FINAL REPORT

ACCIDENT 2021/345

State Commission on Aircraft Accidents Investigation (PKBWL)

UL. CHAŁUBIŃSKIEGO 4/6, 00-928 WARSZAWA | DUTY PHONE (+48) 500 233 233

FINAL REPORT

ACCIDENT

OCCURRENCE NO – 2021/345

AIRCRAFT – Helicopter, Bell 429, SP-KKS

DATE AND PLACE OF OCCURENCE – 22 February 2021, EPPY

The Report is a document presenting the position of the State Commission on Aircraft Accidents Investigation concerning circumstances of the air occurrence, its causes and safety recommendations. The Report was drawn up on the basis of information available on the date of its completion.

The investigation may be reopened if new information becomes available or new investigation techniques are applied, which may affect the wording related to the causes, circumstances and safety recommendations contained in the Report.

Investigation into air the occurrence was carried out in accordance with the applicable international, European Union and domestic legal provisions for prevention purposes only. The investigation was carried out without application of the legal evidential procedure, applicable for proceedings of other authorities required to take action in connection with an air occurrence.

The Commission does not apportion blame or liability.

In accordance with Article 5 paragraph 6 of the Regulation (EU) No 996/2010 of the European Parliament and of the Council on the investigation and prevention of accidents and incidents in civil aviation […] and Article 134 of the Act – Aviation Law, the wording used in this Report may not be considered as an indication of the guilty or responsible for the occurrence.

For the above reasons, any use of this Report for any purpose other than air accidents and incidents prevention can lead to wrong conclusions and interpretations.

This Report was drawn up in the Polish language. Other language versions may be drawn up for information purposes only.

WARSAW 2022

Table of contents

Abbreviations

ADIU	Aircraft Data Interface Unit
ADMM	Aircraft Data Memory Module
AGL	Above ground level
AIP	Aeronautical Information Publication
AMO	Aircraft Maintenance Organisation
AMSL	Above mean sea level
ARC	Airworthiness Review Certificate
ATC	Air Traffic Control
CAA/ULC	Civil Aviation Authority of the Republic of Poland
CAMO	Continuing Airworthiness Management Organization
CPL(H)	Commercial Pilot Licence (Helicopter)
DCU	Data Collection Unit
DU	Display Unit
EEC	Electronic Engine Controls
ELT	Emergency locator transmitter
FH	Flight hours
FI	Flight Instructor
FIS	Flight Information Service
ft	Feet
FTD	Flight Training Device
GS	Ground Speed
IAS	Indicated Airspeed
IFR	Instrument Flight Rules
IOL	Helipad manual
kt	Knot

kW	Kilowatt
LMT	Local Mean Time
LPR	Polish Medical Air Rescue
MS	Maintenance Statement
NOTAM	Notice to Airman
NVG	Night-Vision Goggles
P/N	Part number
PF	Pilot Flying
PIC	Pilot-in-Command
POH	Pilot Operating Handbook
S/N	Serial number
SCAAI/ PKBWL	State Commission on Aircraft Accidents Investigation
SP/AC	Aircraft
TCAS	Traffic Collision Avoidance System
TSB	Transportation Safety Board of Canada
TSN	Time Since New
TQ	Torque
TR	Type Rating
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

General Information

Occurrence reference number:	**2021/345**			
Type of occurrence:	ACCIDENT			
Date of occurrence:	22 February 2021			
Place of occurrence:	EPPY			
Type and model of aircraft:	Helicopter, Bell 429			
Aircraft registration marks:	SP-KKS			
Aircraft user/operator:	Private company			
Aircraft Commander:	CPL (H)			
Number of victims/injuries:	Fatal	Serious	Minor	None
	2	2	-	-
Domestic and international authorities informed about the occurrence:	ULC, TSB, EASA, ICAO			
Investigator-in-charge:	Mieczysław Wyszogrodzki			
Investigating authority:	State Commission of Aircraft Accidents Investigation (PKBWL)			
Accredited Representatives and their advisers:	Accredited Representative – TSB of Canada			
Document containing results:	FINAL REPORT			
Safety recommendations:	NONE			
Addressees of the recommendations:	Not applicable			
Date of completion of the investigation:	20 September 2022			

