AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	**CA18/2/3/8902**		
Aircraft Registration	**ZS-RVA**	**Date of Accident**	25 February 2011		**Time of Accident**	1236Z	
Type of Aircraft	Robinson R44 Ravin II		**Type of Operation**		Aerial Survey / Observation		
Pilot-in-command Licence Type		Commercial	**Age**	44	**Licence Valid**	Yes	
Pilot-in-command Flying Experience		Total Flying Hours	4300		Hours on Type	350	
Last point of departure	Cape Town International Airport (FACT)						
Next point of intended landing	Cape Town International Airport (FACT)						
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)							
Near Paardevlei at a position recorded as S 34° 05' 29.98" & E 018° 48' 26.78							
Meteorological Information							
Number of people on board	1+1	**No. of people injured**	2	**No. of people killed**	0		

Synopsis

On 25 February 2011, the pilot accompanied by a passenger, took-off from Cape Town International Aerodrome to near Paardevlei where trials were conducted for the testing of Radar equipment. During one of the trials, a witness heard a loud noise coming from the helicopter just before it crashed during daytime conditions.

The occupants sustained serious injuries and the helicopter was destroyed during the accident sequence.

The pilot was licensed and qualified for the flight in accordance with existing regulation and held a valid medical certificate.

The weather did not contribute to this accident.

The aircraft was equipped with standard navigation- and communicational equipment as per the minimum equipment list approved by the regulator for the aircraft type with no recorded defects prior to the flight.

The flex plate on the fwd coupling failed in fatigue during flight. Metallurgical analysis of the fracture surface showed definite signs of fatigue. The origin is unsure as it started slightly off from the hole underneath the washer contact surface. No clear signs of corrosion induced pitting could be detected that may have resulted in the initiation of the crack. Nor was any other material related discrepancies noted. It was considered possible that the bolt / nut might have been over-torqued which may have resulted in crack formation, most probably due to the resultant work hardening of the base material in the area of the contact surfaces, thus leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on the surface. At the initiation point, a nick mark is present, together with a reduction in thickness. It would appear that the nick mark had a stress-raising result. The maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures. However, the above scenario points to probable inferior maintenance.

The operator was in possession of a valid Part 127 Air Operator Certificate (AOC) and the aircraft maintenance organization (AMO) was duly certified to carry out the required maintenance on the helicopter. The helicopter was maintained, as required by the manufacturer and the regulator.

Probable Cause			
Cause(s) Uncontrollability of the helicopter after the failure of the flex plate on the forward flex coupling. Contributing Factor(s) Maintenance Manual unclear on correct maintenance procedures Probable inferior maintenance.			
IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator	**:** Base 4 Helicopters
Manufacturer	**:** Robinson Helicopter Company
Model	**:** R44 II
Nationality	**:** South African
Registration Marks	**:** ZS-RVA
Place	**:** Paardevlei – Western Cape
Date	**:** 25 February 2011
Time	**:** 1236Z

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

Purpose 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****.*

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1. FACTUAL INFORMATION

1.1 History of the Flight

1.1.1 On 25 February 2011, the pilot accompanied by a passenger, took-off from Cape Town International Aerodrome for a flight to a site of AECI (Africa Explosive Company International) near Paardevlei. The purpose of the flight was to conduct trials for the testing of Radar equipment. See paragraph 1.18.1 for more detail.

1.1.2 At approximately 1236Z, during one of the trials a witness heard a loud noise coming from the helicopter just before it crashed into the ground during daytime conditions at a position recorded as S 34° 05' 29.98" & E 018° 48' 26.78".

Figure 1: Aerial view of the area where the accident occurred

1.2 Injuries to persons

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

1.3 Damage to aircraft

1.3.1 The helicopter was destroyed during the accident sequence.

Figure 2: View of the wreckage after the accident

1.4 Other damage

1.4.1 There was no other damage.

1.5 Personnel information

1.5.1 Pilot-in-Command

Nationality		South Africa			
Licence No	**********	Gender	Male	Age	44
Licence valid		Yes	Type Endorsed	Yes	
Ratings		Instrument from 8 Jan 2011 - 31 Jan 2012 Flight Instructor Gr ii from 8 Jan 2011 – 31 Jan 2014			
Medical Expiry Date		30 November 2011			
Restrictions		Corrective lenses			
Previous Accidents		Nil			

1.5.2 Flying Experience:

Total Hours: Helicopter Aeroplane	1200 3100
Total Past 90 Days	40
Total on Type Past 90 Days	40
Total on Type	350

1.6 Aircraft information

1.6.1 Airframe:

Type	R44 II	
Serial No.	10076	
Manufacturer	Robinson Helicopter Company	
Date of Manufacture	R44 11 Klipper	
Total Airframe Hours (At time of Accident)	1778.4	
Last MPI (Mandatory Periodic Inspection) (Date & Time)	19 August 2010	1682.5
Hours since Last MPI	95.9	
C of A (Issue Date)	9 March 2005 Expiry date: 8 March 2011	
C of R (Issue Date) (Present owner)	21 June 2010	
Operating Categories	Standard Part 127	

1.6.2 Engine:

Type	Lycoming IO-540AE1A5
Serial No.	L-28629-43A
Hours since New	1682.5
Hours since Overhaul	TBO not reached

1.6.3 Fuel:

Type of fuel used	Avgas 100LL
Fuel on board (litres)	Empty Fuel tanks were ruptured during the accident sequence
Fuel distribution in tanks	Main tank ruptured during accident sequence and the auxiliary tank drained into the main tank

1.7 Meteorological information

1.7.1 According to the official weather report obtained from the South African Weather Service, the following conditions prevailed at FACT (Cape Town International Aerodrome) at the time of the accident.

Wind direction	180°	Wind speed	23 kts	Visibility	Good
Temperature	25℃	Cloud cover	Nil	Cloud base	N/A
Dew point	18℃	FACT 251230Z 18023KT 9999 FEW025 25/18 Q1012 NOSIG=			

1.8 Aids to navigation

1.8.1 The aircraft was equipped with standard navigation equipment as per the minimum equipment list approved by the regulator for the aircraft type with no recorded defects prior to the flight.

1.9 Communications

1.9.1 The aircraft was equipped with standard communication equipment as per the minimum equipment list approved by the regulator for the aircraft type with no reported defects prior to the flight and no recorded communication prior or during the flight.

