

AIRCRAFT ACCIDENT REPORT AND EXECUTIVE SUMMARY

				Reference:	CA18/2/3/9511	
Aircraft Registration	ZS-RZL	Date of Accident	02 January 2016		Time of Accident	0835Z
Type of Aircraft	Eurocopter EC-130 B4 (Helicopter)		Type of Operation		Part 91	
Pilot-in-command Licence Type	Private pilot licence	Age	65	Licence Valid	Yes	
Pilot-in-command Flying Experience	Total Flying Hours	858.7		Hours on Type	747.4	
Last point of departure	Private property Loch Vaal: Free State province					
Next point of intended landing	Private property Loch Vaal: Free State province					
Location of the accident site with reference to easily defined geographical points (GPS readings if possible)						
On a maize field in Parys at GPS co-ordinates determined to be S26° 55" 00 .3' E27° 23" 05.3' at an elevation of approximately 4 650 ft above mean sea level (AMSL).						
Meteorological Information	Temperature- 30°C: Visibility- 10 km: Wind direction-SW @05 knots: Cloud base-±8000 ft: Cloud cover-Scattered cumulus.					
Number of people on board	1 + 2	No. of people injured	3	No. of people killed	0	
Synopsis						
<p>On Saturday 02 January 2016, the pilot accompanied by two passengers was conducting a scenic flight from Loch Vaal, "the pilot's holiday home, located in Parys" to Vredefort Dome when the accident occurred. The pilot reported that on approach to Vredefort Dome, he descended to 6 000 ft AMSL, upon which he experienced a severe downdraft and shudder. The cyclic and the collective felt very unresponsive and he tried to slow the descent by pulling the collective, but without response. According to the pilot's report, before the helicopter hit the ground, he executed an emergency autorotation and managed to stabilize the speed between 60 and 70 knots. During the attempted landing on the maize field a severe dust bowl formed and restricted his vision upon which the helicopter impacted the ground on the tail-boom. All occupants sustained minor injuries and the helicopter was substantially damaged. Nothing abnormal was detected during the investigation. The investigation concluded that the in-flight upset the helicopter encountered was a result of severe downdraft. This condition had produced a very rapid descent, vibrations/shuddering and a reduction in cyclic authority that had resulted in loss of control and subsequent accident.</p>						
Probable Cause						
<p>Poor airmanship/technique.</p>						
SRP Date	11 October 2016	Release Date				

AIRCRAFT ACCIDENT REPORT

Name of Owner/Operator : Beltimar (Pty) Ltd
Manufacturer : Eurocopter Helicopters
Model : EC-130 B4
Nationality : South African
Registration Marks : ZS-RZL
Place : On a maize field
Date : 02 January 2016
Time : 0835Z

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 (2011) this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and **not to establish legal liability.***

Disclaimer:

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

1. FACTUAL INFORMATION:

1.1 History of Flight:

1.1.1 On Saturday 02 January 2016, the pilot accompanied by two passengers was conducting a scenic flight from the pilot's holiday home "Loch Vaal" located in Parys when the accident occurred. Visual meteorological conditions (VMC) prevailed in the area but no flight plan was filed. The pilot's plan was to fly to south west over the Vaal River area below the barrage before flying to the west of Parys to view the Vredefort Dome manoeuvring anti-clockwise around the south of the Parys general flying area (GFA) and then returning to Loch Vaal, "the departure area". The flight was expected to last 40 to 50 minutes. The pilot first considered the weather condition on internet, and it was good. According to the statement provided by the pilot, the helicopter's main tank had about 60% of Jet A1 fuel and the auxiliary tank was refuelled to full capacity. A thorough pre-flight inspection was performed upon which boarding commenced followed by a safety briefing by the pilot. The helicopter was started, then lifted off and headed towards Vredefort Dome, approximately 3 nautical miles (NM) to the west of Parys aerodrome, flying at 7 000 ft AMSL/100 knots indicated air speed (IAS).

