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Swiss Transportation Safety Investigation Board STSB

Aviation Division

Final Report No. 2249 by the Swiss Transportation Safety Investigation Board STSB

concerning the accident involving the EC 120B helicopter, registration HB-ZIX

on 26 September 2013

Oberes Herrenfeld,
Schwyz/SZ municipality

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Ursachen

Der Unfall ist darauf zurückzuführen, dass der Hauptrotor des Helikopters beim Start von einem ungeeigneten Landeplatz mit dem Scheunenvordach kollidierte und der Helikopter in der Folge unkontrolliert auf dem Boden aufschlug.

General information on this report

This report contains the Swiss Transportation Safety Investigation Board's (STSB) conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Art 3.1 of the 10th edition, applicable from 18 November 2010, of Annex 13 to the Convention on International Civil Aviation of 7 December 1944 and Article 24 of the Federal Air Navigation Act, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident/incident prevention, due consideration shall be given to this circumstance.

The definitive version of this report is the original in the German language.

All information, unless otherwise indicated, relates to the time of the accident.

All times in this report, unless otherwise indicated, are stated in local time (LT). At the time of the accident, Central European Summer Time (CEST) applied as local time in Switzerland. The relation between LT, CEST and coordinated universal time (UTC) is:
LT = CEST = UTC + 2 hours.

Final Report

Aircraft type	Eurocopter EC 120B "Colibri"	HB-ZIX
Operator	Alpinlift Helikopter AG, 6374 Buochs, Switzerland	
Owner	Own A Heli AG, 6004 Lucerne, Switzerland	

Pilot	Swiss citizen, born 1965			
Licence	Commercial pilot licence helicopter (CPL(H)), issued by the Federal Office of Civil Aviation (FOCA)			
Essential ratings	EC 120B Mountain landings (MOU(H))			
Medical fitness certificate	Class 1, restrictions: shall wear multifocal lenses (VML), issued on 29 April 2013, valid till 16 May 2014			
Flying hours	**Total on helicopters**	411 hours	**During the last 90 days**	7:10 hours
	On the type involved in the accident	192 hours	**During the last 90 days**	7:10 hours

Location	Oberes Herrenfeld, municipality of Schwyz/SZ		
Coordinates	692 022 / 209 434 *(swiss grid 1903)*	**Elevation**	599 m AMSL
Date and time	26 September 2013, 17:25		

Type of operation	VFR, commercial operation
Flight phase	Take-off
Type of accident	Collision with an obstacle

Injuries to persons

Injuries	Crew	Passengers	Total number of occupants	Others
Fatal	0	0	0	0
Serious	0	0	0	1
Minor	0	0	0	0
None	1	1	2	1
Total	1	1	2	2

Damage to aircraft	Destroyed
Other damage	Projecting barn roof badly damaged

1 Factual information

1.1 Flight preparations and history of the flight

1.1.1 General

For the following description of the flight preparations and history of the flight, the recordings of the collision warning device and the statements of the pilots and the passengers were used.

The flight was conducted according to visual flight rules (VFR). The flight was declared as a commercial flight.

1.1.2 Flight preparations

The pilot had planned a flight from Buochs (LSZC) to Trogen on 26 September 2013 to pick up his son. He intended first to land in Seemattli near Seewen, where he planned to take on two passengers before flying towards Eastern Switzerland. The two passengers were the owners of a large meadow in Seemattli on which the pilot had been permitted to land on several occasions. He had offered the couple a flight to Trogen and back as thanks. The meadow in Seemattli is approximately 2 km west of Oberes Herrenfeld.

Consequently, the pilot called the passengers a few days before the scheduled flight and informed them about the upcoming flight. He told them that he would land in Seemattli and they could board there. On the same day one of the passengers contacted the pilot again and asked him if it would be possible to pick them up at their farm in Oberes Herrenfeld. A year before, the pilot had performed reconnaissance of the area around the farm in Oberes Herrenfeld. At that time he had assessed the terrain around the farm as gently sloping with only a few level areas and therefore rather unsuitable for a landing. The flight was at that time not conducted for other reasons.

