



Safety Investigation Report

ACCIDENT TO AN EUROCOPTER EC120 IN SOUMAGNE ON 18 OCTOBER 2011

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FOREWORD

This report is a technical document that reflects the views of the investigation team on the circumstances that led to the accident.

In accordance with Annex 13 of the Convention on International Civil Aviation, it is not the purpose of aircraft accident investigation to apportion blame or liability. The sole objective of the investigation and the Final Report is the determination of the causes, and define recommendations in order to prevent future accidents and incidents.

In particular, Art. 17.3 of EU Regulation 996/2010 stipulates that a safety recommendation shall in no case create a presumption of blame or liability for an accident, serious incident or incident.

Unless otherwise indicated, recommendations in this report are addressed to the Regulatory Authorities of the State having responsibility for the matters with which the recommendation is concerned. It is for those Authorities to decide what action is taken.

The investigation was conducted by the AAIU(Belgium); H. Metillon, S. Laureys and L. Blendeman, supported by the BEA (France), the Belgian CAA, the Helicopter manufacturer, the engine manufacturer. The Belgian Defense provided hangar space for the wreckage, and the Belgian Defense Aeroclub provided a technician, Mr André Durillieux, with toolings.

The report was compiled by L. Blendeman

NOTE:

1. For the purpose of this report, time will be indicated in UTC, unless otherwise specified.
2. ICAO doc. 9859 was used for the identification of the hazard and the consequence.

Synopsis

Date and hour of the incident

18 October 2011 – 10:16 UTC

Aircraft

Eurocopter EC120B, msn 1581

Accident location

Avenue de la Résistance, 492 – Micheroux - Soumagne, Belgium. (10 nm E of EBLG)

Aircraft Operator

Heli and Co S.A.

Type of flight

Aerial Work – Pipe line Surveillance

Persons on board

2

Departure Airport

EBSP

Destination Airport

EBSP

Abstract

The helicopter took off from EBSP at 07:27 UTC. With a pilot and a photographer on board, it flew a mission of pipeline survey for the Fluxys Company. Having finished the surveillance tasks, the helicopter flew back to its base, the Spa airfield.

When reaching the commune of Soumagne, the helicopter encountered bad weather, and entered in IMC condition.

The helicopter crashed at 10:16 UTC. The two occupants died at impact.

Causes.

The accident was caused by a loss of control of the helicopter, caused by a spatial disorientation of the pilot further to an unintentional entry in IMC.

The contributing factors include: Meteorological conditions, Fatigue of the pilot, Low experience on the type of helicopter (main rotor rotating clockwise and a fenestron).

Hazards¹ identified during the investigation.

Unintentional entry in IMC conditions.

Consequences²

Loss of control.(LOC-I)

¹ Hazard – Condition or object with the potential of causing injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function.

² Consequence – Potential outcome(s) of the hazard

1. Factual information.

1.1 History of flight.

The helicopter took off from EBSP at 07:27 UTC. With a pilot and a photographer on board, it flew a mission of pipeline survey for the Fluxys Company.

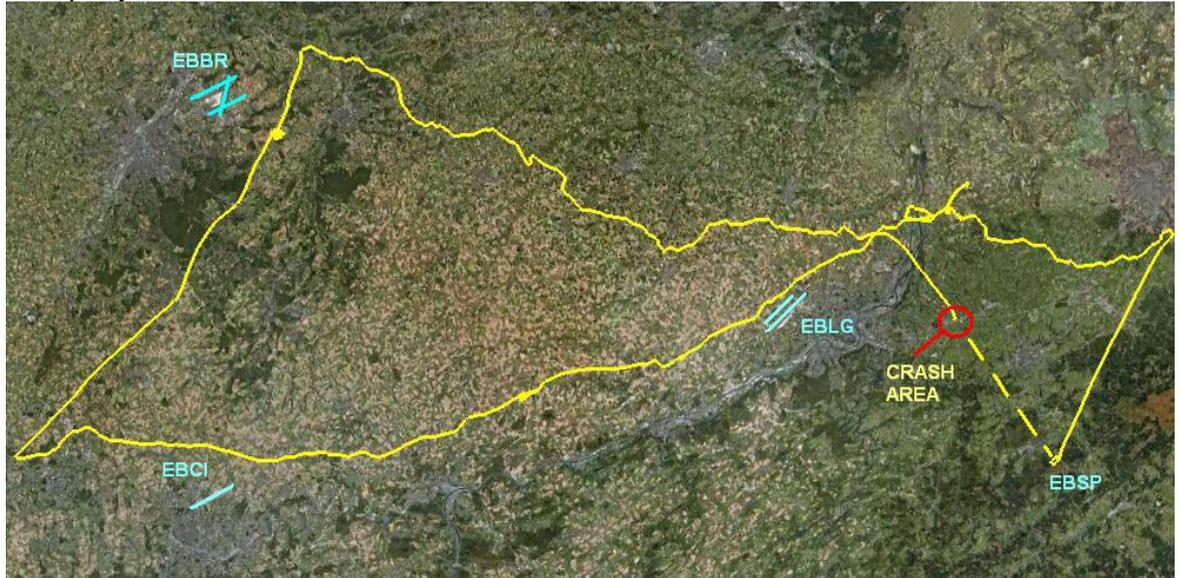


Fig. 1. The Flight

The complete flight was to follow the pipe-line Westward from Raeren to Houtain-Saint Simeon, then further west to Brussels, then on to Charleroi, eastward to Houtain-le Val. The purpose was to take pictures of all works performed in the neighborhood of the pipe-line.

The first picture was taken at the distribution center in Lichtenbusch at 07:40 UTC. Fluxys Station 78D in Eynatten was checked at 07:43 UTC.

The last picture was taken in the vicinity of Fluxys Station 24D, in Fexhe-Slins, along the highway E313.
Terrain elevation: 150m. Location: 15 km NW of crash area.

The helicopter was carrying a computer from Fluxys, able to register when the helicopter was flying in the neighborhood of the Fluxys stations. The last data registered indicates the helicopter flew above (within a radius of 90m) the Fluxys station 25D at 10:09:55.



Fig. 2. Last picture taken in the helicopter

The helicopter left the CTR of EBLG at 10:12 (radar clock).
The helicopter flew then back to EBSP.

It was seen flying at low altitude in the direction of the crash area.

A witness reports

- the helicopter attempted to climb, before turning around its own axis, then finally lost height and crashed in the trees.
- I was home, looking in the direction of Herve (E from his position); I saw a helicopter in difficulty. I see the helicopter turning around itself twice, then pitching down and crashing behind the trees.

The helicopter crashed in Soumagne at 10:16 UTC.

The wreckage lies in the garden of a house close to the N3 road, at 300m from the E40 highway (Liege – Verviers). Small parts of the helicopter were found in the gardens in the vicinity.

A blade tip of a main rotor blade was found lying on the ground at 216m from the main crash area.

EBLG Tower was notified by the emergency services (100) at 10:23 UTC, and indicates the time of crash as 10:10 UTC.