- 1.1.2 The pilot reported that after approximately 25 minutes flying time, on approach to Vredeford Dome, he descended to 6 000 ft upon which he felt a severe downdraft and shudder. The helicopter entered an uncontrolled descent, and according to the pilot's report, the cyclic and the collective lever felt very unresponsive and soft. He tried to slow the descent by pulling the collective to maximise the pitch, but without response. The warning horn sounded and the pilot instantly flattened the collective with the intention of regaining the blade speed. The helicopter showed neither signs of an engine irregularity nor flight control malfunction. The pilot informed the investigators that he executed an emergency auto rotation and was able to stabilize the speed between 60 and 70 knots while looking for a suitable spot to land. According to the pilot, the only suitable spot available was a maize field as there were fences and rocks all over the area. He mentioned that as he flared the helicopter, the low blade speed warning horn sounded, followed by the formation of a severe dust bowl. The helicopter's tail-boom eventually dug onto the soft soil and it rolled over, coming to rest on its left side facing west. The pilot switched off the electrics and pulled the fuel emergency cut-off lever before vacating the helicopter with the passengers.
- 1.1.3 One of the passengers took out the aircraft's equipped portable fire extinguisher and doused some flames that were coming from the engine exhaust. All occupants were injured and the helicopter was substantially damaged during the accident sequence. They were later assisted by friends who drove past and returned them by road to Loch Vaal, at which time the pilot reported the accident to the investigator on standby. Before sunset, the passengers visited the casualty section of Sunning Hill private hospital for medical check-up. One passenger had computed tomography (CT) scans on his back and neck, which showed no damage other than muscle strains. The other passenger had the same tests which showed no damage, but he received fourteen stiches for minor cuts on his head, leg and toe. The pilot also visited the casualty section at Sandton clinic where he was examined and diagnosed with a bruised and cracked rib. In accordance with international civil aviation authority (ICAO) Annex 13, the BEA (Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile) was notified and an accredited representative and technical advisor from the manufacturer was appointed. The helicopter was operated under Part 127 of the South African civil aviation authority (SA CAA) at the time of the accident.
- 1.1.4 The accident happened during day light at GPS co-ordinates determined to be S26° 55' 00 .3' E27° 23' 05.3' at an elevation of approximately 4 650 ft AMSL.