1.10 Aerodrome information

1.10.1 The accident occurred near Somerset West.

Accident Site Location	Near Somerset West
Accident Site Co-ordinates	S 34° 05' 29.98" E 018° 48' 26.78"
Accident Site Elevation	50 ft
Accident Site Surface	Grass / Ground

1.11 Flight recorders

1.11.1 The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR) nor was it required by the relevant aviation regulations.

1.12 Wreckage and impact information

1.12.1 The area where the accident occurred comprised mainly of sand.

Figure 3: The area of the accident site - combination of grass & Ground

1.12.2 The wreckage area was confined to the initial impact marks made by the skids and the main wreckage on its' left-hand side.

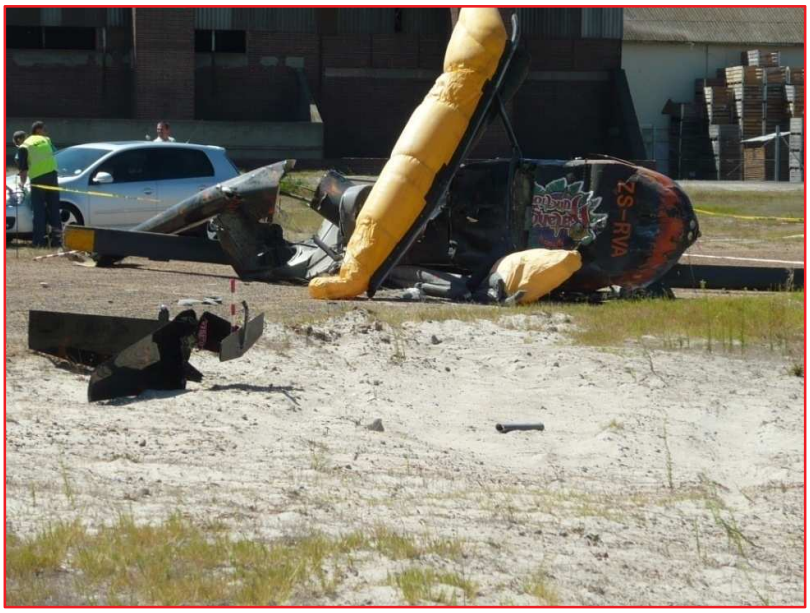

Figure 4: The wreckage area of the accident site

1.12.3 Final portion of flight path

Figure 5: General view of the approach path to the crash site

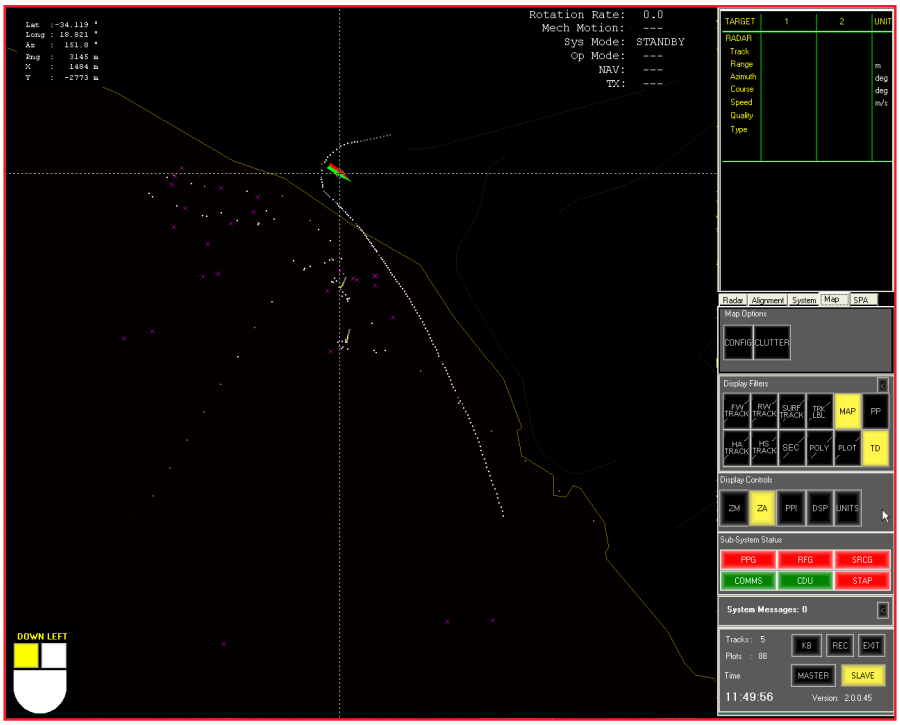

Figure 6: This picture shows the flight path relative to the radar

1.12.4 Impact occurred in a north-eastern direction, with a high rate-of-decent in a nose-up attitude whilst in a slight right-hand turn. The impact marks of the skids were approximately 15m from the main wreckage.

1.12.5 The flight profile of the helicopter just prior to the accident was obtained from the DGPS that was on board the helicopter at the time of the accident flight. The DGPS data is accurate to within 30 cm when post processed as a Differential GPS (DGPS).

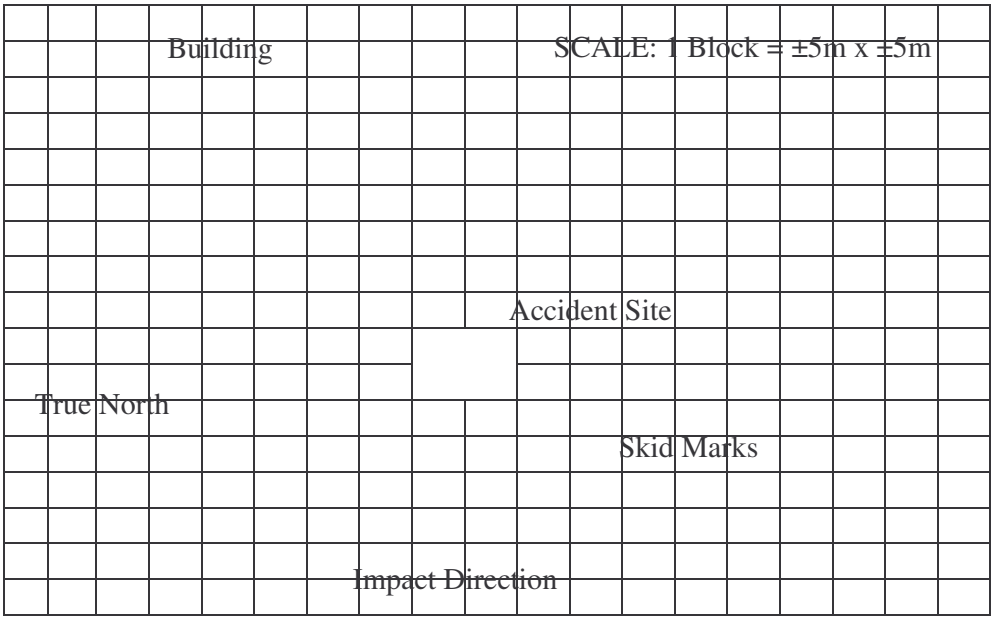

Figure 7: Wreckage Diagram

1.12.6 The flex plate on the fwd coupling failed in fatigue during flight. There after the main fuel tank, the firewall and various pipes were ruptured in the direct vicinity of the coupling by the coupling.