The investigation team was notified by phone at 10:34 UTC by the CANAC supervisor, and arrived at the crash scene at 11:33 UTC

The two pilots were killed upon impact.
The ELT did not activate upon impact.

1.2 Injuries to persons.

Injuries	Pilot	Passenger	Other crew	Total
Fatal	1	1	0	2
Serious	0	0	0	0
Minor	0	0	0	0
None	0	0	0	0
Total	1	1	0	2

1.3 Damage to aircraft.

The helicopter was totally destroyed.

1.4 Other damage.

Impact damage in the yard of the house where the helicopter crashed;

- Two trees had to be sawn off
- The ground had to be sanitized.

1.5 Personnel information.

Pilot

Sex: male

Age: 27 years old

Nationality: Belgian

Commercial Pilot Helicopter Licence, first issued by the Belgian CAA on 04 January 2008, last issued on 24 November 2011, valid until 07 December 2014.

Rating:

- R44, valid until 31 December 2012.
- R22, valid until 31 December 2011
- EC120, valid until 30 November 2011
(qualification held on 24 November 2010)

Medical Certificate: Class 1, issued on 9 Dec 2010, valid until 12 Dec 2011.

Private Pilot Licence (H), first issued on 07 September 2006

Flight Experience:

Total: 436:25FH

Last flight: 30.09.2011 - Robinson R22.

First Flight on EC120: 28.10.2010

Total on EC120: 25:13FH, amongst which 18:42FH as PIC

Last flight not included.

Flying time previous (hours)	24 h:	7 days:	90 days:	Total:
All types (hh:mm)	0:6	0:6	69:16	436:25
EC120 (hh:mm)	0:6	0:6	7:4	25:13

Passenger

The passenger held a valid Student Pilot Licence for helicopters.

1.6 Aircraft information.

Airplane general information.

The Eurocopter EC120 Colibri is a 5-seat, single-engine, single main rotor, light helicopter.

The EC120 B is mostly built from composite materials and has a fenestron tail rotor, making it a particularly quiet helicopter (FAA Appendix J flyover noise signature = 78.7 dB SEL, 6.7 dB SEL below Stage 2 limits). Certified to FAR 27 standards, the EC120 B also features crash-resistant seats and a crash-resistant fuel system.

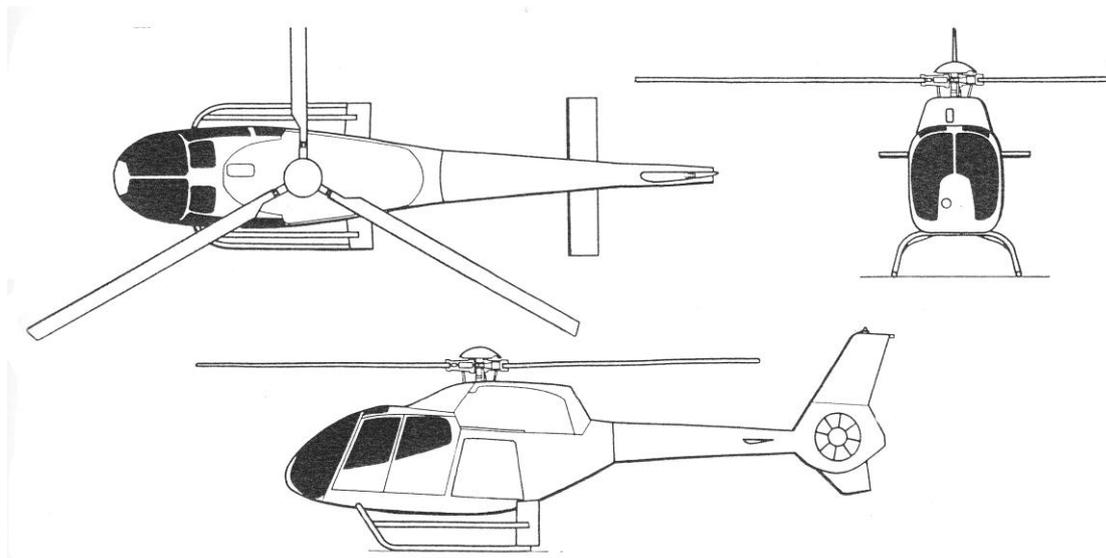


Fig. 3. 3-view drawing



Fig. 4 – EC120 Colibri

Characteristics:

Crew:	1 or 2 pilots
Capacity:	4 passengers
Length:	9.6 m
Rotor diameter:	10.0 m
Height:	3.4 m
Empty weight:	991kg
Useful load:	724kg
Max takeoff weight:	1715kg

Powerplant:	1x Turbomeca Arrius 2F turboshaft 376 kW (504shp)
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Performance

Never exceed speed:	278 km/h (150 knots)
Cruise speed:	223 km/h (120 knots)
Rate of climb:	5.84 m/s (1,150 ft/min)

Airframe:

Manufacturer:	Eurocopter
Type:	EC 120 Colibri
Serial number:	1581
Built year:	December 2008
Certificate of registration:	N° 10430 issued by BCAA on 23 February 2011,
Certificate of airworthiness:	EASA Form 25 issued by BCAA on 22 February 2011.
Airworthiness Review Certificate:	EASA Form 15B, Last issued on 02 December 2008 by FR.MG.0093, with last extension issued on 13 December 2011. Valid until 02 December 2011.
Airframe TT:	531:17FH

Engine:

Manufacturer: Turbomeca
Type: Arrius 2F
Serial number: 34657

Engine TT: 531:17 FH
Cycles NG: 510.75 (8 sep 2011)
Cycles NTL: 822.55 (8 sep 2011)

Maintenance:

The last maintenance was performed by IXAIR, approved Maintenance Organisation (FR-145-504) on 8 September 2011. The following tasks were performed:

- 100h inspection on airframe per maintenance programme Eurocopter 05-21-00, dated 24/02/2011 R30
- 100h inspection on engine per maintenance manual Turbomeca 05-20-00 dated 28/02/2011
- Autotest ELT Kannad 406
- VEMD check; no overlimit
- EASA AD 2011-076 complied with

1.7 Meteorological conditions.

1.7.1. General Forecast

Issued 18/11/2011 at 04:30 UTC
VALID FOR PERIOD: 18/10/11 - 0600 UTC TO 18/10/11 - 1800 UTC

Extract:

2. WEATHER

In frontal zone overcast with rain, moderate rain and embedded showery rain at times, gradually spreading inland 06-11Z in low and mid-Belgium, quickly moving to the Ardennes by noon and afternoon. Low clouds on hills and poor visibilities as the front reaches the Ardennes. On front passage strong gusty surface winds from the SW. (Gusts temporarily up to 30-35kt).