The map depicting Parys where the accident took place on the 2nd of January 2016

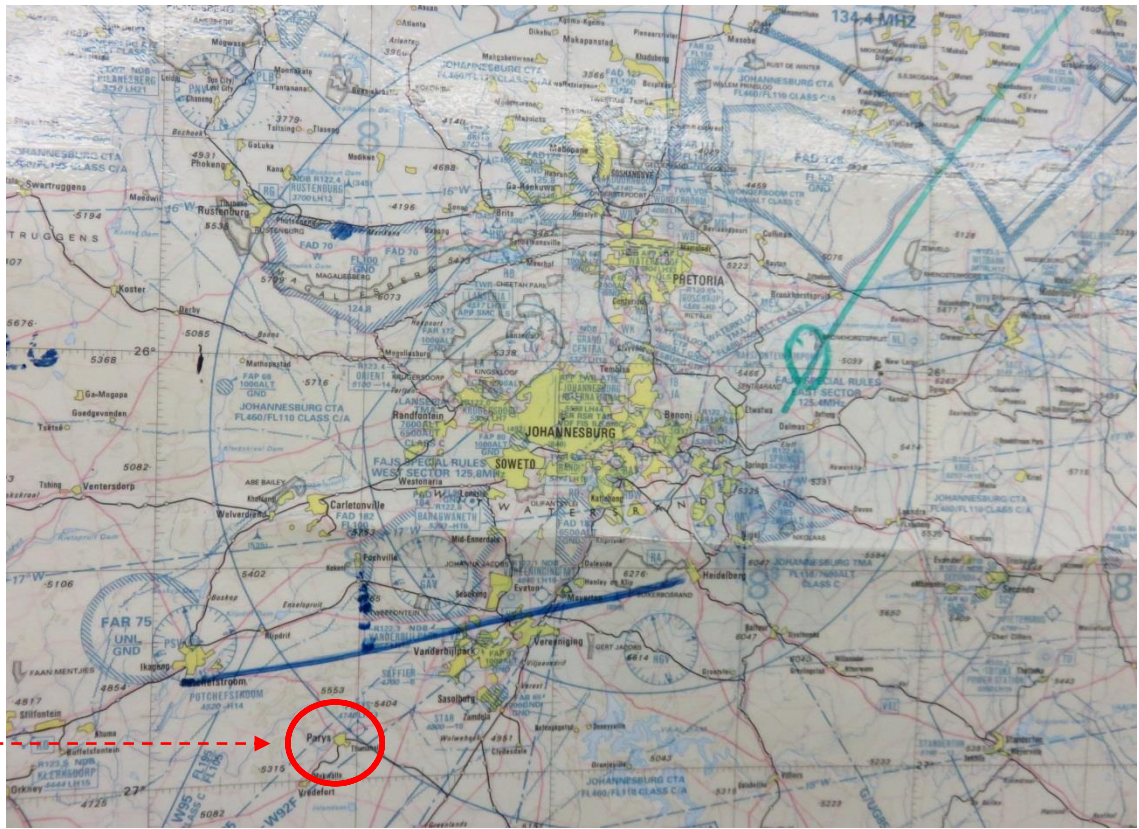


Figure 1: The map showing the area where the accident happened

1.2 Injuries to Persons:

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

1.3 Damage to Aircraft:

1.3.1 The helicopter was substantially damaged during the accident.



Figure 2: The helicopter as found at the accident site

1.4 Other Damage:

1.4.1 Minor damage was caused to the maize field.

1.5 Personnel Information:

Nationality	South African	Gender	Male	Age	65
Licence Number	0271074783	Licence Type	Private pilot licence		
Licence valid	Yes	Type Endorsed	Yes		
Ratings	Night				
Medical Expiry Date	29 February 2016				
Restrictions	To wear suitable corrective lenses				
Previous Accidents	Nil				

Experience:

Total Hours	858.7
Total Past 90 Days	12.8
Total on Type Past 90 Days	12.8
Total on Type	747.5

*NOTE: The pilot was in possession of a valid private pilot licence issued by the South African civil aviation authority (SA CAA). His profile revealed no accident or incident history, enforcement actions, pilot certificate or rating failure, or retest history.

1.6 Aircraft Information:

The helicopter was equipped with a Turbomeca Arriel 2B1 turbo shaft engine. It is a free turbine configuration, capable of producing 847 shaft horsepower. The engine assembly consisted of axial and centrifugal compressors, an annular combustion chamber, gas generator turbine, power turbine, and exhaust section. The power turbine drives an external gearbox, which in turn supplies power to the rotor system via the transmission shaft. The helicopter is equipped with a full authority digital engine control (FADEC) unit. The helicopter is certified in transport category, for day and night operation under VFR and IFR. Significant parts of the helicopter are made of composite materials. The flight controls are operated by two independent hydraulic systems. It uses an automatically varying three bladed star flex main rotor which is matched to an enclosed tail fan anti torque device, known as a Fenestron. The Fenestron is a composite shell structure with the tail rotor mounted in the inner duct. The helicopter was equipped with a Garmin GNS 430 electronic flight display system. The GNS 430 is an electronic flight information system that utilizes the primary flight display (PFD), multi-function display (MFD), air data computer (ADC) and attitude heading reference system (AHRS). The system included also the optional Garmin terrain helicopter synthetic vision technology (HSVT) system. HSVT is primarily comprised of a computer generated, forward looking, attitude aligned view of the landscape in front of the aircraft from the pilot's viewpoint. The HSVT offers a three dimensional view of terrain and obstacles with visual and audio alerts for terrain or obstacles supplied to the pilot. The system provides the pilot with real time three dimensional moving map graphics, terrain features, chart data, navigation aids, and flight plan routings.