On 26 September 2013, the pilot was preparing for the flight using the daily airspace bulletin (DABS), the notice to airmen (NOTAM) and weather information. At approximately 13:00 he updated his flight preparations and prepared the HB-ZIX helicopter at Buochs aerodrome. He refuelled the helicopter and conducted the pre-flight check. In terms of the technical condition of the helicopter, the pilot was informed that on earlier flights the yellow ENG CHIP annunciator had intermittently illuminated due to metal particles in the engine gearbox. This issue was under investigation by the maintenance organisation.

Shortly before the flight, between 14:00 and 14:30, one of the passengers contacted the pilot again to get confirmation of the landing site preferred by the passengers, which was close to the farm. The pilot confirmed this wish after he had re-evaluated the landing area on an electronic map.

At 15:38 the pilot took off from Buochs aerodrome with HB-ZIX and flew along the shore of Lake Lucerne towards Schwyz. Abeam Beckenried, the ENG CHIP annunciator began to flicker. The pilot decided to cross the lake as quickly as possible and then to fly directly to the farm in Oberes Herrenfeld via Brunnen. As planned, he looked for a suitable landing site on the gently sloping terrain north-east of the farm while hovering at low speed. However, the terrain appeared to him to be too steep for a landing. He therefore opted to land in the farm forecourt. He flew around the farmhouse in hovering flight and at 15:47 landed from the south-west on the flat forecourt between the barn and the farmhouse. After landing, the left skid was located on the farmhouse forecourt, formed from interlocking paving stones, while the right skid was on the gravel area adjacent to the barn.

After stopping the engine, the pilot telephoned the aircraft mechanic from Alpinlift Helikopter AG and described the problem with the ENG CHIP annunciator. On the basis of the technical advice received, the pilot decided to conduct the flight with passengers as planned.

After a short briefing with the two passengers the helicopter took off at 15:58. Already while in the control hover the ENG CHIP annunciator flickered again. According to the statement of the pilot, this did not concern him for the remainder of the flight. The pilot accelerated the helicopter uphill from the forecourt in a continuous climb in a northerly direction. The flight continued directly to Trogen in order to pick up the pilot's son.

1.1.3 History of the flight

The pilot took off from Trogen with HB-ZIX with three passengers at 16:53 for the return flight. Before the landing approach, he informed the couple that he would not turn off the engine of the helicopter after landing at the farm in Oberes Herrenfeld due to the nearby thunderstorm. He explained to them that after disembarking the helicopter they should move towards the front right of the aircraft, away from the danger zone. He then intended to fly to Seewen with his son.

The pilot approached the farm in a shallow final approach in a wide left turn from the south-west, with the intention of landing on the same forecourt as before between the farmhouse and barn. At 17:25 the pilot landed with both skids on the gravel area towards the barn, i.e. the left skid was approximately 1 to 1.5 m away from the forecourt formed from interlocking paving stones (see Fig. 1). At this time, he noticed a passenger vehicle on the farm forecourt in the immediate vicinity of the landing site. The pilot could not recall whether this passenger vehicle had been there during the first landing. He then reduced the engine speed to idle. The two passengers disembarked the helicopter and walked away to the front and right. When approximately 5 to 6 m away, they stopped near the barn to watch the helicopter take-off.

Figure 1: The HB-ZIX helicopter shortly before take-off. The recording was made by the passenger.

The pilot increased the speed of the engine and lifted off into a control hover. At the same time the female passenger approached the helicopter to photograph it. The pilot noticed this and as a result wished to leave the forecourt immediately.

The pilot accelerated the helicopter by pitching from hovering to forward flight. In doing so the main rotor blades collided with the projecting barn roof on the right of the helicopter. The pilot made the following statement: *"I was not aware of this projecting barn roof and I was completely surprised by the violent bang."*

The helicopter crashed to the ground from a height of approximately 2 to 3 metres, rolled onto its left side and jerked in the direction of the two passengers, who were standing with their backs to a wooden silo near the barn. The female passenger was struck on both legs and seriously injured by metal parts flung from the helicopter. The second passenger was not injured.

The pilot and his son were able to vacate the helicopter unharmed.