1.7.2. During Flight preparation.

TAF FT – EBLG - 180500Z 1806/1912
21015KT
9999
FEW020 SCT 035

TEMPO 1806/1810
22018G30KT PROB 30

TEMPO 1806/1809
BKN 012

TEMPO 1809/1812
4000 RA SHRA SCT007 BKN010
BECMG 1810/1812
27010KT =

1.7.3. Observations at Liege (EBLG) airport (alt. 600 ft)

METAR EBLG 180920Z 31012KT 280V340 2500 RADZ SCT003
BKN006 08/07 Q1011 NOSIG=

METAR EBLG 180950Z 31010KT 280V340 2300 RADZ SCT003
BKN005 08/07 Q1011 NOSIG=

METAR EBLG 181020Z 29007KT 260V320 2000 RADZ SCT003
BKN005 08/07 Q1012 NOSIG=

METAR EBLG 181050Z 26009KT 3000 RADZ FEW003 BKN006
08/07 Q1012 NOSIG=

METAR EBLG 181120Z 24010KT 4500 RA FEW003 SCT006 BKN030
08/06 Q1012 REDZ TEMPO BKN012=

1.7.4. Observations at Spa (EBSP) airport (alt. 1500 ft)

METAR EBSP 180950Z AUTO 23013KT 190V260 9999 OVC009///
10/08 Q1011=

METAR EBSP 181020Z AUTO 31009G20KT 270V350 4500 NDV RA
VV001 07/06 Q1011=

The Spa airport lies at an elevation of 470m.

Note: VV001 indicates a vertical visibility of 100ft

1.7.5. Weather radar (rainfall detection)

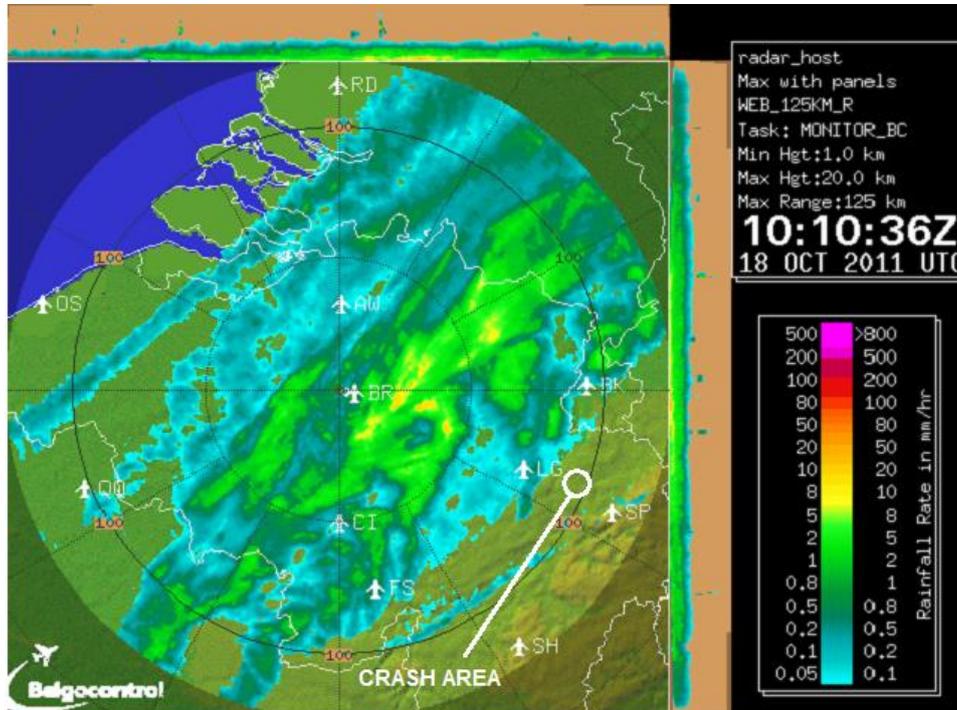


Fig 5: Weather radar 6 min before the crash

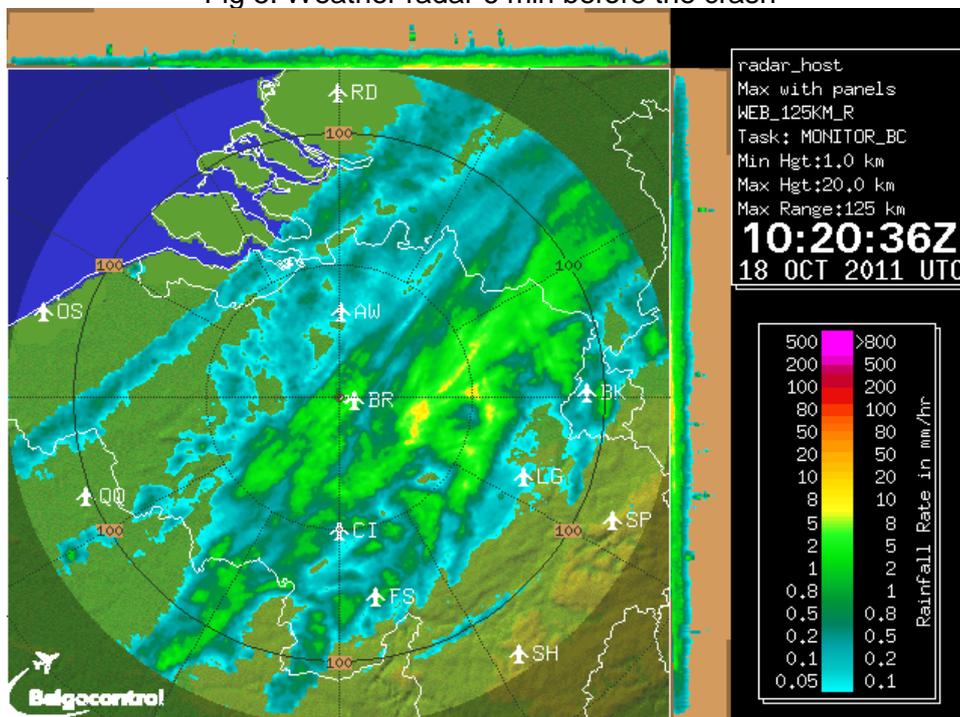


Fig 6: Weather radar 4 min after the crash

1.8 Aids to navigation.

1.18.1. Radar trace

The radar trace shows the last 13 minutes of the flight, with correlated communication (125.25 MHz).