Airframe:

Type	Eurocopter, EC-130 B4	
Serial Number	4004	
Manufacturer	Eurocopter Helicopters	
Maximum take-off weight	5 392.19 lb	
Empty weight	3 348.16 lb	
Year of Manufacture	2005	
Total Airframe Hours (At time of Accident)	892.3	
Last Mandatory Periodic Inspection (Hours & Date)	873.39	10 July 2015
Total Hours Flown	18.91	
Certificate of Airworthiness (Issue Date)	21 January 2006	
Certificate of Airworthiness (Expiry Date)	20 January 2016	
C of R (Issue Date) (Present owner)	31 January 2006	
Operating categories	Standard Part 91	

*NOTE: Following the investigation, it became evident that the aircraft maintenance organisation (AMO) that performed the last annual inspection on the aircraft prior to the accident flight was in possession of a valid certificate No 1285. All concerned airworthiness directive (AD's), service bulletins SB's, mandatory modification on this helicopter and its engine has been complied with. Turn around inspections are carried out as per approved turn around inspection schedules and all the inspections includes checks/inspection as per the manufacturer's guidelines as specified in maintenance program. All relevant aircraft certification such as the certificate of registration and the authority to fly were found to be valid. All maintenance entries made were appropriately certified in accordance with the applicable regulations. The calculated weight and balance was provided by the operator with gross weight and center of gravity data points established for departure from Loch Vaal, Parys in accordance with the helicopters approved type certificate data sheet, the maximum allowable weight and take-off gross weight were 5 392.19 pounds. Based on the calculated weight, the last departure gross weight was estimated to be about 3 348.16 pounds. The helicopter was flown within the permitted weight, center of gravity range estimated to have been longitudinally at 133.8 inches. The calculated weight and balance is attached on the Appendices part of the report. Below is the helicopter photograph.



Figure 3: ZS-RZL photograph

Engine:

Type	Arriel 2B1
Serial Number	23214
Hours since New	892.3
Hours since Overhaul	TBO not reached

1.7 Meteorological Information:

1.7.1 Weather information as per the pilot questionnaire.

Wind direction	South Westerly	Wind speed	05 knots	Visibility	10 km
Temperature	30°C	Cloud cover	Scattered cumulus	Cloud base	±8 000 ft
Dew point	N/a				

1.7.2 An official weather report was obtained from the South African Weather Services (SAWS). The weather data showed the pressure altitude at 4 440 feet AMSL

