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Report RL 2001:25e

***Accident involving helicopter SE-HPL
approx. 5 km north of Ockelbo, X County,
Sweden, on the 21st of February 2001***

Case L-006/01

SHK investigates accidents and incidents with regard to safety. The sole objective of the investigations is the prevention of similar occurrences in the future. It is not the purpose of this activity to apportion blame or liability.

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Translated by *Dennis Lynn Anderson*
From the original Swedish at the request of the Board of Accident Investigation.

In case of discrepancies between the English and Swedish texts, the Swedish text is to be considered the authoritative version.

Statens haverikommission (SHK) Board of Accident Investigation

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Swedish Civil Aviation Administration

601 79 NORRKÖPING

Report RL 2001: 25e

The Board of Accident Investigation (Statens haverikommission, SHK) has investigated an accident that occurred on the 21st of February 2001, approximately 5 kilometers north of Ockelbo, X County, Sweden involving a helicopter with registration SE-HPL.

In accordance with section 14 of the Ordinance on the Investigation of Accidents (1990:717) the Board herewith submits a final report on the investigation.

A translation to English of the report will be submitted.

Olle Lundström

Monica J. Wismar

Henrik Elinder

Contents

Summary	4
1 FACTUAL INFORMATION	6
1.1 History of the flight	6
1.2 Injuries to persons	6
1.3 Damage to aircraft	6
1.4 Other damage	7
1.5 Personnel information	7
1.6 Aircraft information	7
1.7 Meteorological information	7
1.7.1 <i>General</i>	7
1.7.2 <i>Terrain situation</i>	8
1.8 Aids to navigation	8
1.9 Communications	8
1.10 Aerodrome information	8
1.11 Flight recorders	8
1.12 Wreckage and impact information	8
1.12.1 <i>The accident site</i>	8
1.12.2 <i>Aircraft wreckage</i>	9
1.13 Medical information	9
1.14 Fire	9
1.15 Survival aspects	10
1.16 Tests and research	10
1.16.1 <i>Technical investigation</i>	10
1.16.2 <i>Visual illusion</i>	10
1.17 Organizational and management information	10
2 ANALYSIS	11
3 CONCLUSIONS	12
3.1 Findings	12
3.2 Causes	12
4 SAFETY RECOMMENDATIONS	12
APPENDIX	
1 Extracts from Register of Licenses regarding the pilot (to the Swedish Civil Aviation Administration only)	

Report RL 2001:25e

L-006/01

Report finalized 2001-08-24

<i>Aircraft: registration, type</i>	SE-HPL , Bell 206L-1
<i>Class/airworthiness</i>	Normal, Valid certificate of airworthiness
<i>Owner/Operator</i>	The Swedish National Police Board, Box 12256, 102 26, Stockholm
<i>Date and time</i>	The 21 st of February 2001, at 09:35 hours in daylight. Note: All times in the report are given in Swedish standard time = UTC + 1 hour.
<i>Place of occurrence</i>	Approximately 5 kilometers north of Ockelbo, X County, Sweden (position 6055N 1642E, approximately 80 meters above sea level)
<i>Type of flight</i>	Utility aviation
<i>Weather</i>	According to SMHI's (Swedish Meteorological and Hydrological Institute) analysis: wind 300°/12–15 knots, possible gusts of 25–30 knots, visibility unlimited, clear skies, temperature/dewpoint 0/–8 °C, QNH 989 hPa.
<i>Persons onboard: crew</i>	1
<i>passengers</i>	–
<i>Injuries to persons</i>	Serious
<i>Damage to aircraft</i>	Substantially damaged
<i>Collateral damage</i>	Limited damage to an electrical power line
<i>Pilot: age, certificate</i>	33 years old, CPL Helicopter (Swedish BH) with night rating
<i>total flying time</i>	2,562 hours, of which 2,382 hours on the type
<i>flying time the previous 90 days</i>	69 hours, of which 49 hours on the type
<i>number of landings previous 90 days</i>	approximately 30, of which approximately 20 on the type

The Board of Accident Investigation (SHK) was notified on the 21st of February 2001 that an accident had taken place involving a helicopter with registration SE-HPL north of Ockelbo, X County, Sweden on that same day at 09:35 hours.

