CA18/2/3/7965

SOUTH AFRICAN CIVIL AVIATION AUTHORITY

ACCIDENT REPORT – EXECUTIVE SUMMARY

Aircraft Registration	**ZS-RDO**	**Date of Accident**	24 May 2005	**Time of Accident**	1030Z
Type of Aircraft	Robinson R22 Beta		**Type of Operation**	Private	
Pilot-in-command Licence Type	Private	**Age**	50	**Licence Valid**	No
Pilot-in-command Flying Experience	Total Flying Hours	391.2		Hours on Type	334
Last point of departure	Private Farm in Kanon Island				
Next point of intended landing	Farm Neus Berg (Approximately 7 km from Kakamas)				

Location of the accident site with reference to easily defined geographical points (GPS readings if possible)

On the farm Neus Berg, 7 km from Kakamas, Northern Cape

Meteorological Information	Wind light south-easterly 5 – 10 kts, temperature 22°C, visibility CAVOK				
Number of people on board	1 + 1	**No. of people injured**	0	**No. of people killed**	0

Synopsis

The pilot, accompanied by a veterinarian, was busy counting game on the farm Neus Berg, located approximately 7 km from Kakamas in the Northern Cape.

According to the pilot, at a height of approximately 100 – 200 ft above ground level (AGL), he executed a tight right-hand turn to follow a Gemsbok (antelope), which had run away from the herd, when he lost tail rotor control. The pilot attempted corrective action with the left rudder, but the aircraft kept on yawing in a clockwise direction. Just before impact, he attempted to flare the helicopter but the low rotor RPM warning sounded and a hard landing followed.

On impact, the skids, tail and main rotor blades impacted the ground and the helicopter rolled over to the right. The tail rotor was found approximately 7 – 8 ft from where the helicopter impacted the ground. The helicopter sustained damage to the tail rotor gearbox, tail boom, main rotor blades and the skids.

The pilot and passenger sustained no injuries.

The helicopter did not have a valid Certificate of Airworthiness at the time of the accident. The last certificate of Airworthiness was issued on 28 March 2003. The last mandatory periodic inspection (MPI) prior to the accident was certified on 8 July 2003 at a total of 1 223.6 airframe hours, and the aircraft had flown a further 296.3 hours since the last Mandatory Periodic Inspection was certified.

According to available records, the aircraft maintenance organisation (AMO) that certified the last MPI on the aircraft prior to the accident was in possession of a valid AMO Approval, no. 830, with an expiry date of 31 July 2005. The CAA conducted an audit on the AMO on 3 August 2004.

According to available records, this was a private flight, and neither the animals nor the farm belonged to pilot.

This was not an onsite investigation.

Probable Cause

The tail rotor most probably made contact with an obstacle while the pilot was manoeuvring in close proximity to the ground and a hard landing followed.

IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : MMWS Boerdery (PTY) LTD
Manufacturer : Robinson Helicopter Company
Model : R22 Beta
Nationality : South African
Registration Marks : ZS-RDO
Place : Farm Neus Berg, 7 km from Kakamas
Date : 24 May 2005
Time : 1030Z

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 two 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 veterinarian, was busy counting game on the farm Neus berg, located approximately 7 km from Kakamas in the Northern Cape.

1.1.2 According to the pilot, at a height of approximately 100 – 200 ft above ground level (AGL), he executed a tight right-hand turn to follow a Gemsbok (antelope), which had run away from the herd, when he suddenly lost tail rotor control. The pilot attempted corrective action with left rudder, but the aircraft kept on yawing in a clockwise direction (right yaw). Just before impact, he attempted to flare the helicopter, but the low rotor RPM warning sounded and a hard landing followed.

1.1.3 On impact, the skids, tail and main rotor blades impacted the ground and the helicopter rolled over to the right.

1.1.4 The tail rotor was found approximately 7 – 8 ft from where the helicopter impacted the ground.

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 aircraft sustained damage to the tail rotor assembly, tail boom, main rotor blades and the skids.