Synopsis

On 22 February 2021, around 23:27 hrs LMT[1], a pilot (male, aged 51, holder of CPL(H)) took off with a Bell 429 helicopter, SP-KKS registration marks, for a tourist flight with three passengers on-board. The take-off was performed from an off-field area, located in Zagwiździe (about 5 NM north of Opole), the planned destination was the EPPY helipad, located in Piasek n. Pszczyna. The landing site was covered with patches of fog. During approach, the pilot turned on the landing light, which resulted in a loss of visibility due to fog. At around 23:58 hrs LMT, the main rotor blades collided with tall trees, after that the helicopter collided with the ground and overturned, resting on the left side. The pilot and the front seat passenger had no shoulder safety belts fastened and were killed on the spot. Two passengers seated in the passenger cabin were seriously injured. The helicopter was destroyed.

The investigation was conducted by the PKBWL Investigation Team in the following composition:

Mieczysław Wyszogrodzki	Investigator-In-Charge (PKBWL);
Andrzej Bartosiewicz	Team Member (PKBWL);
Krzysztof Błasiak	Team Member (PKBWL);
Piotr Borowik	Team Member (PKBWL);
Bartłomiej Czerkowski	Team Member (PKBWL);
Paweł Jajkowski	Team Member (PKBWL);
Grzegorz Pietraszkiewicz	Team Member (PKBWL).

Cause of the occurrence:

1) **Pilot's error consisting in an attempt to land without having terrain in sight.**
2) **Pilot's loss of spatial orientation during approach after turning on the landing light in dense fog.**

Contributing factors:

1) **Continuation of flight despite deterioration of the weather conditions below the VFR minima.**
2) **Patches of radiation fog covering the landing area.**
3) **Little experience of the pilot in flying the Bell 429 aircraft.**

PKBWL has not proposed safety recommendations after the investigation.

[1] All times in the Report are given in LMT, on the day of the accident LMT=UTC+2h

1. FACTUAL INFORMATION

1.1. History of the flight

On 22 February 2021, around 14:40 hrs LMT, the owner of the Bell 429 helicopter, along with two passengers, arrived at the Piasek helipad (EPPY), where the helicopter pilot was waiting for them. Around 15:00 hrs, the helicopter took off for the first flight on the Piasek - Sośnicowice route. After a 20 minute stay in Sośnicowice, the helicopter took off for a flight to Zagwiździe, where the property of the aircraft owner of was located.

The pilot had an access to a remote view of the helipad from a CCTV camera. According to the witnesses' statements, during the stay in Zagwiździe, around 23:00 hrs, the pilot checked the weather at the EPPY helipad. The helipad had stationary lighting switched on remotely by the pilot. The pilot informed the owner of the helicopter about the deteriorating weather conditions and the need to take off as soon as possible.

After about 35-minute flight, around 23:58 hrs, the pilot made a decision to land at EPPY.

The first attempt to land was abandoned when a passenger pointed out to the pilot that she had noticed trees in close proximity to the helicopter. The pilot reacted by vigorously increasing the flight altitude and proceeded to perform second approach.

During both approaches the helipad area was covered by mist and patches of ground fog, limiting visibility.

During the second attempt, the pilot turned on the landing light. According to the passenger's statement, the surrounding was "completely white", and a moment later the helicopter collided with trees and then with the ground.

After the collision with the ground, the passengers sitting in the passenger cabin, despite serious injuries, left the helicopter wreckage unaided and moved a few meters away. They then tried to establish contact with the pilot and passenger who were still in the cockpit – without success.

The rescue services declared the death of the pilot and the passenger sitting in the front (both of them had only hip belts fastened). The two survivors were given first medical aid.

The helicopter was destroyed.

The accident occurred in a forest area near Studzienice, about 470 meters east of EPPY.