The accident has been investigated by SHK represented by Olle Lundström, Chairman, Monica J Wismar, Chief Investigator Flight Operations, and Henrik Elinder, Chief Technical Investigator Aviation.

SHK has been assisted by Kenneth Nordin as operational expert.

The investigation has been followed by The Swedish Civil Aviation Administration through Kåre Jernling.

Summary

After a flight from Gävle/Sandviken airport, the pilot was to land in the village of Mo, north of Ockelbo. He could tell that the wind was strong and

gusty but determined that there would be no problem in landing at the intended site.

Taking the wind into consideration, he planned to make the approach overhead two electrical power lines that run just east of the intended landing site and thereafter land directly into the wind. He was aware of the fact that overflying electric power lines at low altitude should always take place in the vicinity of the towers. As the visibility was good and he felt completely certain that he saw all the cables clearly, he nevertheless chose to perform the overflight between the towers. When, in his judgement, the helicopter had cleared all the cables, he initiated an approximately 30° steep descent towards the landing site.

His impression was that the descent, despite the gusty wind, proceeded completely normal until, to his surprise, he suddenly felt the helicopter snag a cable. Subsequently the helicopter tipped forward and impacted the ground just less than 20 meters from the power lines.

The accident was caused by the landing being performed with an insufficient safety distance to the electrical power lines. A contributory cause may have been that the helicopter was affected by local turbulence.

Safety recommendations

None.

1 FACTUAL INFORMATION

1.1 History of the flight

The pilot departed from Gävle/Sandviken airport at about 09:20 hours, to fly to the village of Mo, north of Ockelbo, where he was to pick-up a colleague. The en-route flight took place at an altitude of approximately 1,000 feet above ground level. The landing was planned to take place directly into the wind on an open area close to the colleague's house, where the pilot had landed on two previous occasions. He was aware that the wind was strong and gusty but determined that there would be no problem in landing at the site.

Taking the wind into consideration, he planned to make the approach overhead two electrical power lines that run just east of the intended landing site and thereafter land directly into the wind. This meant that the helicopter would pass overhead the power lines between two of the support towers.

He was aware of the fact that overflying electric power lines at low altitude should always take place in the vicinity of the towers; because experience shows that it is very difficult to see and to judge the distance to single power lines from the air.

As the visibility was good and he felt completely certain that he saw all the cables clearly, he nevertheless chose to perform the overflight between the towers. When, in his judgement, the helicopter had cleared all the cables, he initiated an approximately 30° steep descent towards the landing site where his colleague was waiting. He estimated that the safety distance to the nearest electrical cable would be a minimum of five meters.

His impression was that the descent, despite the gusty wind, proceeded completely normal until, to his surprise, he suddenly felt the helicopter snag a cable. Subsequently the helicopter tipped forward and impacted the ground just less than 20 meters from the power lines. Upon impact the pilot temporarily lost consciousness.

The colleague, who witnessed the accident, rushed to the accident site and assisted the pilot in, among other things, turning off the main power to the helicopter. Shortly thereafter the pilot was attended to by the search and rescue personnel who were called-out to the site.

The accident took place on the 21st of February 2001 at 09:35 hours at position 6055N 1642E, approximately 80 meters above sea level.

1.2 Injuries to persons

	<i>Crew</i>	<i>Passengers</i>	<i>Other</i>	<i>Total</i>
Fatal	—	—	—	—
Seriously injured	1	—	—	1
Slightly injured	—	—	—	—
No injuries	—	—	—	—
Total	1	—	—	1

1.3 Damage to aircraft

Substantial.