Figure 8: Damage caused by the Flex Plate

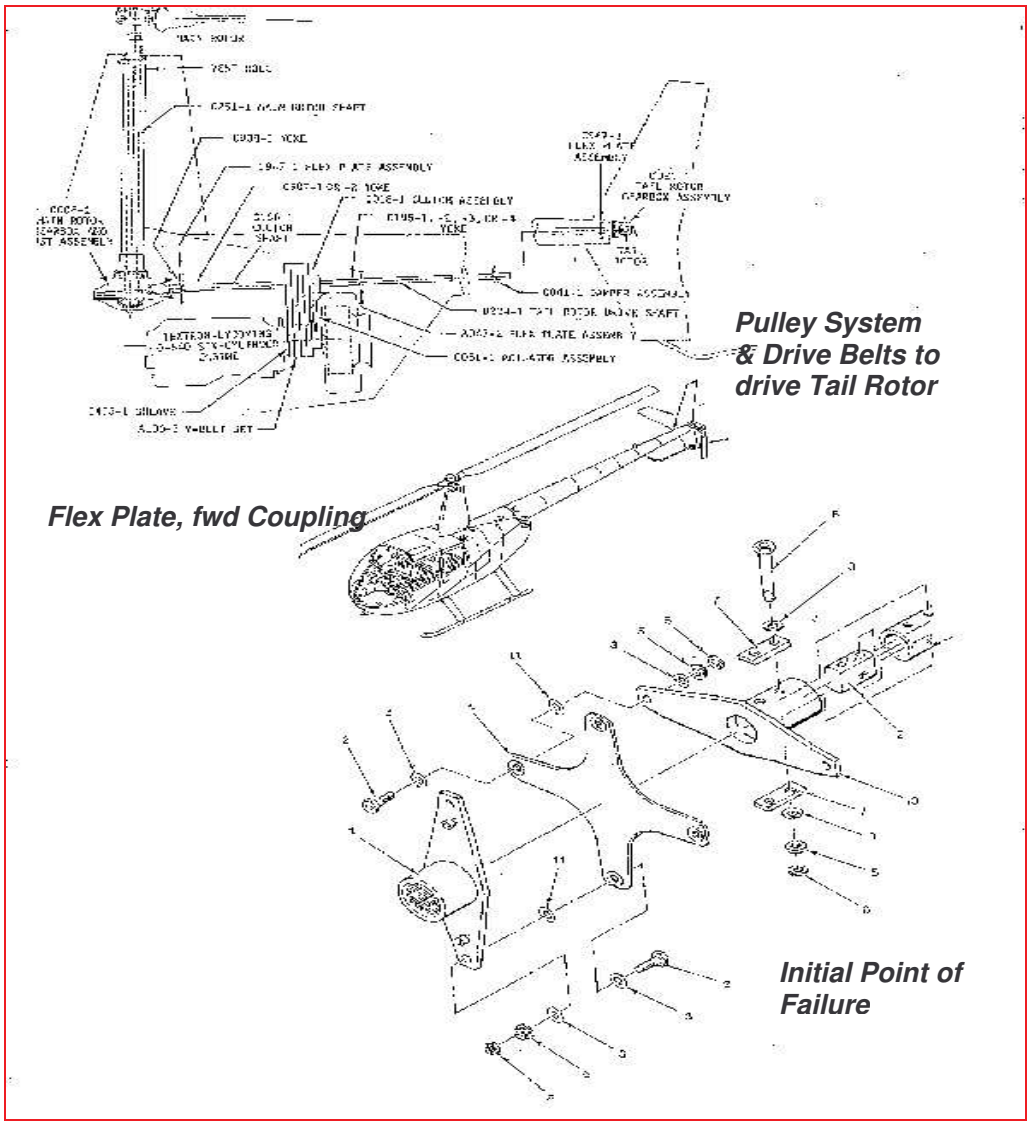

Figure 9: Affected components

1.12.6 Flex Plate Failure – Fwd Coupling

1.12.6.1 The Flex Plate, which failed in fatigue, is a component from the fwd coupling. The purpose of the fwd coupling is to transfer torsion power from the engine to the main rotor gearbox through a pulley system and drive shaft. (See fig 9)

1.12.6.2 When the coupling failed, it was out of balance and caused the drive belts to come off from the pulley system, which also drives the drive shaft to the tail rotor. This resulted in the tail rotor also stopping while the engine was still running. (See fig 9)

1.13 Medical and pathological information

1.13.1 There was no evidence that physiological factors or incapacitation affected the performance of the pilot.

1.14 Fire

1.14.1 There was no evidence of fire in flight or after the impact.

1.15 Survival aspects

1.15.1 The pilot sat in the right-hand seat and the passenger in the left-hand seat at the time of the accident.

1.15.2 Both the front seats collapsed downwards due to the high vertical impact forces as result of the high rate of decent.

1.15.3 Both occupants wore safety harnesses and none of these failed.

1.15.4 The helicopter was equipped with floats, which deployed as result of the high impact forces resulting from the high rate of decent.

1.15.5 The impact was absorbed largely with the front seats collapsing downwards, both occupants wearing safety harnesses, which did not fail, and the floats that deployed on impact, which made the accident survivable.

1.16 Tests and research

1.16.1 Metallurgical analysis of the fracture surface of the Flex Plate showed definite signs of fatigue. The origin is unsure as it started slightly off from the hole underneath the washer contact surface. No clear signs of corrosion induced pitting could be detected that may have resulted in the initiation of the crack. Nor was any other material related discrepancies noted.

1.16.2 It was considered possible that the bolt / nut might have been over-torqued which may have resulted in crack formation, most probably due to the resultant work hardening of the base material in the area of the contact surfaces, thus leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on

the surface.

1.16.3 At the initiation point, a nick mark is present, together with a reduction in thickness. It would appear that the nick mark had a stress-raising result.