1.2 Wreckage and impact information

1.2.1 Site of the accident

The accident site was located at Oberes Herrenfeld between a large barn and a farmhouse (see Fig. 2). The meadows next to and below the two buildings are gently sloping. Above the buildings the gradient increases, apart from a few level areas. The distance between the projecting barn roof and the farmhouse was 16.3 m. The white passenger vehicle was parked on the forecourt in front of the farmhouse during both helicopter landings. The difference in height between the projecting barn roof and the ground was approximately 6.4 m. The barn roof projected 3.3 m beyond the outermost pillars. The approach sector was in a southwesterly direction, while the departure sector was in a northerly direction.

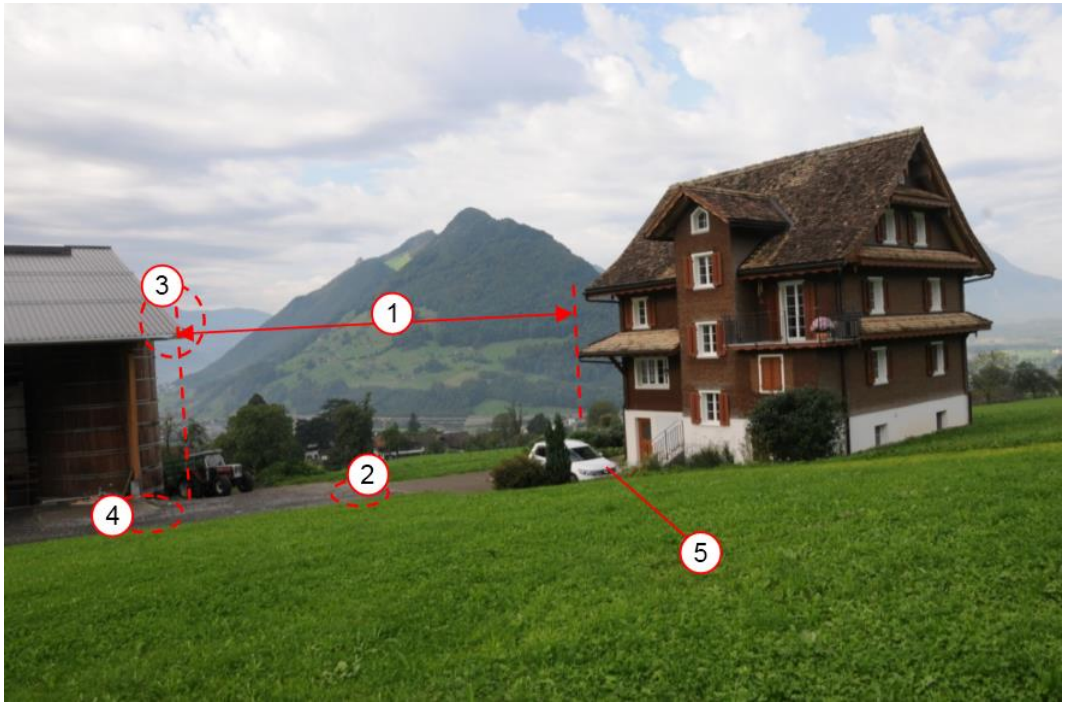

Figure 2: Site of the accident: ① Distance of 16.3 m, ② HB-ZIX landing site, ③ point of collision between the main rotor blades and the projecting barn roof, ④ final position of the helicopter after the accident, ⑤ parked passenger vehicle.

1.2.2 Impact

After the collision with the projecting barn roof, the helicopter crashed onto the gravel area from a height of 2 to 3 m and came to rest on its left-hand side.

1.2.3 Wreckage

The wreckage was lying on its left-hand side below the projecting barn roof (see Fig. 3). The main rotor blades were separated from the rotor head at the blade roots and were severely damaged. Most of the landing gear was torn from the helicopter. The tail boom was severed in the middle, so that the rear half including the Fenestron[1] was only connected to the rest of the airframe by cables. Smaller items of debris were found within a radius of 25 m. Some fragments were embedded in the wooden silo. There was no leakage of fuel or oil.