1.2. Injuries to persons

Table 1. Injuries to persons resulting from the accident

Injuries	Crew	Passengers	Others	Total
Fatal	**1**	**1**	**-**	**2**
Serious	**-**	**2**	**-**	**2**
Minor	**-**	**-**	**-**	**-**
None	**-**	**-**	**-**	**-**

1.3. Damage to aircraft

The Bell 429 helicopter was destroyed. The nature of the damage is shown in Fig. 1, 2, 3, 4. The nose part of the fuselage was crushed as a result of the impact with the ground. The main rotor of the helicopter was damaged after contact with trees, and then it was damaged after the helicopter overturned to the left side - the rotor blades were broken and separated from the hub. During the accident, the tail beam of the helicopter was separated from the fuselage. The detached tail boom was additionally broken in the area of the tail plane. One of the vertical stabilizers was also separated from the tail. The passenger cabin has maintained its integrity. No helicopter part detached inflight.

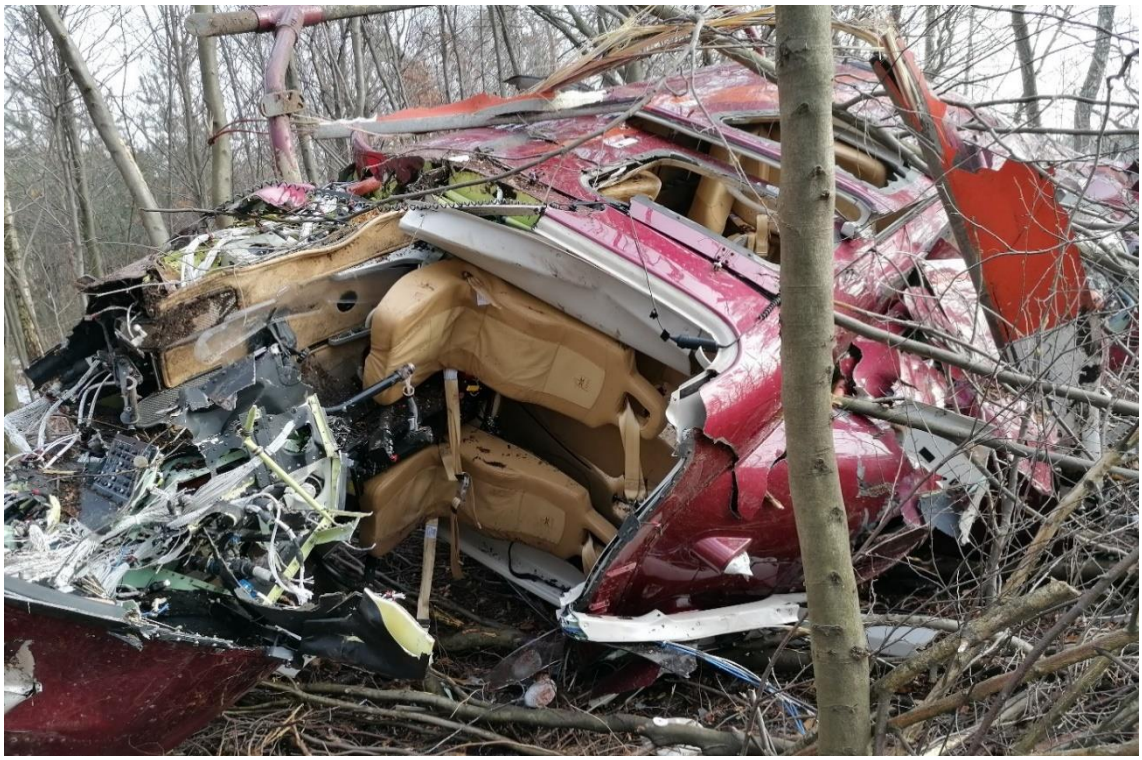

Fig. 1. Bell 429 helicopter fuselage at the accident site [source: PKBWL]

Fig. 2. Bell 429 helicopter fuselage at the accident site – deployed landing light indicated by the yellow arrow [source: PKBWL]

Fig. 3. Detached tail boom with tail rotor gearbox and blades [source: PKBWL]

Fig. 4. Damaged cabin [source: PKBWL]

1.4. Other damage

As a result of the collision of the main rotor blades with the trees (Fig. 19, 20), their tops were cut off at a height of about 14 meters. The young forest area of approximately 50 m² was also destroyed.