The radar trace is transferred on a map;

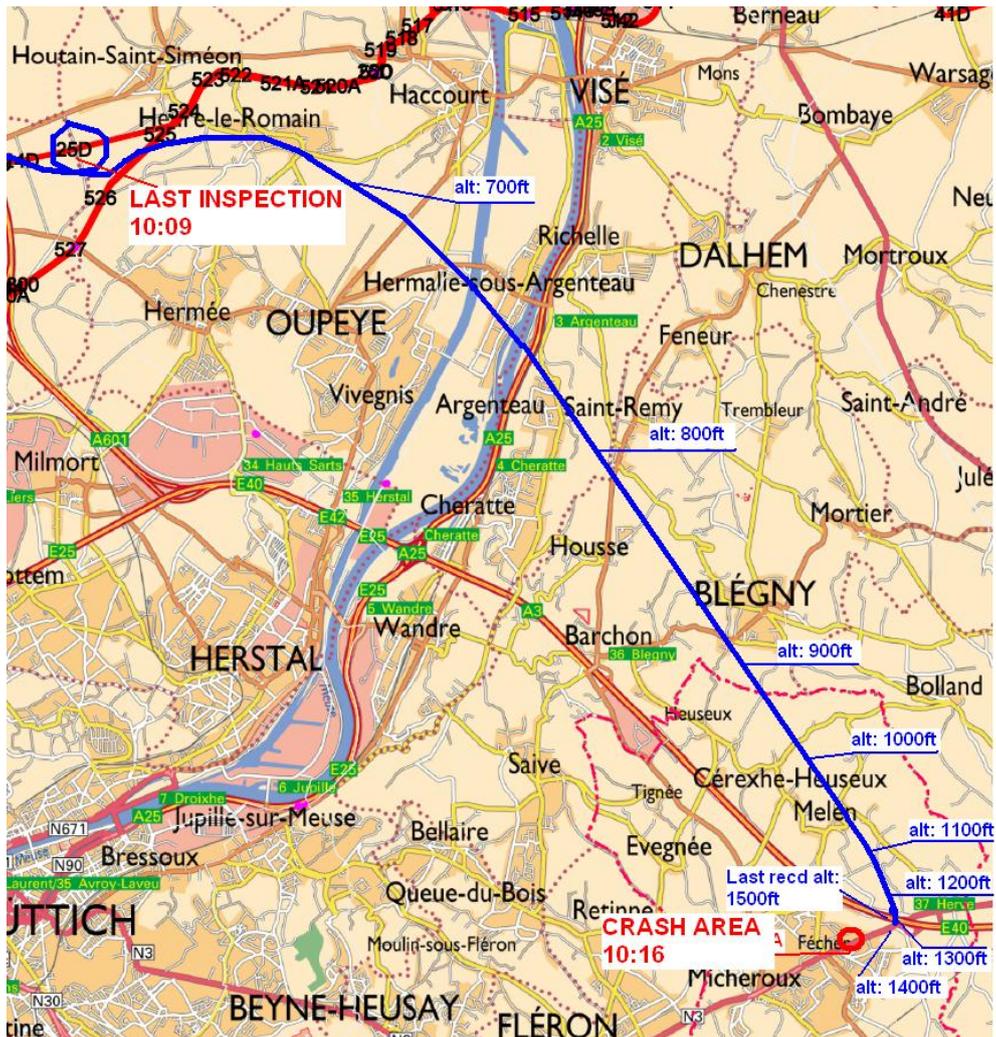


Fig 7. Return flight (radar trace)

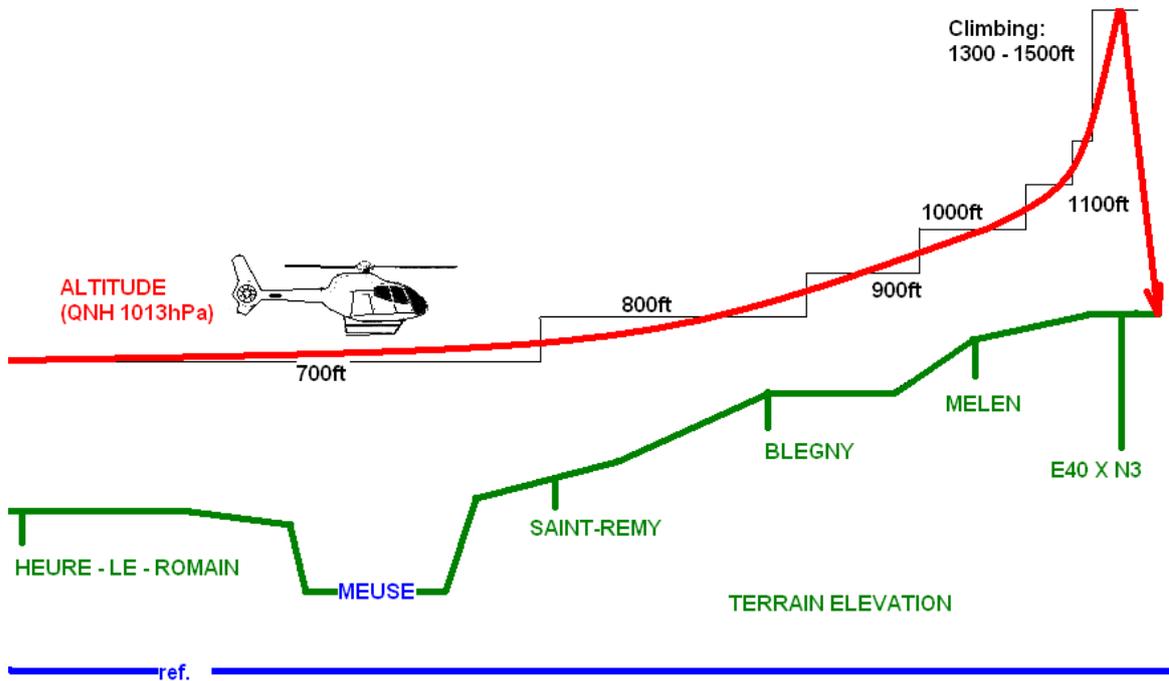


Fig 8. Return Flight (radar trace)

The radar trace shows the helicopter flying in a South Easterly direction, with the Highway E40 at its right hand side, at normal speed.

When reaching the area of Blegny, the helicopter climbs gradually to 1100 ft. Upon reaching the intersection with E40 and N3, the helicopter climbs up to 1500ft, and the horizontal speed drops. The direction of flight fluctuates in a clockwise direction. The helicopter then disappears from the scope at 10:16.

1.9 Communication.

1.9.1. Radio

The communication transcript (125.25 MHz - EBLG AIR) was received from Belgocontrol.

Time	Station	Conversation
10.04.14	helicopter	Liège Tower ?
10.04.18	TWR	Liège, good afternoon, go ahead
10.04.23	helicopter	Good afternoon, Sir. Colibri helicopter, low level pipeline inspection, request to enter via Saint Trond, Glons and to leave via Haccourt for a pipeline inspection low level.
10.04.35	TWR	Liège, Two Three left, QNH One Zero One One, report One minute before crossing the runway axis.
10.04.42	helicopter	One Zero One One, report one minute before crossing runway axis,
10.04.48	TWR	I suppose you stay low level?
10.04.50	helicopter	Low level, exact.
10.04.53	TWR	Roger, Sir, because in about four minutes we'll have a Seven Three Seven established on the ILS.
10.05.01	helicopter	Okay, Sir, I will have a sharp look out and now is Six Hundred feet.
10.05.05	TWR	Roger
10.08.24	TWR	Two Six Five Four, for information, helicopter flying low level close to the runway axis approximately Six miles out at your eleven o'clock, Six miles.
10.08.36	JAF2654	Okay, but we are still in IMC.
10.08.38	TWR	Roger, just to warn you that you will be passing overhead the plane
10.08.42	JAF2654	Merci
10.08.48	TWR	Clear to cross the axis.
10.08.51	helicopter	Clear to cross, thank you.
10.11.59	helicopter	And Charleroi, we are about to leave your zone, request to leave your frequency.
10.12.04	TWR	Cleared to leave, bye bye.
10.12.07	helicopter	Cleared to leave, thank you for your cooperation and have a nice day

1.9.2. Telephone.

Both pilot and passenger had a mobile phone and SMS text messages were received and sent before and during the flight.