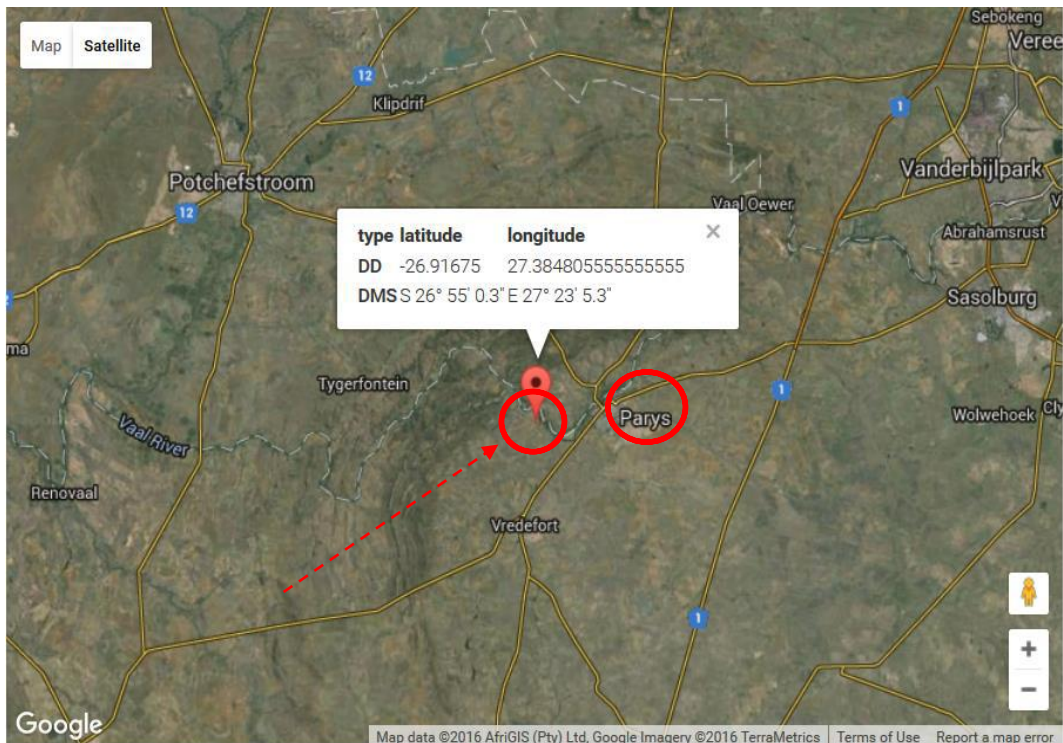


Figure 4: Satellite image taken on 02 January 2016 depicting the accident site West of Parys aerodrome

1.8 Aids to Navigation:

1.8.1 The helicopter was equipped with the following navigational aids.

- Magnetic compass.
- Transponder.
- Panel-mounted Garmin GPS.
- ILS (Instrument Landing System).
- ADF (Automatic Direction Finder).
- VOR (Variable Omni Range) finder.
- DME (Distance Measuring Equipment).

1.9 Communications:

1.9.1 The communication equipment installed on the helicopter was found to comply with the approved equipment list. The pilot was not in radio contact with air traffic control, and no distress calls were heard by other pilots during the time frame of the accident.

1.10 Aerodrome Information:

1.10.1 The accident did not happen at the aerodrome. The accident happened in day light at GPS co-ordinates determined to be S26° 55" 00 .3' E27° 23" 05.3' at an elevation of approximately 4 650 ft above mean sea level (AMSL).

1.11 Flight Recorders:

1.11.1 The helicopter was equipped with vehicle and engine multifunction display (VEMD) computer unit that registers exceedances and system faults. Attached below is a VEMD picture.



Figure 5: VEMD computer unit installed on the helicopter

1.12 Wreckage and Impact Information:

1.12.1 Examination of the helicopter wreckage at the site revealed that it was confined around its final resting position. There was no in-flight disintegration of any part of the helicopter. During examination of the helicopter at the accident site by engineers from Turbomeca, it was observed that the helicopter was resting on the ground facing west with the fuel shut-off lever in the closed position. Rotor strike marks were observed. All three main rotor blades were within the vicinity of the wreckage area. Each main rotor blade broke into multiple pieces, suggesting that the rotor system was powered at the time of the accident. The Perspex windshield shattered during the accident sequence. All the doors were able to move or latch without resistance. Both skids were undamaged; however substantial damage was limited to the helicopter. The tail boom displayed damage consistent with impact damage.

1.12.2 The condition of the left horizontal stabilizer/fin was consistent with impact damage. Flight control continuity was confirmed from the cockpit through the tail rotor system and from the cockpit cyclic and collective controls to the point where the controls are connected to the actuators mounted to the main transmission. Control tubes connecting the swash plate to the hub exhibited fractures consistent with an overload condition from impact. The transmission deck, mounting points, and mounting struts were damaged. Visual inspection on the engine mounting points showed that the engine had moved from its original mounted position. The engine gas producer and power turbine rotated freely. Engine magnetic plugs were removed, and no metallic particles were found. The engine chip detector was also free of metallic particles. The fuel and oil filters were removed and inspected and no debris was found. The air intake duct remained attached to the engine and showed no evidence of cracks or fractures. The drain hole in the air intake duct showed no evidence of blockages. The engine's fuel, oil, and electrical connections remained intact. The presence of fuel in the engine's hydro mechanical unit (HMU) was confirmed. A sample of Jet A1 fuel tested negative for the presence of water. The seats did not show signs of being weakened from impact forces during the accident sequence. The anti-torque pedals showed no signs of damage or stiffness. The damage sustained by the helicopter was all post impact.