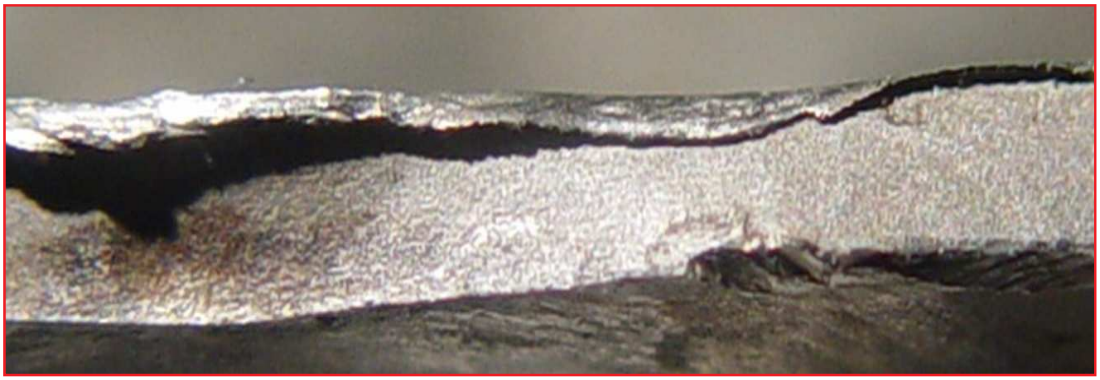

Figure 10: The figure above shows the fractured surface of the flex plate. The arrows indicate the area of reduction in thickness and the nick mark.

1.17 Organizational and management information

1.17.1 Operator:

1.17.1.1 The operator was in possession of a valid Part 127 Air Operator Certificate (AOC), effective 10 December 2010 until 9 December 2011.

1.17.2 Maintenance:

1.17.2.1 The aircraft maintenance organization (AMO) maintaining the aircraft was duly certified to carry out the required maintenance on the helicopter and was in possession of a valid AMO certificate which expires on 31 October 2011.

1.18 Additional information

1.18.1 The objective of the test was to confirm helicopter classification. On the return run to the west the helicopter descends to 300' once past Lourensriver and flies along the beach. Once abeam the radar, the helicopter commences a 180° orbit around the radar site (at 150m from the container) at around 40kts. This part of the test is to confirm the minimum range of the radar (0.1 nm). Once the minimum range to the radar is confirmed, to the North West of the radar, the helicopter climbs out to 1000' to repeat the process. This orbit around the container is carried out over an open space.

1.18.2 The DGPS on board the helicopter at the time of the accident was used to determine the flight profile of the helicopter just prior to the accident. The DGPS data is accurate to within 30 cm when post processed as a Differential GPS (DGPS).

1.19 Useful or effective investigation techniques

1.19.1 Not applicable.

2. ANALYSIS

2.1 The pilot accompanied by a passenger, took-off from Cape Town International Aerodrome to near Paardevlei where trials were conducted for the testing of Radar equipment. During one of the trials, a witness heard a loud noise coming from the helicopter just before it crashed during daytime conditions.

2.2 The occupants sustained serious injuries and the helicopter was destroyed during the accident sequence.

2.3 The pilot was correctly licensed and rated on the aircraft type to conduct the flight and was the holder of a valid medical certificate.

2.4 The weather did not contribute to this accident.

2.5 The aircraft was equipped with standard navigation- and communicational equipment as per the minimum equipment list approved by the regulator for the aircraft type with no recorded defects prior to the flight.

2.6 The aircraft was not equipped with a flight data recorder or a cockpit voice recorder nor was it required by the relevant aviation regulations.

2.7 The flex plate on the fwd coupling failed in fatigue during flight. Metallurgical analysis of the fracture surface showed definite signs of fatigue. The origin is unsure as it started slightly off from the hole underneath the washer contact surface. No clear signs of corrosion induced pitting could be detected that may have resulted in the initiation of the crack. The maintenance manual requires that the flex plate must be inspected around the bolt hole area for cracks, corrosion and fretting. However, it looks like the crack initiated underneath the washer and was not detected. No material related discrepancies were noted. It was considered possible that the bolt / nut might have been over-torqued which may have resulted in crack formation, most probably due to the resultant work hardening of the base material in the area of the contact surfaces, thus leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on the surface. At the initiation point, a nick mark is present, together with a reduction in thickness. It would appear that the nick mark had a stress-raising result. According to the aircraft documentation, the aircraft was maintained as required by the manufacturer and the regulator, however, the above scenario points to inferior maintenance.

2.8 The operator was in possession of a valid Part 127 Air Operator Certificate (AOC), effective 10 December 2010 until 9 December 2011 and the aircraft maintenance organization (AMO) maintaining the aircraft was duly certified to carry out the required maintenance on the helicopter and was in possession of a valid AMO certificate expiring on 31 October 2011. The helicopter was maintained, as required by the manufacturer and the regulator.

3. CONCLUSIONS

3.1 Findings

3.1.1 On 25 February 2011, the pilot accompanied by a passenger, took-off from Cape Town International Aerodrome to near Paardevlei where trials were conducted for the testing of Radar equipment. During one of the trials, a witness heard a loud noise coming from the helicopter just before it crashed during daytime conditions.

3.1.2 The occupants sustained serious injuries and the helicopter was destroyed during the accident sequence.

3.1.3 The pilot was licensed and qualified for the flight in accordance with existing regulation and was the holder of a valid medical certificate.

3.1.4 The weather did not contribute to this accident.

3.1.5 The aircraft was equipped with standard navigation- and communicational equipment as per the minimum equipment list approved by the regulator for the aircraft type with no recorded defects prior to the flight.

3.1.6 The flex plate on the fwd coupling failed in fatigue during flight. Metallurgical analysis of the fracture surface showed definite signs of fatigue. The origin is unsure as it started slightly off from the hole underneath the washer contact surface. No clear signs of corrosion induced pitting could be detected that may have resulted in the initiation of the crack. The maintenance manual requires that the flex plate must be inspected around the bolt hole area for cracks, corrosion and fretting. However, it looks like the crack initiated underneath the washer and was not detected. No material related discrepancies were noted. It was considered possible that the bolt / nut might have been over-torqued which may have resulted in crack formation, most probably due to the resultant work hardening of the base material in the area of the contact surfaces, thus leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on the surface. At the initiation point, a nick mark is present, together with a reduction in thickness. It would appear that the nick mark had a stress-raising result. The maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures. However, the above scenario points to probable inferior maintenance.