Figure 1: Damage to the helicopter

Figure 2: Damage to the tail rotor

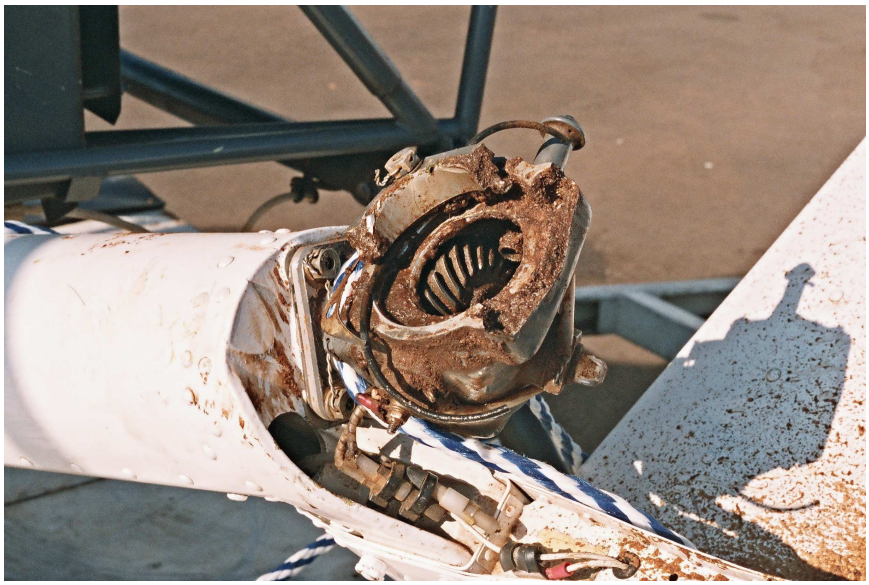

Figure 3: Damage to the tail rotor gearbox

1.4 Other Damage

1.4.1 No other damage was caused.

1.5 Personnel Information

Nationality	South African	Gender	Male	Age	50
Licence Number	**********	Licence Type	Private		
Licence valid	No	Type Endorsed	Yes		
Ratings	None				
Medical Expiry Date	29 April 2005				
Restrictions	Corrective lenses				
Previous Accidents	None				

Note:
The pilot's license was not valid at the time of the accident. The pilot's aviation medical certificate expired on 29 April 2005. The pilot forwarded a new medical certificate to the Air Safety Investigations Department, but the date on which the medical examination was conducted, is the same date as when the accident occurred, i.e. 24 May 2005.

Flying Experience:

Total Hours	391.2
Total Past 90 Days	57.2
Total on Type Past 90 Days	57.2
Total on Type	334

1.6 Aircraft Information

Airframe:

Type	Robinson R22 Beta	
Serial Number	2268	
Manufacturer	Robinson Helicopter Company	
Year of Manufacture	1992	
Total Airframe Hours (At Time of Accident)	1 519.9	
Last MPI (Hours & Date)	1 223.6	08 July 2003
Hours since Last MPI	296.3	
C of A (Issue Date)	28 March 2003	
C of R (Issue Date) (Present owner)	23 December 2004	
Operating Categories	Standard	

Note:
The Aircraft was not in possession of a valid Certificate of Airworthiness due to non-compliance with Part 43.02.01 and 43.02.08.

Engine:

Type	Lycoming O-360
Serial Number	L-6324-39A
Hours since New	2 123.4
Hours since Overhaul	296.3

Note:
A reconditioned/overhauled engine was installed in the aircraft after the aircraft sustained damage in a previous accident on 20 November 1994.

1.7 Meteorological Information

The pilot reported the following weather conditions:

Wind direction	South-east	Wind speed	5 – 10 kts	Visibility	Good
Temperature	22℃	Cloud cover	Clear	Cloud base	None
Dew point	Unknown				

1.8 Aids to Navigation

1.8.1 The aircraft was equipped with standard navigational equipment for this type of helicopter.

1.9 Communications

1.9.1 The aircraft was equipped with standard communicational equipment for this type of helicopter.

1.10 Aerodrome Information

1.10.1 The helicopter impacted rocky slate terrain.

1.11 Flight Recorders

1.11.1 The helicopter was not fitted with a cockpit voice recorder (CVR) nor a flight data recorder (FDR), and neither was required by regulations to be fitted to this type of helicopter.