One message (sent 09:47 UTC) stated that the meteorological conditions were not optimum. No message was neither read, nor sent between 09:54 UTC and the time of the crash (10:16 UTC)

1.10 Aerodrome information.

Not relevant

1.11 Flight recorders.

The helicopter was not equipped with a Flight Data Recorder, nor was it required to.

However, several equipment featured some internal memory:

- A photographic camera, with which the crew took pictures during the survey.
- GPS
- The VEMD

1.11.1. Photographic camera

The passenger used the camera to record the activities in the vicinity of the pipe-line. The last picture shows degrading weather, and rain.

The camera was probably stowed during the flight back to EBSP.

1.11.2. GPS.

The helicopter was equipped with a Garmin GNS 430 GPS, and a portable Garmin GPSmap 496. The latter features a memory, and the data were downloaded by the BEA France laboratory and was received on 15/11/2011.

The download provided flight data, as follows:

- time
- WGS84 location
- Altitude

The flight data were put on Google Earth, and showed an identical profile as the radar trace.

Among others, the GPS data confirms the helicopter altitude; the average cruise speed is around 170 km/h.

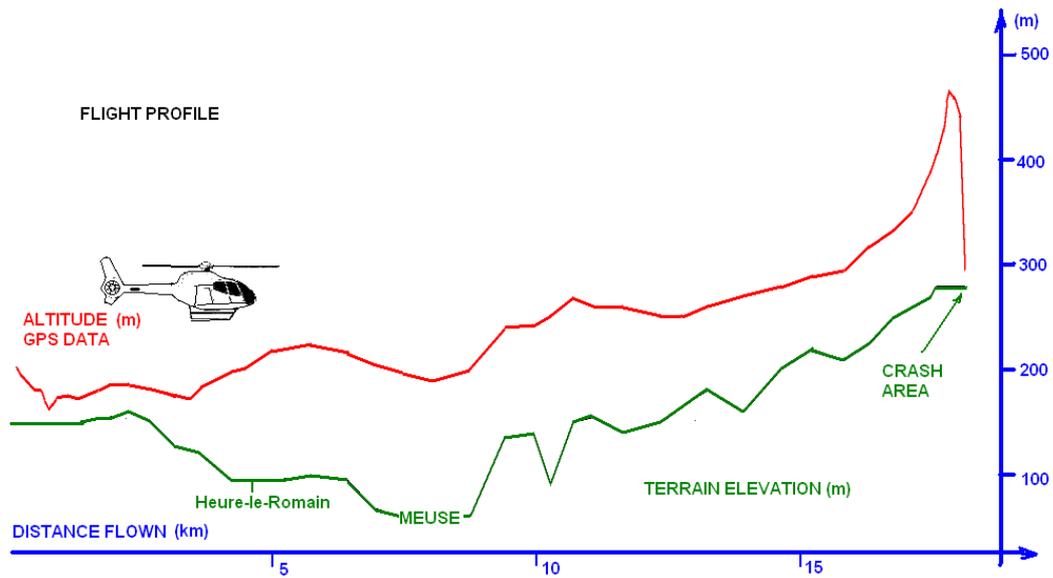


Fig. 9 – Flight profile (GPS data)

The GPS gives information of the flight of the helicopter during the last minute: (Fig 9). The speed value are computed from the distance between position and the elapsed time.



Fig 10. Last 30 seconds

Pos.	Time UTC (hh:min:sec)	Altitude (m)	Speed (km/h)
1	10:15:21	389	152
2	10:15:24	405	129
3	10:15:29	429	101
4	10:15:31	436	67
5	10:15:37	455	27
6	10:15:42	466	31
7	10:15:44	464	40
8	10:15:49	462	24
9	10:15:53	459	34
10	10:15:57	441	110
11	10:15:59	296	297

1.11.3. VEMD

The VEMD was slightly damaged, and sent to BEA-France for the download of recorded data.

The BEA laboratory proceeded to the following:

- Location of memory chips on the board;
- Removing the chips from the board;
- Downloading the recorded binary data;
- Decoding the data,

The operation was performed with the support of Eurocopter, in order to confirm the validity of the data.

Results:

The last flight recorded, identified as N°793, lasted 2 hours, 51 minutes and 15.5 seconds, which matches the GPS data for the last flight.

Two defect messages were logged: they concerned the GPS data interface, not relevant for the accident

A non-dated value of 133% of torque was recorded.

1.12 Wreckage and impact information.



Fig. 11: (Air Support Police Dept) Aerial photography taken above the E40 highway



Fig 12. Crash area



Fig 13. Main body of the helicopter as found by the emergency services

Obstacles

Coming from the NW, when reaching the crash area, the helicopter had to cross 2 electrical High Voltage Power Line, one bordering the highway; the other joining the first, 400m from the crash area.

As reported by Heli and Co, the helicopter would need to be at 1200 ft QNH to pass the line with safety.

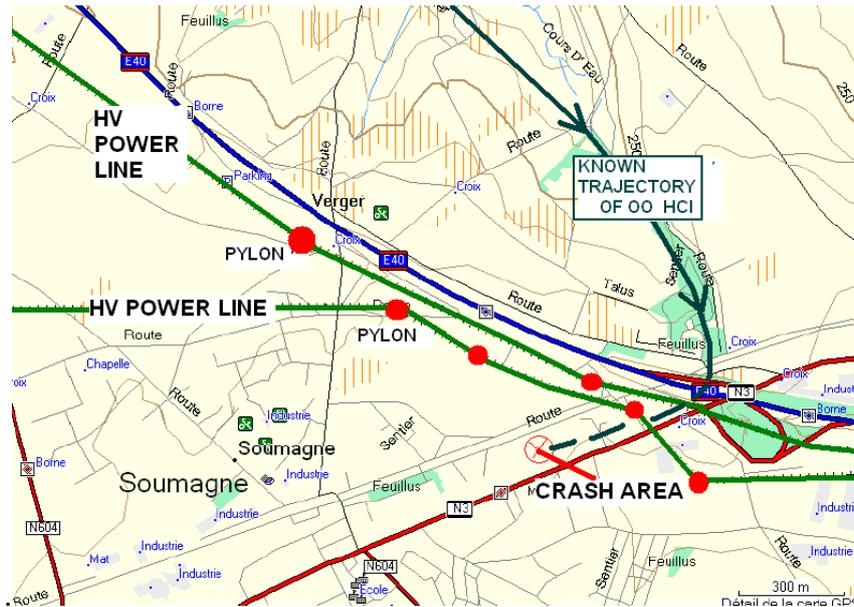


Fig.14 Location of Power lines



Fig 15: the pylons in the vicinity of the crossing between N3 and E40

Wreckage Examination.