1.4 Other damage

Limited damage to an electrical power line.

1.5 Personnel information

The pilot was 33 years old at the time and held a valid Commercial Pilot License Helicopter (Swedish BH) with a night rating. He had police aviator experience level G (green) with an operational weather limitation of 1 kilometer visibility and 250-foot ceiling.

Flying time (hours)

<i>previous</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	4	69	2,562
This type	4	49	2,382

Number of landings this type the previous 90 days: approximately 20.

Flight training on the type was concluded in 1993.

Latest PFT (periodic flight training) was carried out 2000-09-25 on the Bell 206.

1.6 Aircraft information

GENERAL

Manufacturer: Bell Helicopter
Type: Bell 206 L-1
Serial number: 45 212
Year of manufacture: 1979
Gross weight: Maximum authorized 1,882 kg, actual approximately 1,770 kg
Center of gravity: Within allowable limits
Total flight hours: 17,689 hours
Flight hours since last periodic check: 35 hours
Fuel uplifted before event: JET A1

ENGINE

Manufacturer: Allison
Engine model: 250 C-30P
 Number of engines: 1
Compressor hours/cycles since overhaul: 4,598/4,655
Turbine hours/cycles since overhaul: 1,333/1,452

ROTOR

Rotor manufacturer: Bell

The helicopter had a valid certificate of airworthiness.

1.7 Meteorological information

1.7.1 General

An area of low pressure over Finland brought strong and gusty northwesterly winds to the Swedish province of Gästrikland. The wind was estimated at approximately 310°/30 knots at 1,000 feet above the ground. Otherwise the weather was clear.

According to SMHI's analysis: wind 300°/12–15 knots, gusts from 25–30 knots, visibility unlimited, clear skies, temperature/dewpoint 0/–8 °C, QNH 989 hPa.

According to a witness who was inside his residence a few hundred meters from the accident site, the wind gusts were so strong that the "whole house shook".

1.7.2 Terrain situation

The terrain in the vicinity of the accident site is hilly. At the request of SHK, meteorological expertise investigated if, with the prevailing wind, so-called "wind vortices" could have appeared and entailed strong local descending air currents that could have affected the helicopter during the approach. According to the investigation, the prerequisites for this type of wind disturbance were not present. However the gusty wind, varying in both direction and speed can have caused so-called "chaotic mechanical turbulence" at low altitude, which could have affected the helicopter.

1.8 Aids to navigation

Not applicable.

1.9 Radio communications

Not applicable.

1.10 Aerodrome information

Not applicable.

1.11 Flight recorders

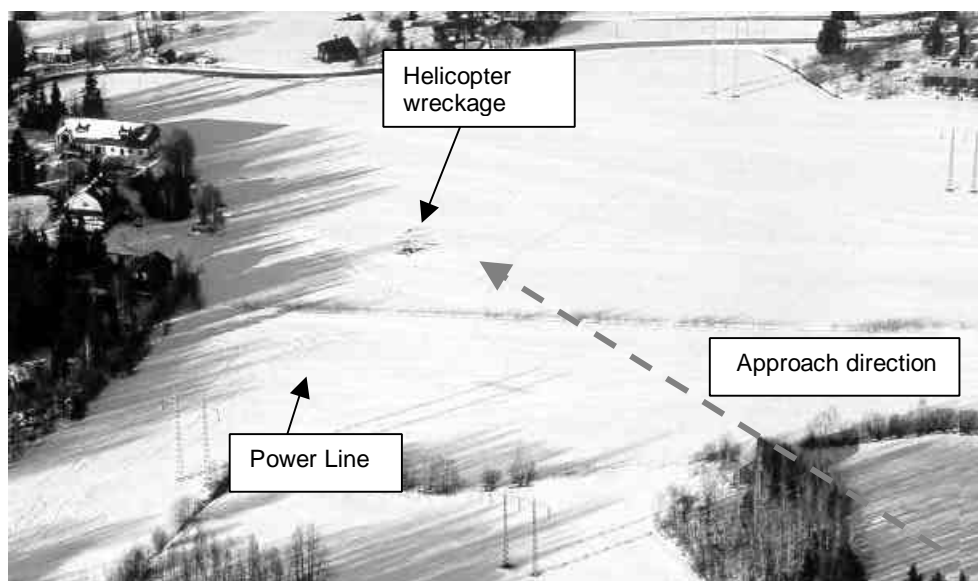
There was no requirement to carry a Flight Data Recorder (FDR) or a Cockpit Voice Recorder (CVR) on board the aircraft and neither was fitted.