1.12 Wreckage and Impact Information

1.12.1 The helicopter impacted rocky terrain approximately 1.5 km from a gravel road.

1.12.2 On impact with the terrain, the helicopter's main rotor blades made contact with the ground and the helicopter rolled over onto its right-hand side.

1.13 Medical and Pathological Information

1.13.1 The pilot did not hold a valid class 2 aviation medical certificate at the time of the accident. The medical certificate, which expired on 29 April 2005, had a medical restriction endorsed stating that the pilot must wear corrective lenses while flying.

1.14 Fire

1.14.1 There was no pre- or post-impact fire.

1.15 Survival Aspects

1.15.1 This was considered a survivable accident as the pilot and passenger were properly restrained with seatbelts at the time of the accident.

1.16 Tests and Research

1.16.1 The tail rotor gearbox assembly was sent for metallurgical analysis to determine whether there had been any pre-existing defects that could have contributed to the event (loss of tail rotor control) as described by the pilot.

1.16.2 The metallurgical report concluded that the tail rotor gearbox failed as a result of almost instantaneous brittle fracture caused by impact loading, most probably on impact with the ground. No evidence of gradual crack propagation was observed. Damage to the tail rotor blades implied that the tail rotor repeatedly hit a large, solid object. This impact probably resulted in the brittle failure of the gearbox.

Visual examination:

A photograph of the failed gearbox in the as-supplied condition is shown in Figure 4, and enlarged views of the fracture surfaces in Figures 5 (a) and (b). As demonstrated in Figure 5, the fracture surfaces are coarse and granular in appearance. Little plastic deformation is evident in the vicinity of the fracture sites (precluding ductile overload failure as fracture mode), and no evidence of gradual crack propagation (such as fatigue beach marks or localised discolouration of the fracture surface) was observed. These observations suggest that the gearbox failed as a result of brittle fracture under impact loading conditions.

Figure 4: The fractured tail rotor gearbox in the as-supplied condition. Magnification: approximately 0,35x.

Figure 5: Enlarged views of the fracture surfaces on the tail rotor gearbox. Magnification: approximately 0,85x.

All four bolts used to connect the gearbox to the tail rotor assembly were recovered in their original positions. Two of these bolts, shown in Figure 6 (a), appear virtually undamaged. As shown in Figure 5 (a), fracture of the gearbox also caused minimal damage to the screw thread in the corresponding bolt holes, and the fracture surface appears to be fairly symmetrical around the bolt holes. The remaining two bolts on the opposite side of the gearbox apparently underwent significant bending during the accident. One of these bolts is still intact, although severely bent (Figure 6 (b)), whereas the last bolt fractured (Figure 6 (c)). Examination of the fracture surface of this bolt confirms that it fractured only after significant bending had taken place.