The wreckage was examined on 10/11/2011 by a team constituted of 10 people, representing BEA-France, Eurocopter, Turbomeca, BCAA (C-COM), BCAA (INS) and AAIU(Be).

The examination showed no pre-existing damage that could explain the accident. The engine delivered power upon impact, and the controls system of the helicopter were operative.

Details of the examination:

Engine.

The engine was removed from the helicopter structure. The damage to the transmission showed the engine delivered power at impact. The free turbine rotated freely, as did the gas turbine. The compressor and turbine blades, as the combustion chamber showed the presence of white particles, coming from the deterioration of the inner labyrinth seals (damage consecutive to a internal movement of the gas turbine, further to the impact). The fuel filter clogging visual indicator, as well as the oil filter were found in the normal (not popped-out) position. The magnetic chip detector did not show any presence of particles



Fig 16: Engine

Equipment.

The fuel control lever was below the start position (22°) and the anticipator was in the 110 % position. The command cable support shows distortion.

Instruments

The power handle (twist grip): RH: flight position – LH (undefined)

The clock is stopped and frozen on 10:17 H

Fuel shut-off: open

Brake: Flight position

Hydraulic cut-off switches: LH: Normal position – RH: Undefined

The warning lights are LED technology, no post-crash diagnostic possible.

Structures.

The structure of the helicopter shows only static fractures, and mostly vertical efforts.

The skids show deformation to the rear.

The cabin floor forward side is deformed upward.

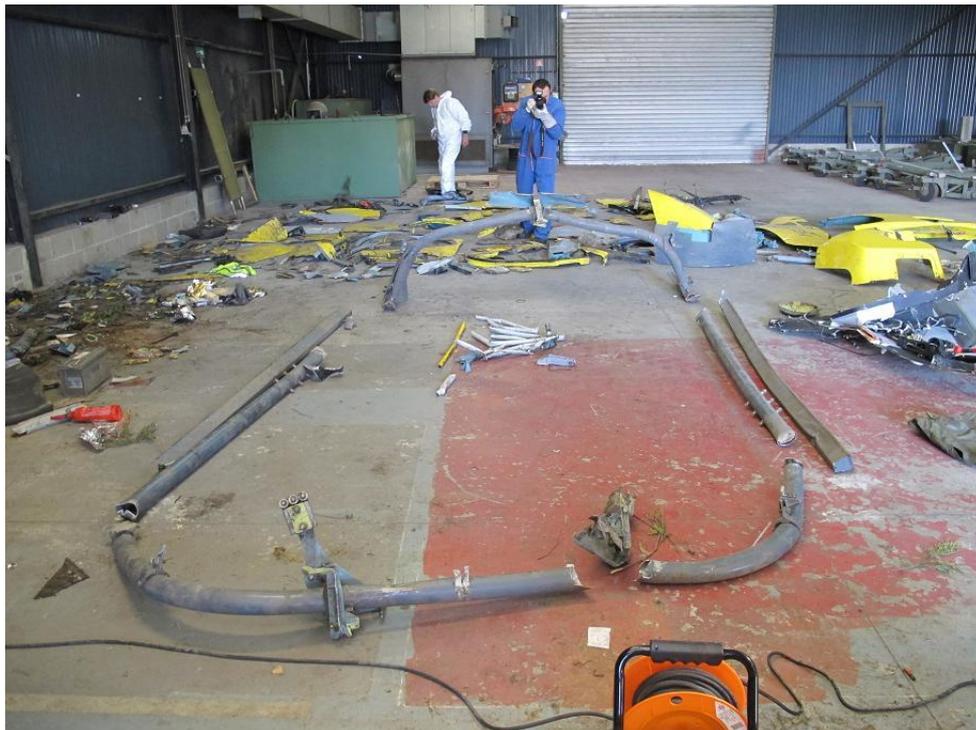


Fig 17: The skids

Power transmission

The power transmission shows breakage and deformation under power. The connection grooves show damage made during rotation.



Fig. 18: Power transmission

Control linkages and gearboxes

All controls linkages to the BTP and the BTA show continuity of the control systems. All fracture examined are static.

The Teleflex relaying the rudder pedal controls to the Tail Rotor Gearbox was still operating.

The BTP was still rotating (there was continuity of the inner parts of the BTP)

The magnetic chip detector of the BTP was clean.

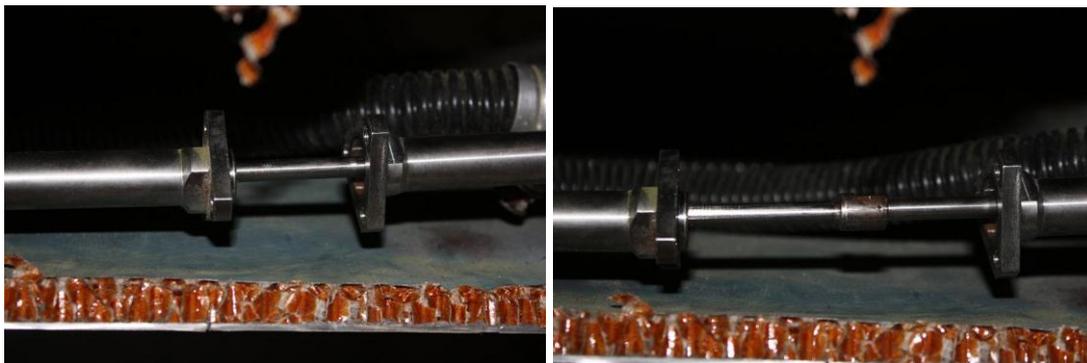


Fig 19: Teleflex operation

Main Blades:

The blades show impact damage with a fixed structure (tree).

The yellow blade shows less deformation, but the deformation of the main rotor showed the rotor hub had a tendency to continue the rotation while the main rotor blades were stopped.

Only one blade tip was found (it was found 213 m away from the main wreckage).



Fig 20: blade tips

1.13 Medical and pathological information.

An autopsy was performed.

The occupants of the helicopter died as a result of the forces during impact.

1.14 Fire.

There was no fire.

1.15 Survival aspects.

1.15.1. Emergency Locator Transmitter

The ELT did not activate upon impact, however, this had no incidence on the survivability aspects.

ATC had not received any ELT warning upon the crash.
The ELT was last tested at Ixair on September 8, 2011, but the test does not involve an access to the actual ELT box.

1.15.2. Seats

The seats are equipped with a system of vertical shock absorption, designed to mitigate the impact forces (up to 20G). The deformation were as follows:

LH Seat - LH absorber: 17.5cm
 - RH absorber: 11 cm

RH Seat: - LH absorber: 12.5 cm
 - RH absorber: 12.5 cm

In addition the lower structure of the seat are broken.