3.1.7 The operator was in possession of a valid Part 127 Air Operator Certificate (AOC), effective 10 December 2010 until 9 December 2011 and the aircraft maintenance organization (AMO) maintaining the aircraft was duly certified to carry out the required maintenance on the helicopter and was in possession of a valid AMO certificate expiring on 31 October 2011. The helicopter was maintained, as required by the manufacturer and the regulator.

3.2 Causes

3.2.1 Uncontrollability of the helicopter after the failure of the flex plate on the forward flex coupling.

3.3 Contributing Factor(s)

3.3.1 Probable inferior maintenance.

3.3.2 Maintenance manual unclear on procedures

4. SAFETY RECOMMENDATIONS

In the interests of Aviation Safety, it is recommended that an urgent MAN (Mandatory Aeronautical Notice) be issued to: ***(Approved by DCA on 18 March 2011).***

4.1 Ground ALL South African registered Robinson R44 and R22 helicopters with immediate effect pending a proper inspection of the forward flex plates before any further flight.

4.2 That the Airworthiness section of the SACAA, compile an inspection procedure / method to carry out this inspection. The method used should either be NDT or as per inspection intervals.

APPENDICES

Metallurgical report:

I analysed the fracture surface from the input shaft - there is definitively signs of fatigue (see photo underneath) - the origin is slightly baffling as it usually starts in the bolt holes. In this case, slightly of from the hole underneath the washer contact surface. I could not detect any clear signs of corrosion induced pitting that may have resulted in the initiation of the crack. Nor did I noted any other material related discrepancies, up to now. The other possibilities are, based on the current results, possible over-torque of the bolt/nut that may have resulted in crack formation, most probably due to the resultant work-hardening of the base material in the area of the contact surfaces, this leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on the surface. I noted some reduction in thickness as well. Also, there seems to be a 'nick-mark (see photo) at the initiation point that could have had the same stress-raising result.

C.J.C. Snyman

Physical Metallurgist
Aircraft Accident Investigator
Ionising Radiation Protection Officer

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	**CA18/2/3/8902**		
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Last point of departure	Cape Town International Airport (FACT)						
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Near Paardevlei at a position recorded as S 34° 05' 29.98" & E 018° 48' 26.78							
Meteorological Information							
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Synopsis

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The weather did not contribute to this accident.

The aircraft was equipped with standard navigation- and communicational equipment as per the minimum equipment list approved by the regulator for the aircraft type with no recorded defects prior to the flight.

The flex plate on the fwd coupling failed in fatigue during flight. Metallurgical analysis of the fracture surface showed definite signs of fatigue. The origin is unsure as it started slightly off from the hole underneath the washer contact surface. No clear signs of corrosion induced pitting could be detected that may have resulted in the initiation of the crack. Nor was any other material related discrepancies noted. It was considered possible that the bolt / nut might have been over-torqued which may have resulted in crack formation, most probably due to the resultant work hardening of the base material in the area of the contact surfaces, thus leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on the surface. At the initiation point, a nick mark is present, together with a reduction in thickness. It would appear that the nick mark had a stress-raising result. The maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures. However, the above scenario points to probable inferior maintenance.

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Probable Cause			
Cause(s) Uncontrollability of the helicopter after the failure of the flex plate on the forward flex coupling. Contributing Factor(s) Maintenance Manual unclear on correct maintenance procedures Probable inferior maintenance.			
IARC Date		Release Date	

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator	**:** Base 4 Helicopters
Manufacturer	**:** Robinson Helicopter Company
Model	**:** R44 II
Nationality	**:** South African
Registration Marks	**:** ZS-RVA
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1.1 History of the Flight

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1.1.2 At approximately 1236Z, during one of the trials a witness heard a loud noise coming from the helicopter just before it crashed into the ground during daytime conditions at a position recorded as S 34° 05' 29.98" & E 018° 48' 26.78".

Figure 1: Aerial view of the area where the accident occurred

1.2 Injuries to persons

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

1.3 Damage to aircraft

1.3.1 The helicopter was destroyed during the accident sequence.

Figure 2: View of the wreckage after the accident

1.4 Other damage

1.4.1 There was no other damage.

1.5 Personnel information

1.5.1 Pilot-in-Command

Nationality		South Africa			
Licence No	**********	Gender	Male	Age	44
Licence valid		Yes	Type Endorsed	Yes	
Ratings		Instrument from 8 Jan 2011 - 31 Jan 2012 Flight Instructor Gr ii from 8 Jan 2011 – 31 Jan 2014			
Medical Expiry Date		30 November 2011			
Restrictions		Corrective lenses			
Previous Accidents		Nil			

1.5.2 Flying Experience:

Total Hours: Helicopter Aeroplane	1200 3100
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1.7 Meteorological information

1.7.1 According to the official weather report obtained from the South African Weather Service, the following conditions prevailed at FACT (Cape Town International Aerodrome) at the time of the accident.

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Temperature	25℃	Cloud cover	Nil	Cloud base	N/A
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1.10.1 The accident occurred near Somerset West.

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Accident Site Surface	Grass / Ground

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1.12.1 The area where the accident occurred comprised mainly of sand.

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1.12.2 The wreckage area was confined to the initial impact marks made by the skids and the main wreckage on its' left-hand side.

