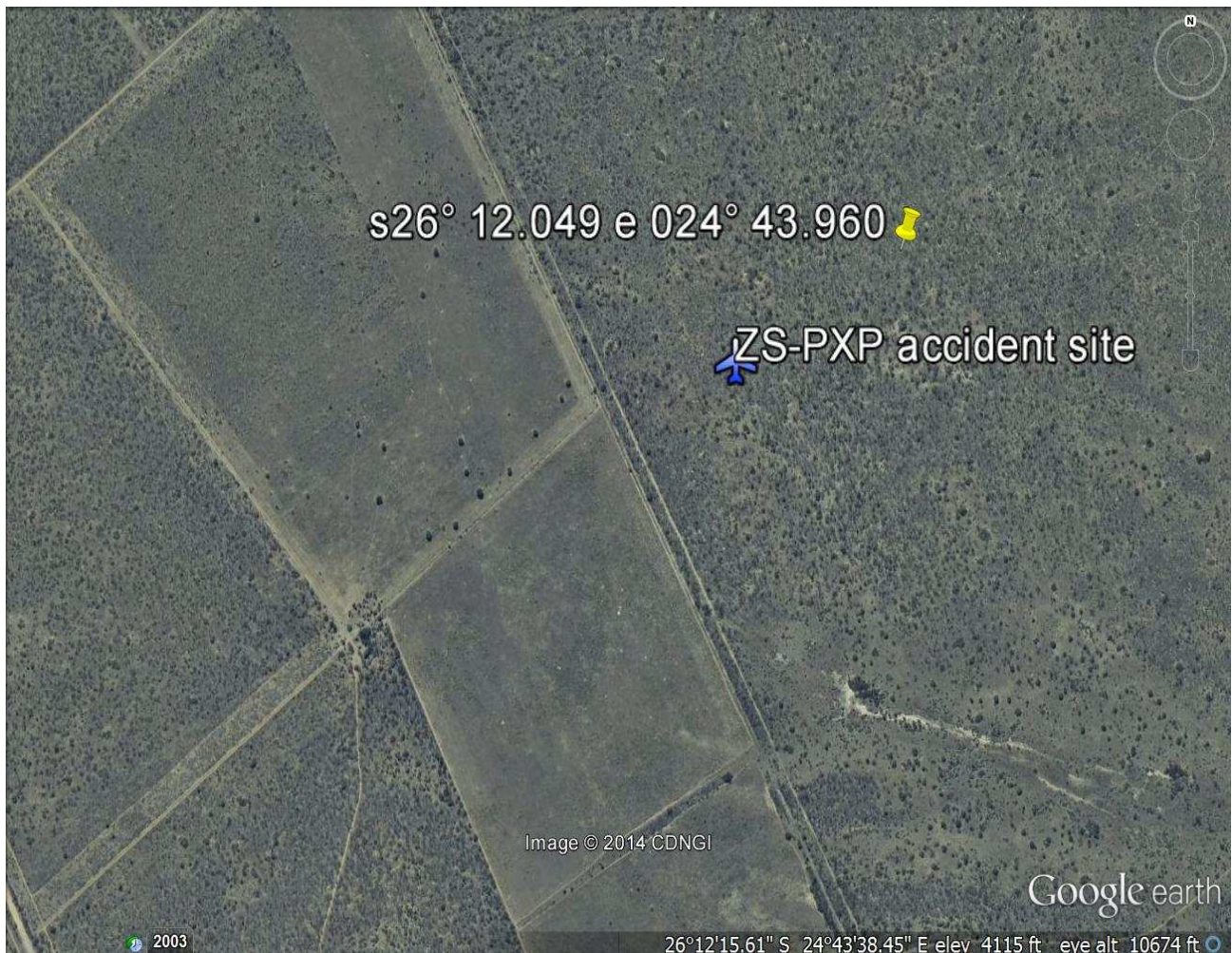


Figure 1: Google earth location of the accident site.