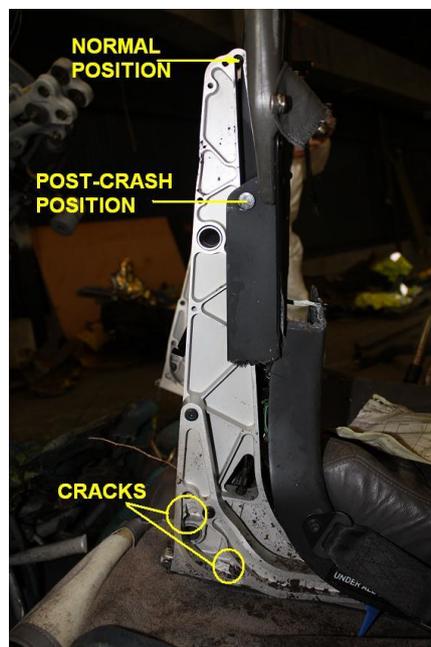


Fig.21: Seat

Note: a book (flight manual) was inserted under the pilot's seat; this might have had a negative effect on the ability of the seat to mitigate impact forces.

1.16 Tests and research.

Not Applicable

1.17. Organisation and Management information

The Company

Heli and Co S.A. is holding an Authorization for Air Works (N° 720, last issued by BCAA on 06/04/2011, valid until 24/01/2011) , for the following operation;

- First Flights
- Aerial photography
- Schooling RF
- Publicity (fixed)
- Aerial surveillance

The Mission

The photographic mission is happening 4 times a week, and is called the “daily flight”.

The photographic mission is usually performed with a Robinson R-44. But that day, the designated R-44 was under maintenance, and it was decided to use another helicopter – the EC120- instead.

The log book of the helicopter indicates it was used only once for a Fluxys daily flight prior to the accident.

The survey mission would be quicker (2:50 h) with the EC120 (flying faster) than with the R-44 (3:12 h).

The EC120 is used by Heli and Co S.A. is further leased to a flight training organization (Helyfly). Therefore, the helicopter was still equipped with double controls. Reportedly the double controls are not easy to remove.

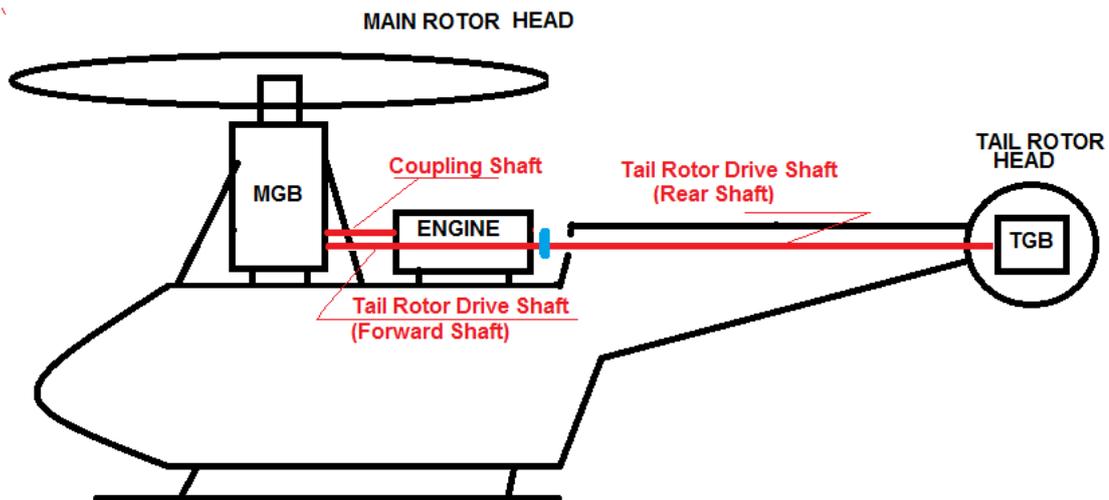
The flight preparation happened as usual, the pilot signing the pre-flight document.

Fuelling: Full tank (280 l were added in EBSP before the flight)

2. Analysis.

2.1. The helicopter.

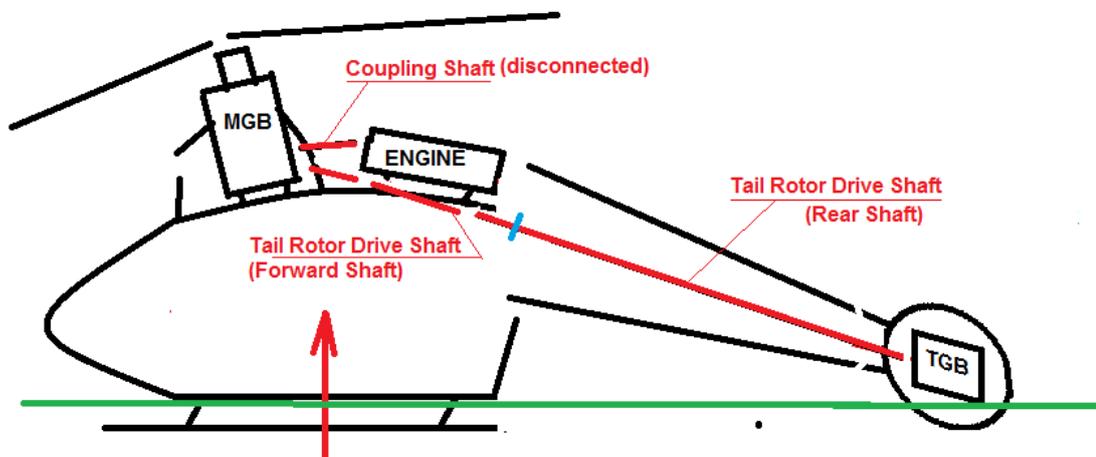
The engine transmits its power through rotating shafts and gearboxes to the Main Rotor and the Tail Rotor.



Engine.

The engine was in good mechanical condition, and the detailed examination determined that it was delivering significant power at the moment of impact;

- the gas turbine and the power turbine rotated freely and smoothly.
- The internal parts showed no significant impact marks on the leading edge, ruling out any foreign object ingestion.
- The magnetic particles detectors were clean, as the oil filter; indicating that there was no indication of abnormal wear.
- There were particles visible inside the combustion chamber, as well as in the turbine section. These particles are from the abrasible coating around the centrifugal impeller, indicating a brutal axial movement of the rotating parts of the engine when the helicopter impacted the ground.
- There were traces of beat on the splines of the transmission shaft sleeve and on the muff coupling (Main Gear Box) indicating that the engine was running at the moment of the disengagement of the coupling shaft.
- The engine was still attached to the structure of the helicopter. The damage were consistent with the impact forces.