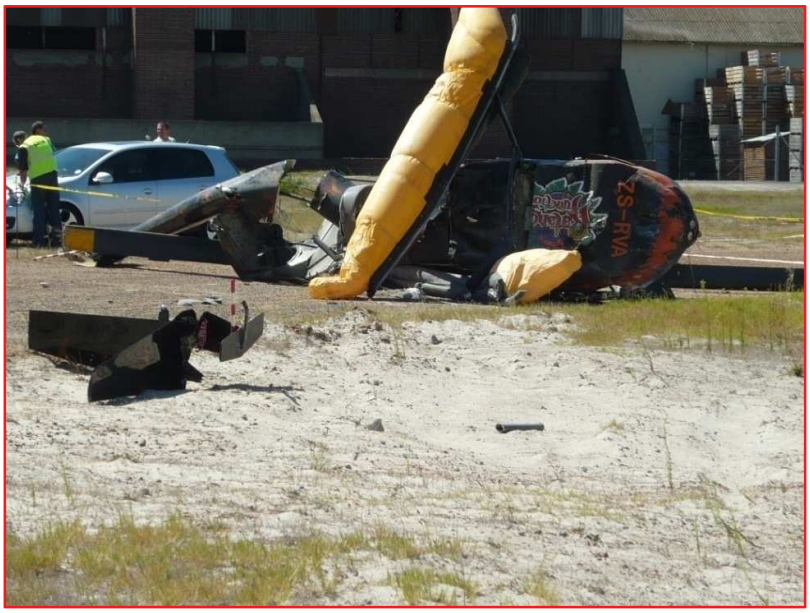

Figure 4: The wreckage area of the accident site

1.12.3 Final portion of flight path

Figure 5: General view of the approach path to the crash site

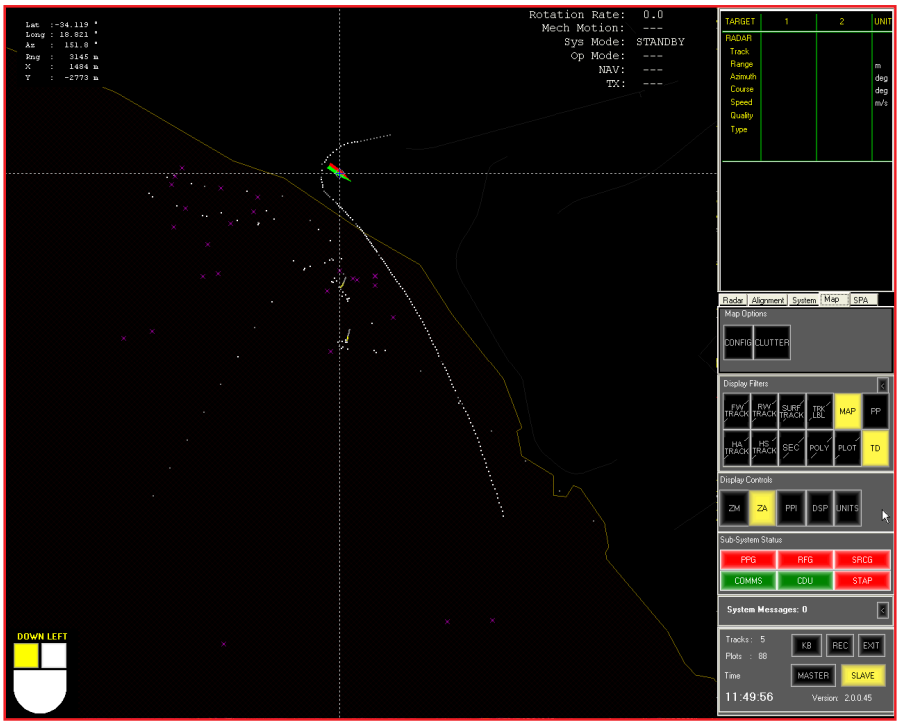

Figure 6: This picture shows the flight path relative to the radar

1.12.4 Impact occurred in a north-eastern direction, with a high rate-of-decent in a nose-up attitude whilst in a slight right-hand turn. The impact marks of the skids were approximately 15m from the main wreckage.

1.12.5 The flight profile of the helicopter just prior to the accident was obtained from the DGPS that was on board the helicopter at the time of the accident flight. The DGPS data is accurate to within 30 cm when post processed as a Differential GPS (DGPS).

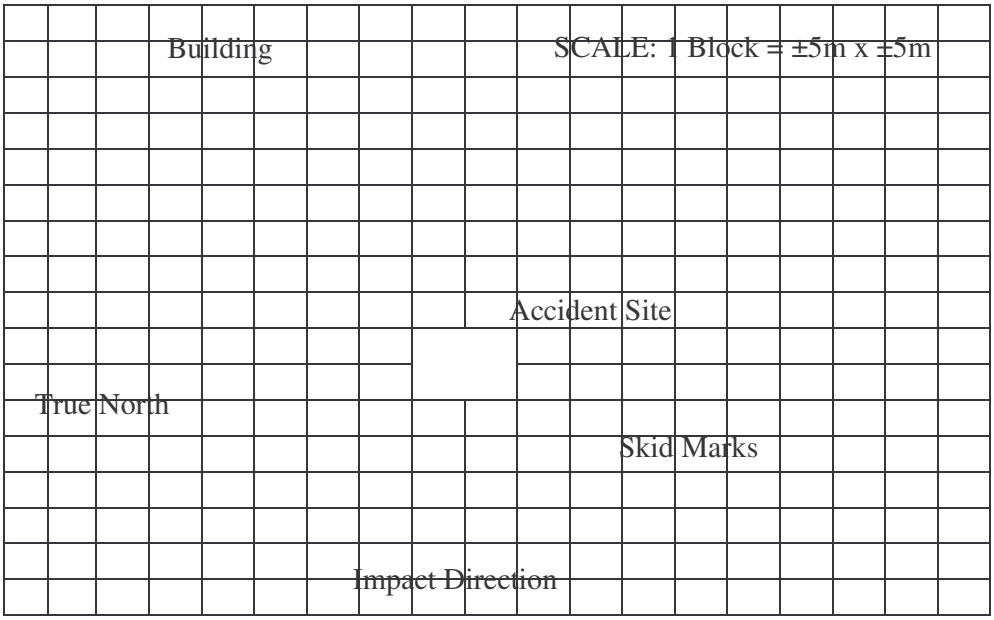

Figure 7: Wreckage Diagram

1.12.6 The flex plate on the fwd coupling failed in fatigue during flight. There after the main fuel tank, the firewall and various pipes were ruptured in the direct vicinity of the coupling by the coupling.