Figure 6: The helicopter as found at the accident site on the maize field



Figure 7: Closer view of the helicopter rotor head at the accident site

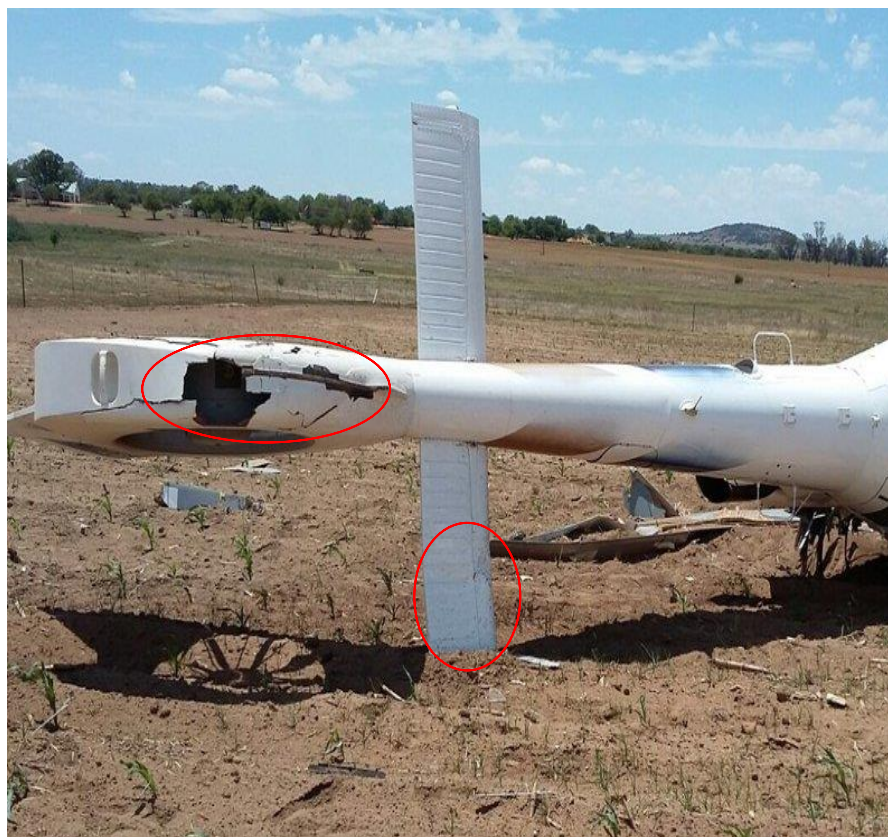


Figure 8: Damage sustained by the helicopter's tail section

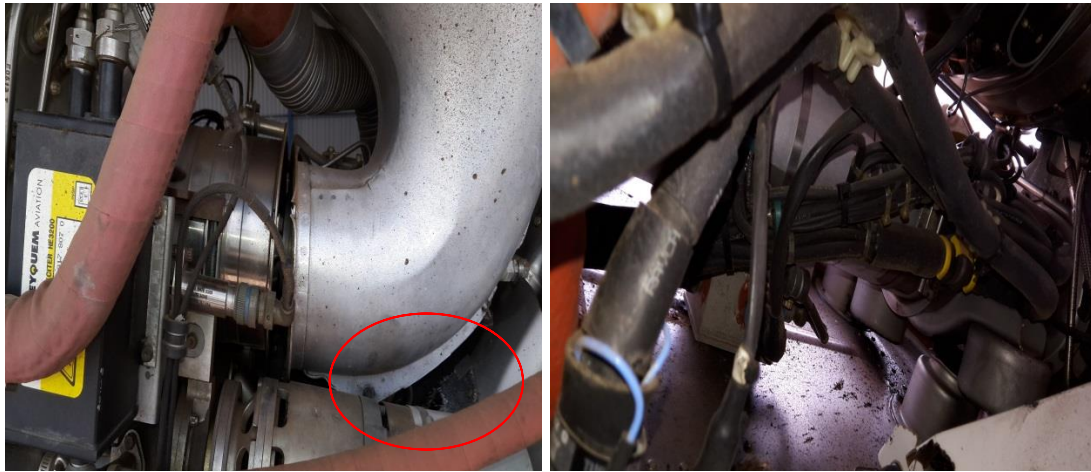


Figure 9: Engine moved from its mounting point with the exhaust muffler separated



Figure 10: A photograph showing a detached hydraulic actuators and a damaged engine support bar



Figure 11: Photographs showing the final position of the rotor head



Figure 12: The position of the fuel shut-off lever

1.13 Medical and Pathological Information:

1.13.1 None.

1.14 Fire:

1.14.1 The fire that was observed after the accident was successfully doused using the helicopter's hand held fire extinguisher.

1.15 Survival Aspects:

1.15.1 The accident was considered survivable. All occupants were properly harnessed and the cockpit/cabin area was intact.

1.16 Tests and Research:

1.16.1 Following the initial investigations at the accident site, the helicopter was recovered to Wonderboom (FAWB) for further investigation. Engineers from Turbomeca and Airbus Helicopters gathered and conducted a thorough engineering investigation under the auspices of the accident and incident investigation division (AIID) appointed investigator in charge (IIC). In depth examination of the helicopter confirmed flight control continuity of the tail rotor drive system and there were indications consistent with engine power on the turbine wheel output shaft. Following all the documented findings from day one of the initial investigation, the unanimous decision not to download the recorders (VEMD & DECU) was made. The decision was made after consultation with an appointed representative from BEA. The pilot also did not refer to any problem with the helicopter's controls or