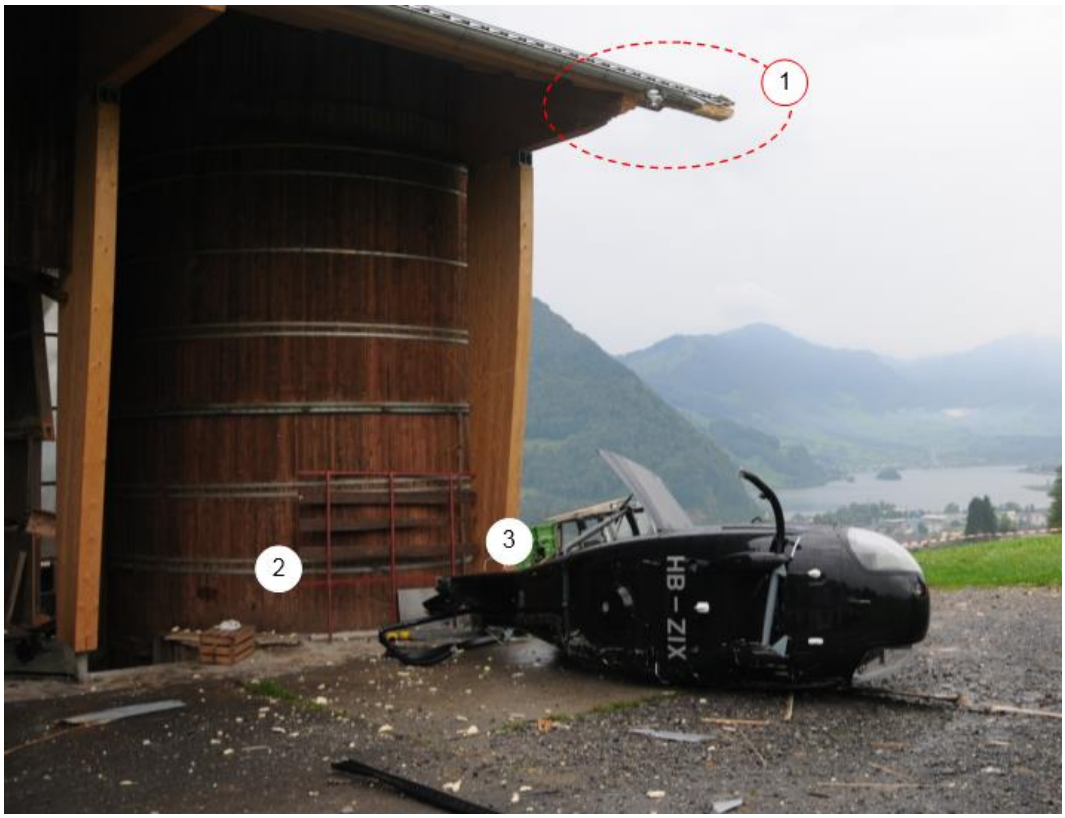

Figure 3: Final position of the wreckage: ① Point of collision ② and ③ location of the passengers at the time of the accident.

1.3 Meteorological information

1.3.1 General meteorological situation

A high-pressure area over the North Sea extended towards the south. There was an almost stationary cold front over southern Germany.

1.3.2 Weather at the time and location of the accident

In front of this cold front, moist, unstably layered tropical air was entering Central Switzerland. This resulted in rain and thunderstorm cells, which caused precipitation of very different intensities. Winds at ground level were light.

[1] The manufacturer of the helicopter denominates the shrouded tail rotor as a Fenestron.

Cloud	8/8 at 5300 ft AMSL[2]	
Visibility	1200 m	
Wind	variable at 3 kt	
Temperature/dewpoint	17 °C / 15 °C	
Atmospheric pressure QNH	1016 hPa	
Hazards	Thunderstorms	

1.3.3 Astronomical information

Position of the sun	Azimuth: 248°	Elevation: 18°
Lighting conditions	Daylight	

1.3.4 Images from webcams in the region

Figure 4: Schwyz webcam, 26 September 2013, 17:11, 14 minutes before the accident.

[2] AMSL: above mean sea level

Figure 5: Schwyz webcam, 26 September 2013, 17:30, 5 minutes after the accident.