Figure 8: Damage caused by the Flex Plate

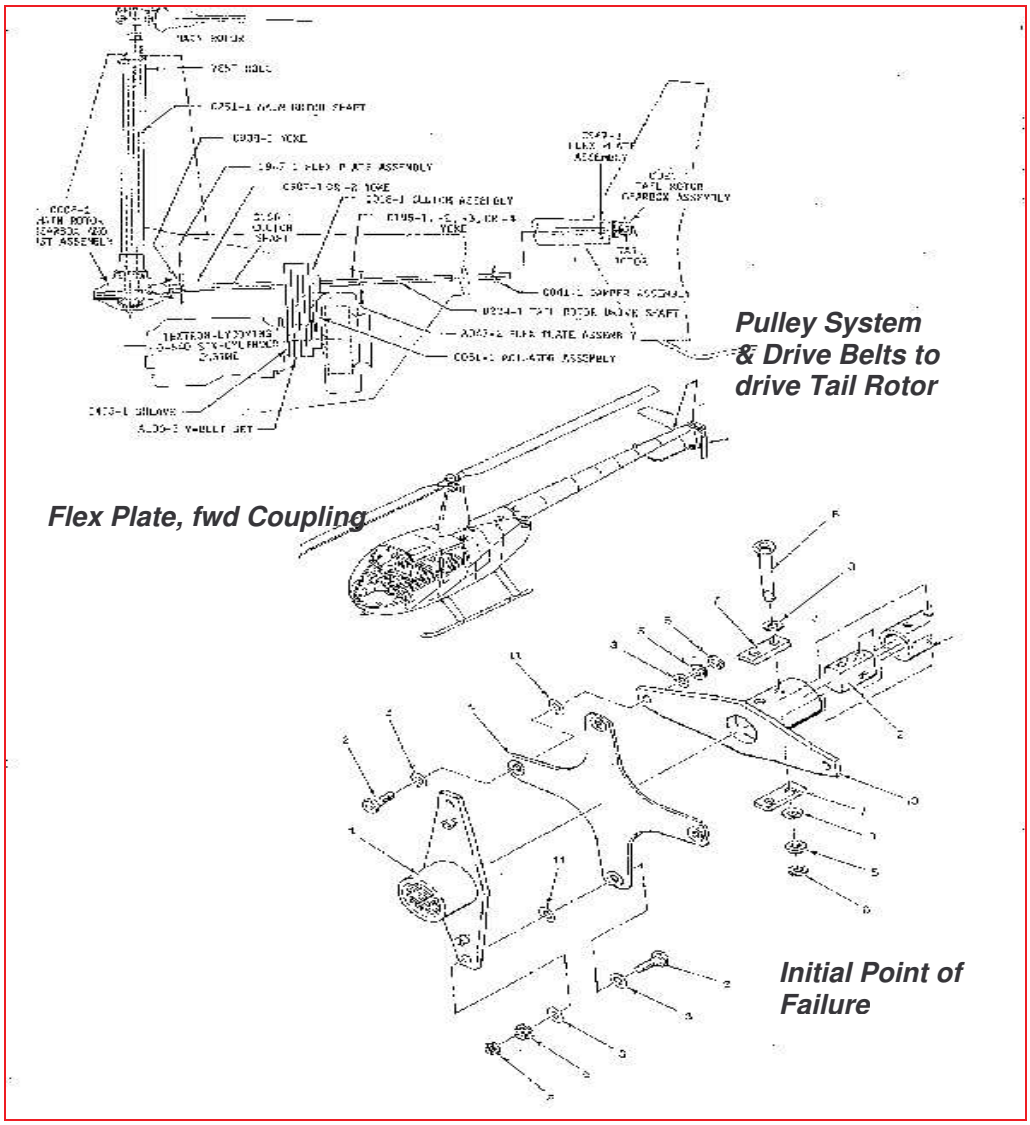

Figure 9: Affected components

1.12.6 Flex Plate Failure – Fwd Coupling

1.12.6.1 The Flex Plate, which failed in fatigue, is a component from the fwd coupling. The purpose of the fwd coupling is to transfer torsion power from the engine to the main rotor gearbox through a pulley system and drive shaft. (See fig 9)

1.12.6.2 When the coupling failed, it was out of balance and caused the drive belts to come off from the pulley system, which also drives the drive shaft to the tail rotor. This resulted in the tail rotor also stopping while the engine was still running. (See fig 9)

1.13 Medical and pathological information

1.13.1 There was no evidence that physiological factors or incapacitation affected the performance of the pilot.

1.14 Fire

1.14.1 There was no evidence of fire in flight or after the impact.

1.15 Survival aspects

1.15.1 The pilot sat in the right-hand seat and the passenger in the left-hand seat at the time of the accident.

1.15.2 Both the front seats collapsed downwards due to the high vertical impact forces as result of the high rate of decent.

1.15.3 Both occupants wore safety harnesses and none of these failed.

1.15.4 The helicopter was equipped with floats, which deployed as result of the high impact forces resulting from the high rate of decent.

1.15.5 The impact was absorbed largely with the front seats collapsing downwards, both occupants wearing safety harnesses, which did not fail, and the floats that deployed on impact, which made the accident survivable.

1.16 Tests and research

1.16.1 Metallurgical analysis of the fracture surface of the Flex Plate showed definite signs of fatigue. The origin is unsure as it started slightly off from the hole underneath the washer contact surface. No clear signs of corrosion induced pitting could be detected that may have resulted in the initiation of the crack. Nor was any other material related discrepancies noted.

1.16.2 It was considered possible that the bolt / nut might have been over-torqued which may have resulted in crack formation, most probably due to the resultant work hardening of the base material in the area of the contact surfaces, thus leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on

the surface.

1.16.3 At the initiation point, a nick mark is present, together with a reduction in thickness. It would appear that the nick mark had a stress-raising result.

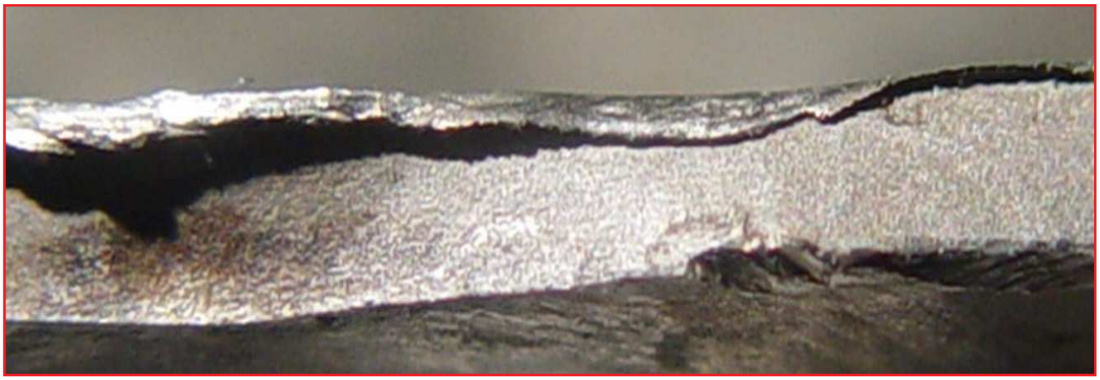

Figure 10: The figure above shows the fractured surface of the flex plate. The arrows indicate the area of reduction in thickness and the nick mark.

1.17 Organizational and management information

1.17.1 Operator:

1.17.1.1 The operator was in possession of a valid Part 127 Air Operator Certificate (AOC), effective 10 December 2010 until 9 December 2011.

1.17.2 Maintenance:

1.17.2.1 The aircraft maintenance organization (AMO) maintaining the aircraft was duly certified to carry out the required maintenance on the helicopter and was in possession of a valid AMO certificate which expires on 31 October 2011.