engine during the initial investigation. The wreckage was thoroughly examined during post-accident investigation. Based on the observation by the investigators, together with experts, it was determined that there had been flight control continuity before the accident.

1.17 Organizational and Management Information:

1.17.1 This was a private flight.

1.17.2 The last mandatory periodic Inspection prior to the accident flight was certified on 10 July 2015 at 873.39 airframe hours.

1.18 Additional Information:

1.18.1 None.

1.19 Useful or Effective Investigation Techniques:

1.19.1 None.

2 ANALYSIS:

2.1 The helicopter was certified, equipped, and maintained in accordance with existing regulations and approved procedures. The helicopter had flown a total of 18.91 hours and had undergone its last mandatory periodic inspection at 873.39 hours. The pilot held a valid private helicopter pilot's license validated by a flight medical on 20 February 2015. He had approximately 858.7 flight hours total time on helicopters, of which about 747.4 hours were on the EC-130 B4 type. A review of his records indicated that he was trained and certified appropriately for the flight. The helicopter was being operated within the prescribed limits for weight and center of gravity. The weather at the time of departure from Loch Vaal private was clear with visibility under visual flight rules (VFR) conditions. Taking into account the pilot's statement, it is possible that just before the in-flight upset, the wind direction may have changed in a short time as the helicopter was descending for Vredefort Dome. This could have happened without a decrease in wind speed and might have been misjudged or hard for the pilot to recognize requiring careful power management. It is likely that the pilot's approach was conducted with a tail wind of which he was unaware, due to the sudden change of wind direction. This may have caused the helicopter to lose transitional lift, probably generating a sudden increase in the rate of descent.