1.12 Wreckage and impact information

1.12.1 The accident site

The helicopter impacted the ground on a snow-covered field approximately 50 meters from the intended landing site. Electrical power lines consisting of two phase cables 15.6 meters above the ground and two header cables 21.9 meters above the ground run about 20 meters east of the impact site. The phase cable cross-sectional area is 454 mm² and that of the header cables is 85 mm². Another set of power lines runs parallel to these about 90 meters to the east. The second set of power lines consists of three phase

cables and two header cables at about the same height as the first set of lines.



1.12.2 Aircraft wreckage

The helicopter received extensive structural damage. It was lying on its right-hand side with the nose section pointed in the opposite direction of the approach. The main rotor blades were shattered and the tail boom was separated from the helicopter. The damage to the forward landing skid legs and foot supports indicated that the helicopter had collided with a power line.



1.13 Medical information

Nothing has been found to indicate that the mental or physical condition of the pilot had been impaired prior to or during the flight. Subsequent to the occurrence he underwent an eye examination. The examination found no faults.

In the accident the pilot suffered, in addition to minor wounds, several rib injuries.

1.14 Fire

There was no fire.

1.15 Survival aspects

The pilot was secured with a four-point safety belt and the cabin remained relatively intact after the impact, which probably contributed to the fact that his bodily injuries were not more serious. The helicopter was equipped with a type 3000 A emergency locator beacon. There were no signals received from the locator beacon and the pilot believes that he could have disabled it himself in connection with the de-energizing of the other power units.

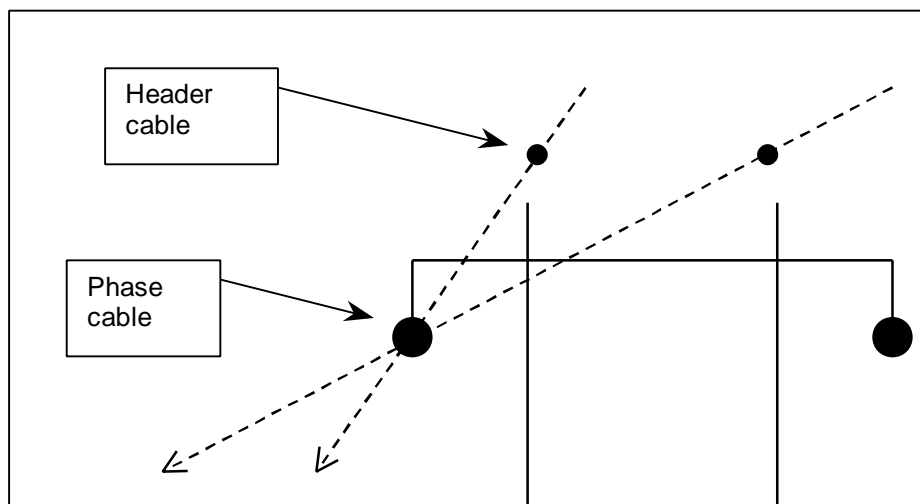
1.16 Tests and research

1.16.1 Technical investigation

The pilot was of the opinion that technically the helicopter functioned fail-free prior to the collision and nothing in the sequence of events indicates otherwise. The technical investigation has therefore been limited to a visual examination of the wreckage of the helicopter. No technical fault or abnormality that could have influenced the sequence of events has been found.