## 1.2 Injuries to Persons:

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

## 1.3 Damage to Aircraft:

1.3.1 The helicopter was substantially damaged during the accident sequence.



Figure 2: Wreckage as found at accident site.



Figure 3: Evidence of damage to skids and airframe.

## 1.4 Other Damage:

1.4.1 None.

## 1.5 Personnel Information:

Nationality	South African	Gender	Male	Age	46
Licence Number	0272273863	Licence Type	Commercial		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Game/Livestock Cull Rating				
Medical Expiry Date	31 May 2014				
Restrictions	None				
Previous Accidents	Nil				

Flying Experience:

Total Hours	698
Total Past 90 Days	64
Total on Type Past 90 Days	64
Total on Type	698

## 1.6 Aircraft Information:

1.6.1 The Robinson R44 is a single-engine four-seater light utility helicopter constructed primarily of metal and equipped with skid-type landing gear. The helicopter is powered by an IO540 six-cylinder horizontally opposed fuel-injected engine with angled valve head and tuned induction capable of producing 300 horsepower. The engine is controlled by an electronic governor, also manufactured by Robinson. Fuel is fed by gravity, with an electric prime pump. Should the engine inadvertently shut down, the loss of oil pressure turns the pump off, preventing the engine from flooding during a restart.

1.6.2 The output shaft powers both the cooling fan and the drive belt sheave. The cooling fan provides air to cylinder heads and oil coolers, and also serves for gearbox cooling and cabin heating. The main rotor system is a two-blade underslung teetering hinge. The all-metal stainless steel blades are connected to the hub by two sealed Teflon-coated coning hinges. The pitch change bearings are wet and enclosed by a neoprene boot at the blade root.

- 1.6.3 The main gearbox contains a single-stage splash-lubricated gear set and is driven by a V-belt sheave that lies directly above the engine sheave. The sprag one-way drive clutch is contained within the upper sheave and can easily be checked for operation by the pilot on pre-flight. An automatic clutch actuator raises the upper sheave when the pilot engages the clutch, and a tensioner automatically stops the engagement when the correct tension is achieved. It also automatically adjusts tension in flight. The tail rotor drive does not have any hanger bearings; it drives a splash-lubricated gearbox. The two metal tail rotor blades are attached to a teetering hub with a fixed coning angle, and use elastomeric teetering bearings and Teflon pitch-change bearings.
- 1.6.4 The hydraulic system consist of a pump, three servos, a reservoir and lines boosting the main rotor flight control while eliminating cyclic and collective feedback forces. At the same time the flight controls maintain a direct mechanical link, allowing full control should the hydraulics fail. The pump is driven by the main gearbox, operating at a relatively low pressure of 450 to 500 pressure per square inch (psi). The pilot can turn the hydraulics off, although electrical power is required to do so, providing a fail-safe system.
- 1.6.5 The 28-volt DC electrical system powers a single bus bar and includes an alternator, voltage controller, battery relay and 24-volt battery. Standard lighting on the R44 helicopter includes strobe, navigation, panel and map lights. The warning lights are extensive, and the low rotor warning also includes a horn activated at 97 per cent rpm. Another standard feature is the four-place voice activated intercom system. The helicopter has a press-to-talk (PTT) switch in the pistol grip on the cyclic control, which is activated by the index or key finger. The hydraulic switch is located on the front of the cyclic stick.



Figure 4: Cyclic control.

- 1.6.6 All the equipment has been installed for easy accessibility for the observer or pilot in day or night operations, including independent audio controls, map lights and a pouch for binoculars. Removable left seat pedals and collective control may be installed to allow a rated co-pilot to control the helicopter using the centre cyclic control.



Figure 5: The helicopter before the accident.