1.18 Additional information

1.18.1 The objective of the test was to confirm helicopter classification. On the return run to the west the helicopter descends to 300' once past Lourensriver and flies along the beach. Once abeam the radar, the helicopter commences a 180° orbit around the radar site (at 150m from the container) at around 40kts. This part of the test is to confirm the minimum range of the radar (0.1 nm). Once the minimum range to the radar is confirmed, to the North West of the radar, the helicopter climbs out to 1000' to repeat the process. This orbit around the container is carried out over an open space.

1.18.2 The DGPS on board the helicopter at the time of the accident was used to determine the flight profile of the helicopter just prior to the accident. The DGPS data is accurate to within 30 cm when post processed as a Differential GPS (DGPS).

1.19 Useful or effective investigation techniques

1.19.1 Not applicable.

2. ANALYSIS

2.1 The pilot accompanied by a passenger, took-off from Cape Town International Aerodrome to near Paardevlei where trials were conducted for the testing of Radar equipment. During one of the trials, a witness heard a loud noise coming from the helicopter just before it crashed during daytime conditions.

2.2 The occupants sustained serious injuries and the helicopter was destroyed during the accident sequence.

2.3 The pilot was correctly licensed and rated on the aircraft type to conduct the flight and was the holder of a valid medical certificate.

2.4 The weather did not contribute to this accident.

2.5 The aircraft was equipped with standard navigation- and communicational equipment as per the minimum equipment list approved by the regulator for the aircraft type with no recorded defects prior to the flight.

2.6 The aircraft was not equipped with a flight data recorder or a cockpit voice recorder nor was it required by the relevant aviation regulations.

2.7 The flex plate on the fwd coupling failed in fatigue during flight. Metallurgical analysis of the fracture surface showed definite signs of fatigue. The origin is unsure as it started slightly off from the hole underneath the washer contact surface. No clear signs of corrosion induced pitting could be detected that may have resulted in the initiation of the crack. The maintenance manual requires that the flex plate must be inspected around the bolt hole area for cracks, corrosion and fretting. However, it looks like the crack initiated underneath the washer and was not detected. No material related discrepancies were noted. It was considered possible that the bolt / nut might have been over-torqued which may have resulted in crack formation, most probably due to the resultant work hardening of the base material in the area of the contact surfaces, thus leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on the surface. At the initiation point, a nick mark is present, together with a reduction in thickness. It would appear that the nick mark had a stress-raising result. According to the aircraft documentation, the aircraft was maintained as required by the manufacturer and the regulator, however, the above scenario points to inferior maintenance.

2.8 The operator was in possession of a valid Part 127 Air Operator Certificate (AOC), effective 10 December 2010 until 9 December 2011 and the aircraft maintenance organization (AMO) maintaining the aircraft was duly certified to carry out the required maintenance on the helicopter and was in possession of a valid AMO certificate expiring on 31 October 2011. The helicopter was maintained, as required by the manufacturer and the regulator.

3. CONCLUSIONS

3.1 Findings

3.1.1 On 25 February 2011, the pilot accompanied by a passenger, took-off from Cape Town International Aerodrome to near Paardevlei where trials were conducted for the testing of Radar equipment. During one of the trials, a witness heard a loud noise coming from the helicopter just before it crashed during daytime conditions.

3.1.2 The occupants sustained serious injuries and the helicopter was destroyed during the accident sequence.

3.1.3 The pilot was licensed and qualified for the flight in accordance with existing regulation and was the holder of a valid medical certificate.

3.1.4 The weather did not contribute to this accident.

3.1.5 The aircraft was equipped with standard navigation- and communicational equipment as per the minimum equipment list approved by the regulator for the aircraft type with no recorded defects prior to the flight.

3.1.6 The flex plate on the fwd coupling failed in fatigue during flight. Metallurgical analysis of the fracture surface showed definite signs of fatigue. The origin is unsure as it started slightly off from the hole underneath the washer contact surface. No clear signs of corrosion induced pitting could be detected that may have resulted in the initiation of the crack. The maintenance manual requires that the flex plate must be inspected around the bolt hole area for cracks, corrosion and fretting. However, it looks like the crack initiated underneath the washer and was not detected. No material related discrepancies were noted. It was considered possible that the bolt / nut might have been over-torqued which may have resulted in crack formation, most probably due to the resultant work hardening of the base material in the area of the contact surfaces, thus leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on the surface. At the initiation point, a nick mark is present, together with a reduction in thickness. It would appear that the nick mark had a stress-raising result. The maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures. However, the above scenario points to probable inferior maintenance.

3.1.7 The operator was in possession of a valid Part 127 Air Operator Certificate (AOC), effective 10 December 2010 until 9 December 2011 and the aircraft maintenance organization (AMO) maintaining the aircraft was duly certified to carry out the required maintenance on the helicopter and was in possession of a valid AMO certificate expiring on 31 October 2011. The helicopter was maintained, as required by the manufacturer and the regulator.

3.2 Causes

3.2.1 Uncontrollability of the helicopter after the failure of the flex plate on the forward flex coupling.

3.3 Contributing Factor(s)

3.3.1 Probable inferior maintenance.

3.3.2 Maintenance manual unclear on procedures

4. SAFETY RECOMMENDATIONS

In the interests of Aviation Safety, it is recommended that an urgent MAN (Mandatory Aeronautical Notice) be issued to: ***(Approved by DCA on 18 March 2011).***

4.1 Ground ALL South African registered Robinson R44 and R22 helicopters with immediate effect pending a proper inspection of the forward flex plates before any further flight.

4.2 That the Airworthiness section of the SACAA, compile an inspection procedure / method to carry out this inspection. The method used should either be NDT or as per inspection intervals.

APPENDICES

Metallurgical report:

I analysed the fracture surface from the input shaft - there is definitively signs of fatigue (see photo underneath) - the origin is slightly baffling as it usually starts in the bolt holes. In this case, slightly of from the hole underneath the washer contact surface. I could not detect any clear signs of corrosion induced pitting that may have resulted in the initiation of the crack. Nor did I noted any other material related discrepancies, up to now. The other possibilities are, based on the current results, possible over-torque of the bolt/nut that may have resulted in crack formation, most probably due to the resultant work-hardening of the base material in the area of the contact surfaces, this leading to the lower fatigue strength and possible micro-cracking that cause stress-raisers on the surface. I noted some reduction in thickness as well. Also, there seems to be a 'nick-mark (see photo) at the initiation point that could have had the same stress-raising result.

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Aircraft Accident Investigator
Ionising Radiation Protection Officer