1.16.2 Visual illusion

By drafting the electrical power lines in question to scale, representing the height above the ground and the distance between the cables; one is able to see from the sketch below that the thinner header cables can spatially collocate and become “hidden” in front of the thicker phase cables at certain approach angles. Critical angles of approach in this respect were approximately 30° and 65°.



1.17 Organizational and management information

The aviation division of The Swedish National Police Board pursues professional aviation of a special character. These activities include, among other things, flying during operational police missions, search and rescue services, traffic surveillance and forest fire watch.

The National Police Board's aviation division is based in the cities of Malmö, Gothenburg, Tullinge and Boden.

2 ANALYSIS

Considering the strong and gusty winds, the pilot was justified in planning a landing straight into the wind, even if this entailed that the approach would be performed overhead the two electrical power lines. He was fully aware that without position reference it is difficult to see and determine the range to individual power cables from the air and that therefore power lines should always be passed in the vicinity of the towers which could provide this reference.

It can therefore appear noteworthy that the pilot, even though he had previously landed at the site from the same direction earlier, in this case nevertheless chose to deviate from this rule and cross the power lines between the towers. He felt that the visibility and light conditions were so good that he could see all the cables clearly and that he had a sufficient margin of safety to the nearest cable. Therefore the collision with the power line came as a complete surprise to him during a flight that he thought he had complete control over.

This occurrence demonstrates how difficult it is to discern individual power cables from the air, even for a very experienced pilot. It also points out how important it is that pilots always adhere to the safety regulations that have been developed for this purpose.

In this case there are several possible explanations as to why the pilot could make such a serious misjudgment of the header cable's distance from the helicopter. A combination of several of these could even have been the case.

- The short distance between the power lines and the intended landing site entailed the requirement of a steep descent. The header cable could then have ended-up below the visual field through the forward windscreen.
- The header cables are thinner than the phase cables and more difficult to see. As depicted in section 1.16.2 the header cable in question could have been "hidden" in front of a phase cable.
- At a short distance a header cable can be mistaken for a thicker phase cable at a long distance.
- The header cable could have oscillated up and down in the strong and gusty wind, which in this case made it difficult to see and caused it to come closer to the helicopter during an "up oscillation".
- During the approach the helicopter could have been influenced by local turbulence that momentarily caused the descent rate of the aircraft to be higher than what the pilot had intended.
- The turbulence could also have entailed a momentary decrease in the forward speed of the helicopter, which caused the pilot to unconsciously move the control stick forward to regain airspeed, resulting in altitude loss.

The possibility that the helicopter's dome-shaped floor windscreen could have created an optical refraction that made it more difficult for the pilot to determine the position of the cables during the approach has been discussed, but has been considered improbable by expertise at SHK.

Apart from the fact that the pilot should have followed the basic rule to always pass overhead power lines in the vicinity of the support towers, it can be questioned if the intended landing site was suitable at the time. Considering the prevailing winds he should have instead, in the opinion of SHK, chosen to land farther away from the power lines where there was an excess of open space, even if this had entailed a certain amount of inconvenience for his colleague who was waiting on the ground. By doing this, the margin of safety distance to the header cables would have been significantly greater.

3 CONCLUSIONS

3.1 Findings

- a) The pilot was qualified to perform the flight.
- b) The helicopter had a valid certificate of airworthiness.
- c) The wind was strong and gusty.
- d) The approach took place over electrical power lines between the support towers.
- e) The pilot misjudged the distance to the nearest power cable.

3.2 Causes

The accident was caused by the landing being performed with too little margin of safety distance to the electrical power lines. A contributory cause could have been that the helicopter was influenced by local turbulence.

4 SAFETY RECOMMENDATIONS

None.