#### Airframe:

Type	Robinson R44 Raven II	
Serial Number	11851	
Manufacturer	Robinson Helicopter Company	
Date of Manufacture	2007	
Total Airframe Hours (At time of Accident)	901	
Last Inspection (Hours & Date)	891,1	17 January 2014
Hours since Last Inspection	9.9	
Certificate of Airworthiness (Issue Date)	14 September 2009	
Certificate of Airworthiness (Expiry Date)	13 September 2014	
C of R (Issue Date) (Present owner)	17 August 2012	
Service Ceiling	14 000 ft	
Maximum take-off mass	2 400 lbs	
Aircraft empty weight	1 400 lbs	
Operating Categories	Standard Part 127	
Recommended fuel used	Avgas LL 100	

NOTE: The operating categories and conditions for the helicopter were indicated as commercial, allowing forest and wildlife conservation activities. The last mandatory periodic inspection carried out on the helicopter prior to the accident was certified at 891,1 hours on 17 January 2014 by an approved aircraft maintenance organisation (AMO) No. 247.

#### Engine:

Type	Lycoming IO-540-AE1A5
Serial Number	L-32065-48E
Hours since New	690,1
Hours since Overhaul	Not reached

#### Weight and Balance calculation:

Item	Weight (lbs)	Arm (inches)	Moment (lbs-inches)
Helicopter empty weight	1400,00	144,87	160 815,00
Pilot (96 kg)	224	49,5	11 088
Fore left passenger (100 kg)	220	49,5	10 890
Right aft passenger	0	79,5	+12,2
Left aft passenger	0	79,5	-12,2
<b>Zero fuel weight</b>	<b>1844,00</b>	<b>99,1</b>	<b>182 793,00</b>
Main fuel tank (100 litres)	158	106,0	1 674
<b>Take-off weight</b>	<b>2002,00</b>	<b>99,6</b>	<b>199 541,00</b>

According to the pilot's operating handbook (POH), the maximum (certificated and recommended) take-off weight for the helicopter type (R44) in question was not allowed to exceed 2 400 pounds. The helicopter's total weight before departure was calculated to be 2 002 lbs, which means that it was within its allowable weight.

### 1.7 Meteorological Information:

#### 1.7.1 Weather information as obtained from the pilot's questionnaire:

Wind direction	030°	Wind speed	Very light breeze	Visibility	Clear
Temperature	28°C	Cloud cover	Nil	Cloud base	N/a
Dew point	Unknown				



## **1.8 Aids to Navigation:**

- 1.8.1 The helicopter was fitted with standard navigational equipment certified for the helicopter type. No defects or malfunctions of the equipment were reported prior to or during the flight.

## **1.9 Communications:**

- 1.9.1 The communications equipment installed in the helicopter was found to be in accordance with the approved equipment list. No defects of the communications equipment were reported prior to the accident.

## **1.10 Aerodrome Information:**

- 1.10.1 The accident did not occur at or near an aerodrome. It occurred in the morning in a bushy terrain on a farm at geographical position determined to be South 26° 12,049' East 024° 43,964' at an elevation of 4 115 feet above mean sea level (AMSL)'.

## **1.11 Flight Recorders:**

- 1.11.1 The helicopter was not equipped with a flight data recorder or a cockpit voice recorder, nor were they required to be fitted to this helicopter type according to regulatory requirements.

## **1.12 Wreckage and Impact Information:**

- 1.12.1 The helicopter collided with a number of small trees before landing hard on the skids. The main rotor blade severed the tail boom during the impact sequence and there was substantial damage. The tail rotor was also severed during the impact sequence with the trees. The helicopter cockpit area was intact and all the instruments were still intact and secured to their mounting points. The helicopter seats were secured to their anchors with the safety harnesses intact. Figure 6 shows the final position of the helicopter as found at the accident site and Figure 7 and 8 the damaged rotor and tail section (tail boom and tail rotor blades).