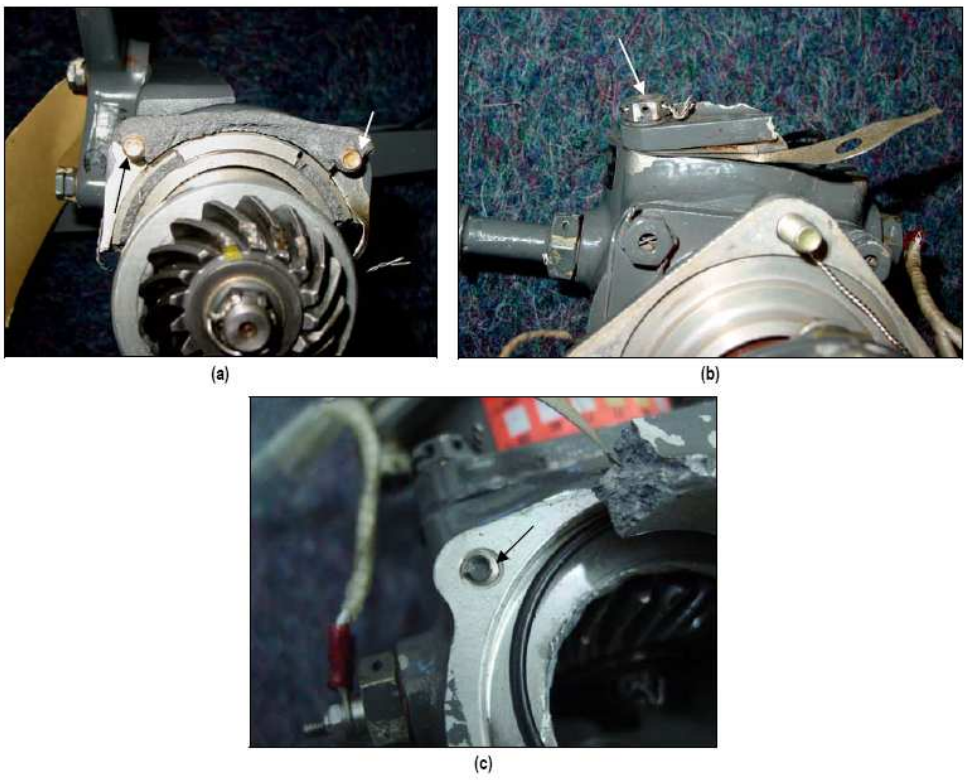

Figure 6: The bolts (highlighted by the arrows) used to connect the gearbox to the tail rotor assembly. Magnification: approximately 1x.

Since the crack propagated through the bolt holes shown in Figure 6(a), these bolts and the corresponding bolt holes incurred minimal damage. The remaining two bolts were apparently still in position when the two parts of the gearbox started separating subsequent to the brittle fracture, causing both bolts to bend. A number of the gear teeth were observed to be chipped, but no evidence of overheating or excessive abrasive wear damage was observed. This suggests that damage to the gear teeth was probably caused by debris created as a result of the brittle fracture of the gearbox.

Figure 7: Chipped gear teeth. Magnification: 0,7x.

The results of this examination suggest that the gearbox failure was caused by impact. Figures 8 (a) and (b) display photographs of the tail rotor in the as-supplied condition. Both blades are deformed and severely damaged, with most of the deformation concentrated near the ends. The damage observed appears to indicate that the blades experienced repeated impact with a hard, solid object. This impact probably caused the brittle failure of the alluminium gearbox, compounded by the low impact toughness of alluminum alloys in general. Unless the helicopter was involved in a midair collision, the results suggest that the impact damage occurred while the helicopter was on the ground or close to the ground during take-off or landing.

Figure 8: Damage observed on the tail rotor blades.
Magnification: approximately 0,26x.

1.17 Organisational and Management Information

1.17.1 This was a private flight. Game was being counted at another person's farm with a veterinarian on board the helicopter. The helicopter was the property of the pilot who flew the aircraft at the time of the accident. In terms of the Domestic Air Services Regulations, 1991, a G10 Air Service licence is required when counting game. No documentation was found to indicate that this operation was conducted under a (valid) Air Operators Certificate.

1.17.2 The aircraft maintenance organisation (AMO) that certified the last mandatory periodic inspection prior to the accident was in possession of a valid AMO approval, no. 830, with an expiry date of 31 July 2005. The SACAA conducted an audit on the AMO on 3 August 2004. One major finding and four minor findings were raised during the audit. However, the findings were resolved before the AMO approval was issued. A surveillance audit was conducted on the AMO on 13 July 2004.

1.18 Additional Information

1.18.1 Air Navigation Regulation 1976 Chapter 2.22 states:

Decrease in medical fitness

(3) If the holder of a licence, certificate or rating, who has been duly notified in terms of sub-regulation (1), fails without reasonable cause to undergo the medical examination on or before the date specified, his medical fitness shall be deemed to be below the standard required for the issue, reissue or renewal of that licence, certificate or rating and the provisions of sub-regulation (2) shall *mutatis mutandis* apply.