1.4 Aircraft information

1.4.1 General information

The Eurocopter EC 120 B "Colibri" is a light helicopter with five seats. It is powered by a Turboméca Arrius 2F free-turbine turboshaft engine with a take-off power of 376 kW (511 hp). The maximum permissible continuous power output of the engine is 335 kW (444 hp). The EC 120 B type has an articulated Spheriflex® main rotor with three blades; it rotates in a clockwise direction (viewed from above) and has a diameter of 10 m. The necessary torque compensation is achieved using a so-called Fenestron.

Max. permitted take-off mass	1715 kg
Mass and centre of gravity	Both the mass and centre of gravity were within the permitted limits according to the aircraft flight manual (AFM) during the entire flight.
Analysis of the vehicle and engine multifunction display (VEMD)	The analysis of the recorded data indicated no exceedance of the maximum allowable limits up to the time of the accident.
Operating hours	321:44 hours
Maintenance	The last scheduled maintenance took place on 11 July 2013 at 278:56 operating hours.
Fuel	On take-off in Buochs there were approximately 245 l of fuel on board. At the time of the accident, there were still 105 l of fuel on board.
Certificate of Registration	Issued by the FOCA on 31 December 2012, valid till deletion from the aircraft register.

Certificate of Airworthiness	Issued by the FOCA on 3 December 2010, valid till revoked.
Airworthiness Review Certificate	Date of issue: 9 November 2012
	Date of expiration of validity: 3 December 2013
Scope of Utilisation	Private and commercial
Types of operation	VFR day / VFR night

The pilot stated that apart from the illumination of the ENG CHIP annunciator, the helicopter had been in perfect working condition. No snags were entered in the helicopter's technical logbook.

The operator and maintenance organisation were aware of the intermittent illumination of the yellow ENG CHIP annunciator and a corresponding troubleshooting process had been initiated. Further work in this regard had been planned for after the flight.

1.4.2 Extract from the aircraft flight manual

Part 3 of the aircraft flight manual for the EC 120B helicopter describes the emergency procedures. It stipulates the following in relation to the yellow ENG CHIP annunciator:

"SECTION 3

EMERGENCY PROCEDURES

ENG CHIP *Metal particles in engine oil circuit*

LAND AS SOON AS POSSIBLE[3]

Execute a minimum power approach landing and be prepared in case of an engine flame-out."

1.5 Technical investigations

The technical investigation of the wreckage revealed a thin, approximately 5 mm long, metal particle on the turbine gearbox's magnetic chip detector plug. No abrasion or metal particles were detected on the other plugs.

1.6 Medical and pathological information

After the accident, the pilot was subjected to a medical investigation with no abnormal findings.

[3] "LAND AS SOON AS POSSIBLE: *emergency conditions are urgent and require landing at the nearest landing site at which safe landing can be made"* (Definition according to AFM).

2 Analysis

2.1 Technical aspects

There are no indications of any pre-existing technical defects which might have caused or influenced the accident.

Before the flight on 26 September 2013 the HB-ZIX helicopter had no entry in the helicopter technical logbook which would have restricted a flight or made a flight impossible. However, the pilot stated that before the flight he had been informed about intermittent illumination of the yellow ENG CHIP annunciator on previous flights. This means that the technical status of the helicopter and its on-board documentation did not correspond. One of the purposes of the on-board documentation is to inform the pilot of the current technical status upon taking control of an aircraft.

According to the aircraft flight manual, the flight should have been aborted when the yellow CHIP ENG annunciator illuminated shortly after take-off in Buochs (cf. Section 1.4.2).

When the pilot landed in Oberes Herrenfeld for the first time, he telephoned the aircraft mechanic and consulted him regarding the ENG CHIP annunciator. The aircraft mechanic explained to the pilot the problem that had existed for some time and had no reservations about allowing the pilot to continue to fly without further inspection on site.

According to the manufacturer's instructions, any illumination of the ENG CHIP annunciator requires landing as soon as possible and a subsequent technical examination. In this respect, the assessment of the situation was not appropriate.

2.2 Human and operational aspects

A year before the accident the pilot had performed reconnaissance of the area around the farm and assessed it as rather unsuitable for a landing. His original intention to land at Seemattli was therefore logical and safety conscious.

It is understandable that upon the passengers' request for a landing directly at the farm the pilot wanted to revisit his earlier assessment. Any change of the previous assessment must be based on accurate, up-to-date on-site reconnaissance. This must include the identification and stipulation of safe options for approach, landing and departure. Otherwise a landing should be avoided and the passengers should embark at a suitable landing site in the vicinity.