**Figure 6: Rear view of wreckage.**



**Figure 7: Destroyed main rotor.**



**Figure 8: Severed tail boom.**

### **1.13 Medical and Pathological Information:**

1.13.1 No injuries were reported.

### **1.14 Fire:**

1.14.1 There was no evidence of a pre- or post-impact fire.

### **1.15 Survival Aspects:**

1.15.1 All occupants were properly restrained by the helicopter-equipped safety harnesses. The cockpit/cabin area remained intact during the accident sequence. Nobody was injured in the accident, which was associated with a low kinetic energy impact sequence.

### **1.16 Tests and Research:**

1.16.1 The helicopter crashed in bushy terrain and the investigation was off-site. All the switches inside the cockpit were found to be in an OFF position and the investigating team could not confirm their position after the accident. The tail boom and the main rotor were removed from the airframe and the helicopter, serial number 11851 with the engine still secured to it was recovered on a trailer by a SA CAA-approved AMO to Wonderboom (FAWB) aerodrome located north of Pretoria, Gauteng, for further engine testing and examination (see Figure 9).





**Figure 9: Helicopter secured on a trailer at FAWB Aerodrome.**

1.16.2 The engine and its components were air-blown to remove sand and dust and then subjected to a thorough inspection. All components were found to be secured to their respective mounting points and still in good condition. No fuel leak was found. The fuel filter was removed and analysed and was free from contaminants. A fuel sample was taken and was found to be clean, free from contaminants (Figure 10).



**Figure 10: Fuel sample from helicopter.**



1.16.3 One of the investigators got inside the cockpit and switched ON the electrics with intention to determine whether the engine auxiliary fuel pump, the mechanical fuel pump and the clutch were functioning or operative and all were found to be serviceable, and the auxiliary fuel pump light illuminated. An aircraft maintenance engineer rated on helicopter type, (R44 Raven II) subsequently inspected and tested the helicopter's hydraulic system. This included a visual inspection of the system, an operational check using a slave hydraulic pump driven by an electric motor, and an operational check of the hydraulic pump. He concluded that the hydraulic system had functioned normally (Figure 11).