1.5. Personnel information (crew data)

Pilot: male, aged 51, holder of CPL(H) issued on 4 July 2017 (valid for unlimited period) with ratings:

- Robinson R44 TR valid until 31 December 2021;
- Bell 407 TR valid until 31 August 2021;
- Bell 429 TR valid until 30 November 2021;
- Instructor Rating with limitations;
- Class 1 aero-medical certificate, issued on 27 February 2020, valid until 27 February 2021;
- Radio communication maintained in English (level 4) rating, valid until 31 October 2024;
- Radio operator certificate, valid for unlimited period.

Table 2. Pilot's flight time data

	24 hours	7 days	90 days	Total flight time
All types	No data	No data	No data	~ 4900:00 FH
Bell 407 GX	No data	No data	No data	~ 1770:00 FH
Bell 429	01:20 FH	13:21 FH	30:00 FH	~ 30:00 FH

Table 3. Ten recent flights performed by the pilot prior to the occurrence.

Date (DD.MM.YYYY)	Aircraft type	Operation type	Flight time (HH:MM)	Comments
1.02.2021	Bell 429	Private	03:30	-
02.02.2021	Bell 429	Private	00:18	-
02.02.2021	Bell 429	Private	00:54	-
02.02.2021	Bell 429	Private	00:58	-
02.02.2021	Bell 429	Private	00:20	-
03.02.2021	Bell 429	Private	00:20	-
03.02.2021	Bell 429	Private	00:45	-
11.02.2021	Bell 429	Private	02:27	-
13.02.2021	Bell 429	Private	02:54	-
22.02.2021	Bell 429	Private	00:38	Accident flight

The Pilot:

- was rested in the last 48 hours;
- during the accident occupied the right, front seat, which is consistent with the Bell 429 Flight Manual;
- performed flights systematically, he was in continuous training;
- completed theoretical training, flight simulator training and practical training on Bell 429 helicopter. The training took place from 9 to 19 November 2020 in Fort Worth, Texas, USA.
- on 20 November 2020, he passed the examination for Bell 429 TR.

1.6. Aircraft information

1.6.1. General information

The Bell 429 helicopter, SP-KKS registration marks, was manufactured by Bell Textron Canada Limited. The Bell 429 is a single-rotor, twin-engine, metal-composite classic helicopter with a tail rotor.

Fig. 5. The accident helicopter [source: Facebook]

The main rotor consists of four composite blades mounted to the hub.

The Bell 429 helicopter is powered by two Pratt & Whitney Canada engines, PW 207D1 model, with a total power of 820 kW.