1.18.2 Civil Aviation Regulation of 1997 states:

Part 43.02.01 Aircraft maintenance schedules

(1) Each aircraft on the South African Civil Aircraft Register shall be maintained according to an approved aircraft maintenance schedule as prescribed in Regulation 43.02.8.

(2) The owner of an aircraft shall draw up, or have drawn up, a maintenance schedule for his or her aircraft in accordance with the provisions of Technical Standard 43.02.8 in Document SA-CATS-GMR.

(3) The owner or the responsible aircraft maintenance organisation shall submit the proposed maintenance schedule to the Commissioner for approval.

(4) Provided the proposed maintenance schedule meets all the requirements of Technical Standard 43.02.8, the Commissioner shall approve the proposed aircraft maintenance schedule either as submitted or as amended by him or her in the interest of aviation safety.

(5) The owner may request the Commissioner for a permanent or temporary amendment to the approved aircraft maintenance schedule.

(6) Notwithstanding the provisions of sub-regulations (1) to (5), the owner of a non-type certificated aircraft, operated in terms of Part 94 of these Regulations, may be exempted from the need to submit an aircraft maintenance schedule for approval to the Commissioner, provided he or she maintains his or her aircraft in accordance with the provisions of Part 24 and Part 94.

Part 43.02.8 Mandatory inspections

(1) Mandatory tests and inspections shall be carried out in accordance with the approved maintenance schedule for a particular aircraft at the prescribed times or intervals.

(2) Mandatory inspections include:
   (a) for aeroplanes with a maximum certificated mass of 5 700 kg or less or a maximum approved passenger seating configuration of not more than 9 seats, and for helicopters with a maximum certificated mass of 3 175 kg or a maximum approved passenger seating configuration of not more than 9 seats, either:
      (i) a mandatory periodic inspection; or
      (ii) inspections in accordance with an approved progressive inspection programme;
   (b) for any aircraft, other than those referred to in paragraph (a), the approved maintenance schedule for the particular category and type of aircraft at the intervals prescribed by the schedule.

(3) An aircraft referred to in sub-regulation (2)(a)(i) that has not accumulated 100 hours within 12 months since its last inspection shall undergo a mandatory periodic inspection before being released to service.

(4) An aircraft referred to in sub-regulation (2)(a)(ii) that has not completed its progressive inspection programme within the period specified by the manufacturer or the Commissioner shall undergo the remainder of the progressive inspection programme before being released to service.

(5) The maintenance schedules referred to in sub-regulation (1) are defined in Document SA-CATS-GMR.

1.18.4 Domestic Air Services Regulations, 1991

Classes of air services

(1) The council shall issue a licence in respect of any of the following classes of air services:
   (a) Class I – scheduled public air transport service;
   (b) Class II – non-scheduled public air transport service;
   (c) Class III – general air service.

(2) An air carrier's licence, which shall in terms of section 33(1) of the Act be deemed to be an air service licence issued in terms of the Act, shall:
   (a) in the case of a Class I air carrier's licence as contemplated in regulation 3 of the Civil Air Services Regulations, 1964, published under Government Notice No. R.449 of 20 March 1994 be deemed to be a Class I air service licence;
   (b) in the case of a Class II air carrier's licence as contemplated in regulation 3 of the Civil Air Services Regulations, 1964, published under Government Notice No. R.449 of 20 March 1964, be deemed to be a Class II air service licence; and

(c) in the case of a Class III and a Class IV air carrier's licence as contemplated in regulation 3 of the Civil Air Services Regulations, 1964, published under Government Notice No. R.449 of 20 March 1964 be deemed to be a Class III air service licence.

Types of air services

(3) The types of air services are:
(c) in respect of a Class III licence:
(x) type G10: game and livestock selection, culling, counting and herding.

Categories of aircraft

(4) The categories of aircraft are:
(f) category H2: any single-engine helicopter.

1.19 Useful or Effective Investigation Techniques

1.19.1 None considered necessary.

2. ANALYSIS

2.1 According to available information, the pilot, accompanied by a passenger (a veterinarian), was busy counting game on a farm near the town of Kakamas in the Northern Cape. While counting the game at a height of 100 – 200 ft AGL, the pilot conducted a tight right-hand turn to follow a Gemsbok that left the herd, when according to him, he suddenly lost tail rotor control and a hard landing followed.