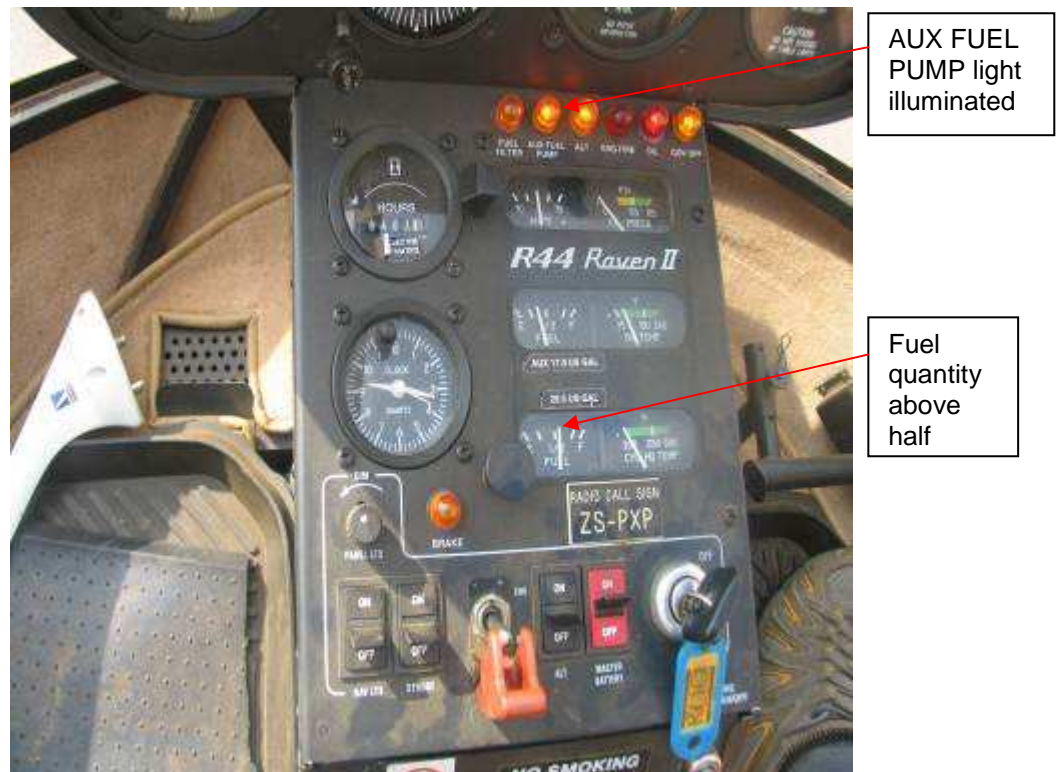


Figure 11: The helicopter instrument panel.

1.16.4 A certified test pilot rated on the helicopter type assisted the investigating team in starting the engine. All parameters were met. The engine operated normally, and power was increased in stages until it was evident that it was capable of operating at full power. The investigation did not identify any defects with the engine which could have contributed to the accident.

## 1.17 Organisational and Management Information:

1.17.1 The flight was conducted under the provisions of Part 127 of the Civil Aviation Regulations of 1997, as amended. The operator was in possession of a valid air operating certificate (AOC) reference number FO 7675 at the time of the accident.

1.17.2 The last mandatory periodic inspection carried out on the helicopter prior to the accident flight was certified on 17 January 2014 at 891,1 airframe hours. The AMO that performed the last maintenance on the helicopter was in possession of a valid AMO approval certificate.

### **1.18 Additional Information:**

1.18.1 None.

### **1.19 Useful or Effective Investigation Techniques:**

1.19.1 None.

## **2. ANALYSIS:**

2.1 The pilot held the required licence and had the helicopter type endorsed in his logbook. The helicopter was maintained in accordance with the manufacturer's approved procedures. There were no recorded defects or malfunctions on the helicopter that could have had any effect on the controllability of the helicopter during take-off. The helicopter had flown a total of 9,9 hours since the last annual inspection. Although the pilot reported a sudden loss of engine power in-flight, the post-accident investigation did not identify any defects with the engine which could have contributed to the accident. It was therefore concluded that the pilot was most probably focused on the animals whilst manoeuvring the helicopter, thinking that his finger was on the siren switch, and inadvertently switched OFF the hydraulic system, which contributed to cyclic control handling difficulties and rendered ground impact inevitable.

## **3. CONCLUSION:**

### **3.1 Findings:**

3.1.1 The pilot was the holder of a valid commercial pilot's licence and had the helicopter type endorsed in his licence.

3.1.2 The pilot was in possession of a valid aviation medical certificate that was issued by a CAA-approved medical examiner.

3.1.3 The pilot had a cull rating endorsed in his licence.

3.1.4 The helicopter was in possession of a valid certificate of airworthiness at the time of the accident and had flown a total of 9,9 hours since the last maintenance

inspection was certified on 17 January 2014.

- 3.1.5 The helicopter operator was in possession of a valid air operating certificate (AOC) at the time of the accident.
- 3.1.6 Post-accident investigation on the engine did not identify any defects that might have contributed to the accident.
- 3.1.7 The take-off weight of the helicopter was calculated to be 2 002 pounds, below the maximum certified take-off weight as stipulated in the POH.
- 3.1.8 The accident was considered survivable.

### **3.2 Probable Cause/s:**

- 3.2.1 Poor technique.

## **4. SAFETY RECOMMENDATIONS:**

- 4.1 It is recommended to the Director for Civil Aviation that the regulating authority through the Federal Aviation Administration (FAA) advise Robinson Helicopter Company to install a safety guard on all Robinson R44 hydraulics toggle switches, to prevent pilots from inadvertently switching them OFF in-flight. (Such a recommendation was proposed and submitted to the FAA via the NTSB in May 2008, accident reference number CA18/2/3/8485. The FAA declined the recommendation at the time. However, AIID still holds the opinion that this design shortcoming with the switch on the cyclic control stick remains unsafe).

## **5 APPENDICES:**

- 5.1 None.