The distance between the farmhouse and the projecting barn roof was 16.3 m. Landing directly between these two buildings gives a lateral rotor clearance of approximately 3 m on each side. Landing in such a tight space is not appropriate under the circumstances. On the second landing, the distance to the projecting barn roof decreased significantly since the landing took place 1 to 1.5 m further to the right. Furthermore, according to his statement, the pilot was not aware of the extreme forward projection of the barn roof. Neither was he aware of the passenger vehicle in the immediate vicinity of the landing site during the first landing. The gravel dust whipped up by the rotor wash means that landing directly next to a passenger vehicle should be considered inappropriate without a compelling reason.

This indicates that the pilot's assessment of the potential hazards was incomplete.

When the helicopter returned from Eastern Switzerland and approached the farm again, the pilot noticed the approaching thunderstorm. He therefore decided to allow the couple to disembark with the rotor turning. This suggests that the pilot was under a certain amount of time pressure.

3 Conclusions

3.1 Findings

3.1.1 Crews

- The pilot held the necessary licences for the flight.
- There are no indications of the pilot suffering any health problems during the flight.

3.1.2 Technical aspects

- There are no indications of any pre-existing technical defects which might have caused or influenced the accident.
- However, the pilot stated that before the flight he had been informed about intermittent illumination of the yellow ENG CHIP annunciator on previous flights.
- According to the manufacturer's instructions, any illumination of the ENG CHIP annunciator requires landing as soon as possible and a subsequent technical examination.
- Both the mass and centre of gravity of the helicopter were within the permitted limits according to the aircraft flight manual (AFM) during the entire flight.

3.1.3 History of the flight

- At 15:38 on 26 September 2013 the pilot of the HB-ZIX helicopter took off from Buochs aerodrome (LSZC) with no passengers on board.
- The yellow ENG CHIP annunciator began to illuminate intermittently in the Beckenried region.
- The pilot then crossed the lake and then flew directly to the farm in Oberes Herrenfeld via Brunnen.
- At 15:47 the pilot landed in Oberes Herrenfeld on a forecourt between a barn and a farmhouse.
- The pilot telephoned the aircraft mechanic and consulted him regarding the ENG CHIP annunciator. The aircraft mechanic explained to the pilot the problem that had existed for some time and had no reservations about allowing the pilot to continue to fly without further inspection on site.
- Approximately ten minutes later the pilot took off in the direction of Trogen with two passengers on board in order to pick up his son.
- At 16:53 the pilot took off from Trogen with three passengers on board and flew back toward Oberes Herrenfeld.
- The landing at Oberes Herrenfeld took place at 17:25; the two passengers disembarked with the rotor turning.
- Shortly thereafter the helicopter took off again. When it did so, the main rotor collided with the projecting barn roof.
- As a result of the collision, the helicopter became uncontrollable and crashed to the ground.
- No occupants were injured.

- The female passenger who had exited and who was very close at the time of the accident, was injured by debris ejected during the impact.
- The second passenger who had exited and who also was in the danger zone was unharmed.

3.1.4 General conditions

- The distance between the farmhouse and the projecting barn roof was approximately 16.3 m.
- Landing directly between these two buildings with this helicopter type gives a lateral rotor clearance of around 3 m on each side.
- On the second landing, the distance to the projecting barn roof decreased since the landing took place 1 to 1.5 m further to the right.
- At the time of the accident it was cloudy and a thunderstorm was approaching.

3.2 Causes

The accident is attributable to the fact that upon take-off from an unsuitable landing site the main rotor of the helicopter collided with a projecting barn roof and as a result the helicopter became uncontrollable and impacted the ground.

4 Safety recommendations, safety advices and measures taken since the accident

4.1 Safety recommendations

None

4.2 Safety advices

None

4.3 Measures taken since the accident

None

Payerne, 2 December 2015 Investigation Bureau STSB

This final report was approved by the Board of the Swiss Transportation Safety Investigation Board STSB (Art. 10 lit. h of the Ordinance on the Safety Investigation of Transportation Incidents of 17 December 2014).

Berne, 26 November 2015