Main Gearbox (MGB)

The Main Gearbox transmits the power from the engine to the Main Rotor Head and the Tail Gearbox (TGB) and Tail Rotor Head (TRH).

Instants before the helicopter hit the ground, the Main Gearbox was still transmitting power from the engine to the Main Rotor Head and the blades;

- By turning the Main Rotor Head, it was still possible to drive the input and output pinion, confirming the mechanical continuity inside the Main Gearbox.
- The Main Gearbox was still attached to the helicopter structure; three out of four suspension bars, holding the MGB in place are deformed and one is broken by overload.
- The damages seen on the drive splines of both input pinion and Tail Rotor Drive shaft are consistent with an uncoupling under power at impact, due to the deformations of the helicopter structure.

Coupling shaft

The coupling shaft (from the engine to the Main Gearbox) was transmitting power until it was disconnected on both ends due to the impact of the helicopter with the ground.

- The close examination of the input pinion driving splines shows elongation and damage consistent with an uncoupling under power, consistent with the sequence of events at impact .
- The coupling tube surrounding the coupling shaft is torn open due to the rotation of the coupling shaft after its disconnection from the Main Gearbox.
- The coupling arm to the Main Gearbox is broken due to the overload resulting from the engine displacement (with respect to the MGB) at impact.
- The coupling shaft was still attached to the flexible couplings on both sides. The flectors revealed signs of traction with significant torsional bending. This indicates a high traction loading leading to the rupture of the fixing screws and the front flange (on the engine side).

Tail Rotor Drive Shaft

The Forward Shaft is broken in three parts, showing static / overload stress.

The Rear Shaft is in overall good condition and turns freely. It is disconnected from the Tail Gear box.

Tail Gearbox and Tail Rotor Head

The fenestron impacted the ground in a vertical movement. The tail rotor blades were found buried under the ground. All the blade fractures show evidence of overload failure. This indicates that a lot of rotational energy was still present upon impact.

Main rotor blades

The damages on the rotor blades are consistent with impact with the ground and trees at high rotation speed.

A blade wing tip was liberated, and found at 170 m from the main crash area, indicating also high rotational energy.

Flight controls

The cabin floor is crushed by impact. Both cyclic sticks are bent.

The rod transmission of the controls, from the cabin floor to the Main Rotor Head shows continuity or evidence of static failure. No pre-crash failure condition was seen.

The Tail Rotor Control cable (Teleflex) was still operating.

2.2. The flight.

It would have been a long day for the pilot. The day started with a 2-hours drive time to reach the Spa airfield.

The pilot sent his first SMS text of the day at 04:38 UTC, stating he was driving to Spa airfield for a 3-hour flight.

The preparation of the flight started around 06:45 UTC (08:45 LT), including a 6-min flight for the refuelling.

The helicopter took off from Spa Airfield at 07:27 UTC (09:27 LT)

The flight itself was conducted at low altitude, including hover flight, requiring constant attention from the pilot.

The pilot sent SMS texts during the flight, one in particular stating the weather was not optimum (09:47 UTC).

The pilot sent a last test message at 09:53 UTC, when flying between Leuven en Zoutleeuw, and read a last text message at 09:54 UTC. The pilot further did not respond nor send any telephonic message, indicating an increased attention for the flight.

The meteorological conditions were rapidly degrading; at the time of the crash (data at 10:20 UTC), the weather report in Liege airport – EBLG (lower elevation than the crash area) showed scattered clouds at 300 ft, and broken clouds at 500 ft, while at Spa airfield, it was raining, and the vertical visibility dropped to 100 ft.

The crew completed the mission at 10:10 UTC, and headed towards Spa airfield, probably eager to get back home (get-home-itis).

The meteorological conditions kept degrading when the helicopter flew towards Soumagne, basically due to the overall conditions, and due to the terrain elevation moving up. The meteorological conditions were nevertheless similar to the forecast issued for the period.

When reaching the highway, the helicopter had to climb to avoid the high voltage lines; the GPS and the radar data show the helicopter climbing 300ft. At this height, flying at 152 km/h, it went suddenly in IMC condition.

The pilot reacted promptly, turning the helicopter to the right, going back where it came from, as prescribed by the procedure.

The helicopter kept turning, as seen on the GPS recording, and the pilot lost control. It is believed that the turning rate in IMC caused the spatial disorientation of the pilot. When the helicopter came lower, still turning, it was too late for the pilot to regain control of the helicopter.

2.3. The pilot

The pilot had an adequate experience on helicopters, in general, but his experience flying the EC120 was limited (Total on EC120: 25:13FH, amongst which 18:42FH as PIC).

The pilot was not qualified for Instruments flights.

Furthermore, most of his flight experience was gained with Robinson R22 and R44 helicopters having their main rotor rotating counter-clockwise and featuring conventional tail rotors.

The EC120 has a main rotor rotating clockwise and a ducted tail rotor, the fenestron. The reactions of this type of helicopter would be different than a helicopter fitted with a counter-clockwise rotating main rotor and a conventional tail rotor type.

Nevertheless, when suddenly confronted with the IMC situation, the pilot would have reacted instinctively, and his limited experience in this type of helicopter would have played a role in his ability to control the helicopter.

This factor is believed to be contributory to the mishap, having led the pilot to a spatial disorientation.

3. Conclusions.

3.1 Findings.

- The helicopter was airworthy before the accident.
- The examination of the wreckage showed that, at the moment of impact, the engine delivered significant power, that was transmitted to the Main Rotor blades and Tail Rotor blades.
- No pre-crash failure was found in the transmission of the control rods and cables; all failure can be related to the effect of impact forces.
- The pilot was duly qualified.
- The experience of the pilot was adequate, however, his experience flying the EC120 was not extensive.
- The meteorological conditions were adequate at the initiation of the flight, but degraded considerably during the flight.
- The mission was completed, and the helicopter was returning to its base when the accident occurred.

3.2 Causes.

The accident was caused by a loss of control of the helicopter, caused by a spatial disorientation of the pilot further to an unintentional entry in IMC.

The contributing factors include:

- Meteorological conditions,
- Fatigue of the pilot,
- Low experience on the type of helicopter (main rotor rotating clockwise and a fenestron).

4. Safety recommendations.

The recent series of helicopter accident showed that the human factors are playing a very important role in helicopter accidents. AAIU(Be) is of the opinion that safety promotion is a key element to improve pilot's awareness, and therefore supported the BCAA initiative of a "Helicopter Safety Day", as part of the Belgian Safety Plan.

The "Helicopter Safety Day" was organised by BCAA on Wednesday 27 June 2012. AAIU(Be) participated with a presentation on helicopter accidents.

The Belgian State Safety Plan was also amended to ensure a yearly organisation of (or participation of BCAA / AAIU(Be) in) safety seminars

Further to this action, the website of the Federal Public Service – Mobility and Transport – is relaying the publications of EHEST; the European Helicopter Safety Team.

Therefore, considering the actions already done by BCAA, no safety recommendation was issued for this investigation.



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Mobility and Transport**

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