2.2 The pilot stated that he had had a tail rotor gearbox failure. The tail rotor gearbox was sent for metallurgical analysis to determine the failure mode. The metallurgical report concluded that the tail rotor gearbox failed as a result of almost instantaneous brittle fracture caused by impact loading, most probably on impact with the ground. The report further concluded that no evidence of gradual crack propagation was observed. Damage to the tail rotor blades implied that the tail rotor repeatedly hit a solid object. This impact probably resulted in the brittle failure of the gearbox and, unless the helicopter was involved in a midair collision, the results suggest that the impact damage most probably occurred while the helicopter was being operated in close proximity to the ground.

2.3 The pilot indicated that he was performing a tight right-hand turn when he lost tail rotor control; however, evidence indicated that the tail rotor stabiliser sustained no damage. Therefore, it would appear that the pilot manoeuvred the helicopter in close proximity to the ground and was not, as he stated, at an altitude of 100 – 200 ft AGL. Furthermore, he most probably allowed the tail rotor blades to make contact with a solid object on the ground or an object protruding from the ground, as evidenced by the damage on the tail rotor blades and separation/failure at the tail rotor gearbox. The pilot was unable to control the helicopter following the

event and it impacted with the ground and rolled over. If the pilot lost tail rotor control at a height of 100 – 200 ft AGL, as he stated, then it would have been highly unlikely that the tail rotor would have been found so close to the main wreckage (7 – 8 ft).

2.4 It would further appear that the pilot, who was also the owner of the helicopter, had little regard for safety. He was not in possession of a valid pilot license at the time of the accident. He flew a helicopter that was not airworthy at the time of the accident. He appears to have been operating without the appropriate license required by the Air Services Licensing Act section 12 and the Domestic Air Services Regulations 1991, Regulations 2 – 5. It should be noted that the pilot forwarded a new medical certificate to the Air Safety Investigations Department, but the date on which the medical examination was conducted, is questionable, as it is the same date as when the accident occurred, which was 24 May 2005.

3. CONCLUSION

3.1 Findings

3.1.1 The pilot's license was not valid at the time of the accident. (ANR Chapter 2.22)

3.1.2 The aircraft was not airworthy at the time of accident. (CAR Part 43.02.01 and Part 43.02.08), due to the fact that, according to available records, an MPI had not been carried out every 100 hours.

3.1.3 The pilot was operating without a Domestic Air Services licence. (Domestic Air Services Regulations, Regulations 2 – 5)

3.1.4 The aircraft sustained damage to the airframe, main rotor blades, tail rotor gearbox and tail rotor blades.

3.1.5 The tail rotor gearbox was sent for metallurgical analysis and the metallurgical report concluded that the tail rotor gearbox failed as a result of almost instantaneous brittle fracture caused by impact loading.

3.2 Probable Cause/s

3.2.1 The tail rotor most probably made contact with an obstacle while the pilot was manoeuvring in close proximity to the ground, and a hard landing followed.

4. SAFETY RECOMMENDATIONS

4.1 It is recommended that the Commissioner for Civil Aviation take action to enhance safety oversight in respect of helicopter game operations to prevent non-compliances with regard to the following:

1. Flying of a helicopter without a valid license. (ANR Chapter 2.22)
2. Flying a helicopter without a valid Certificate of Airworthiness. (CAR Part 43.02.01 and Part 43.02.08)

3. Provision of a service without being the holder of a valid Air Operator's Certificate. (Domestic Air Services Regulations 2 – 5.)

4.2 It is recommended that the regulations pertaining to a culling and livestock rating be reviewed to be brought in line with the types of Air Services licences issued, with specific emphasis on G10 type licences and services where herding and counting of livestock are included. The rating given to pilots does not address these.

5. APPENDICES

5.1 None

-END-

Report reviewed and amended by Office of the EM: AIID 17 March 2009