2.2 The combination of a steep approach, unknowingly conducted downwind approach at slow speed with power applied; probably caused the helicopter to descent into its own downwash. At no time was the helicopter recovered, but it became uncontrollable and crashed onto the maize field resulting into substantial damage. The investigator concluded that the pilot's actions were consistent with someone who lost control and awareness of the situation. The dust formed from the maize field also exacerbated the vision of the pilot. In a nutshell, this accident highlights the importance of continually assessing and reassessing the prevailing conditions and their effect on the performance of the helicopter.

3. CONCLUSION:

3.1 Findings:

- 3.1.1 The pilot held a valid private pilot's licence and had the helicopter type endorsed in his logbook.
- 3.1.2 The pilot's medical certificate was valid with restrictions to wear suitable corrective lenses.
- 3.1.3 The flight was operated as a general aviation flight under VMC.
- 3.1.4 The helicopter was in possession of a valid certificate of airworthiness at the time of the accident.
- 3.1.5 The AMO who performed the last mandatory inspection on the helicopter prior to the accident flight was in possession of a valid approval certificate No 1285.
- 3.1.6 The accident was considered survivable.

3.2 Probable Cause/s:

- 3.2.1 Poor airmanship/technique.

4. SAFETY RECOMMENDATIONS:

- 4.1 None.

5. APPENDICES:

- 5.1 The helicopter's weight and balance sheet.

EC130B4 - ZSRZL

LONGITUDINAL CENTRE GRAVITY CALCULATION - 2ND JANUARY 2016

	kg.	m/kg.
EEW	1518.70	5392.19
Front Seats	284.00	440.20
Rear seats	0.00	0.00
Side Cargo (Aux Fuel)*	124.80	400.00
Rear cargo	15.00	69.00
Fuel**	259.20	903.00
	2201.70	7204.39

CG = m/kg. divided by kg. 3.27

Longitudinal CG limit = See Graph

*156 litres = 124.8 kg

** 324 litres = 259 kg

LATERAL CENTRE GRAVITY CALCULATION - 2ND JANUARY 2016

	kg.	m/kg.
EEW	1518.70	0.30
Front Seats	284.00	1.80
Rear seats	0.00	0.00
Side Cargo (Aux Fuel)*	124.80	-75.00
Rear cargo	15.00	0.00
Fuel**	259.20	0.00
	2201.70	-72.90

CG = m/kg. divided by kg. -0.03

Lateral CG limit left -0.10

Lateral CG limit right 0.10

2.2.3 LONGITUDINAL CG

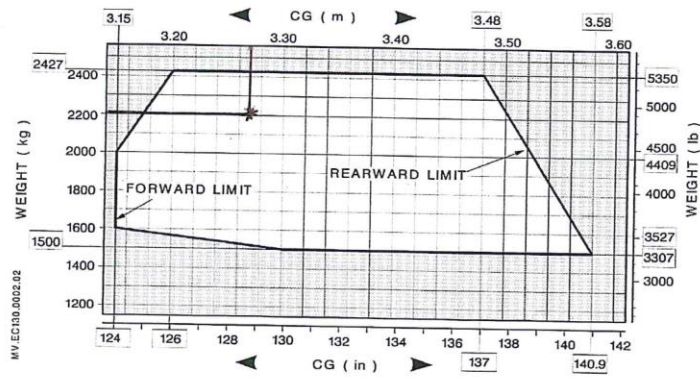
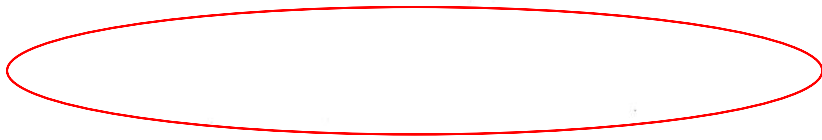


Figure 2-1 : Longitudinal CG Chart

NOTE

The datum is located 3.40 m (133.8 in) forward of the main rotor head center line.



END