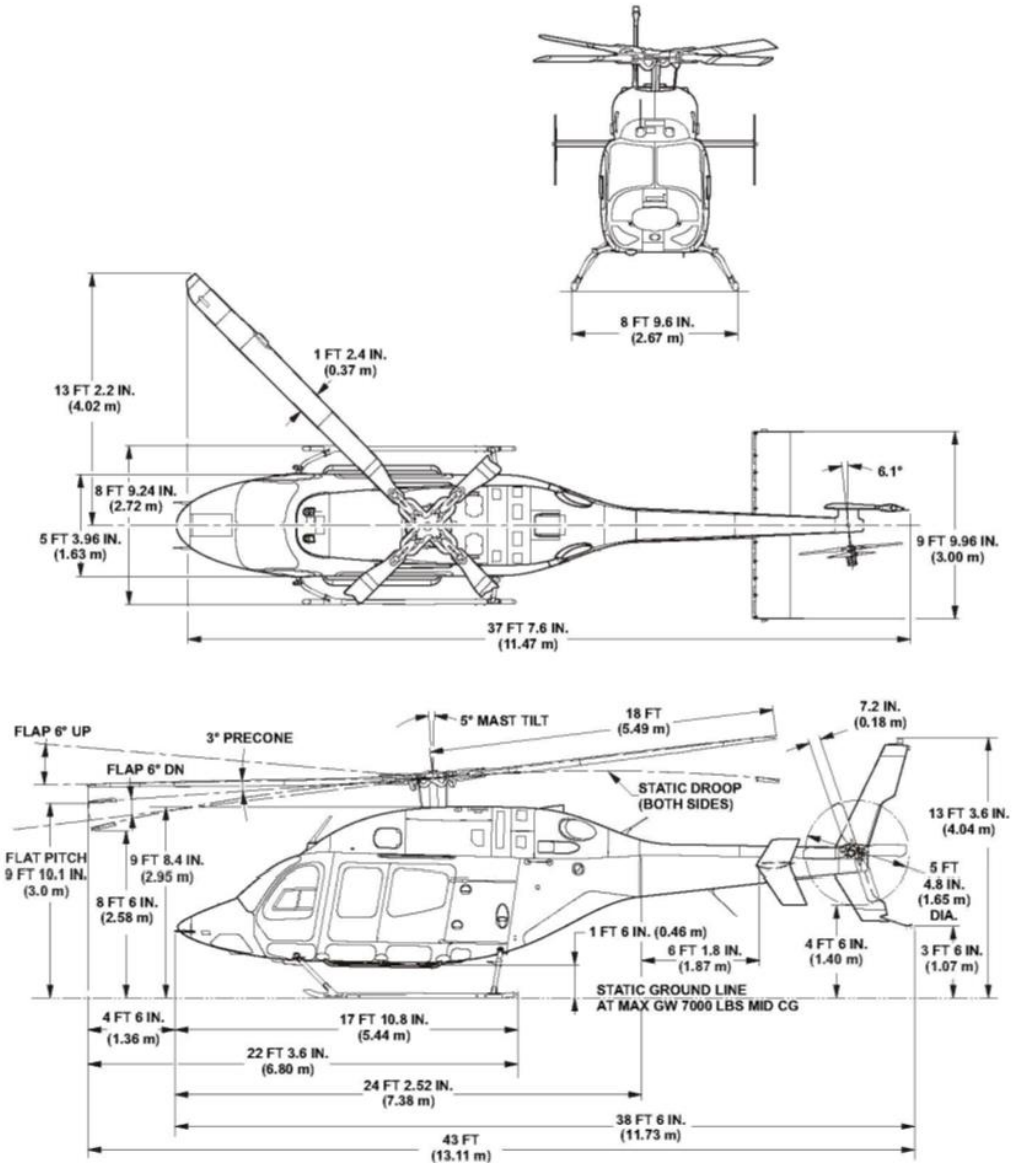

Fig. 6. 3-D view of Bell 429 helicopter – [source: www.bellhelicopter.com]

1.6.2. Helicopter data

Table 4. Airframe

Year of manufacture	Manufacturer	Serial number	Registrastrion marks	Register number	Registration date
2020	Bell Textron Canada Limited	57412	SP-KKS	873	05.01.2021

(ARC) issued on:	29.01.2021
valid until:	29.01.2022
TSN:	Around 30 FH
MS valid until :	100 FH or 29.01.2022
Next periodic operations :	100 FH or annual

Table 5. Engines data

Year of Manufacture	Manufacturer	Type	Serial number
2020	Pratt & Whitney Canada	PW 207D1	0839
2020	Pratt & Whitney Canada	PW 207D1	0840

The engines installed on the helicopter were new, and their TSN was about 30 FH. The first periodic operations on the engines should be performed after 100 hours of their operation.

The helicopter was serviced in accordance with applicable regulations in a certified maintenance organization and its continuing airworthiness documentation was properly maintained.

1.6.3. Helicopter mass and balance

Aircraft mass:

– empty mass 2271,0 kg;
– fuel mass prior to take-off ~405,0 kg;
– crew and passenger mass 412,5 kg;
– baggage mass 60,0 kg;
– actual total mass 3148,5 kg;
– permissible total mass 3175,0 kg.

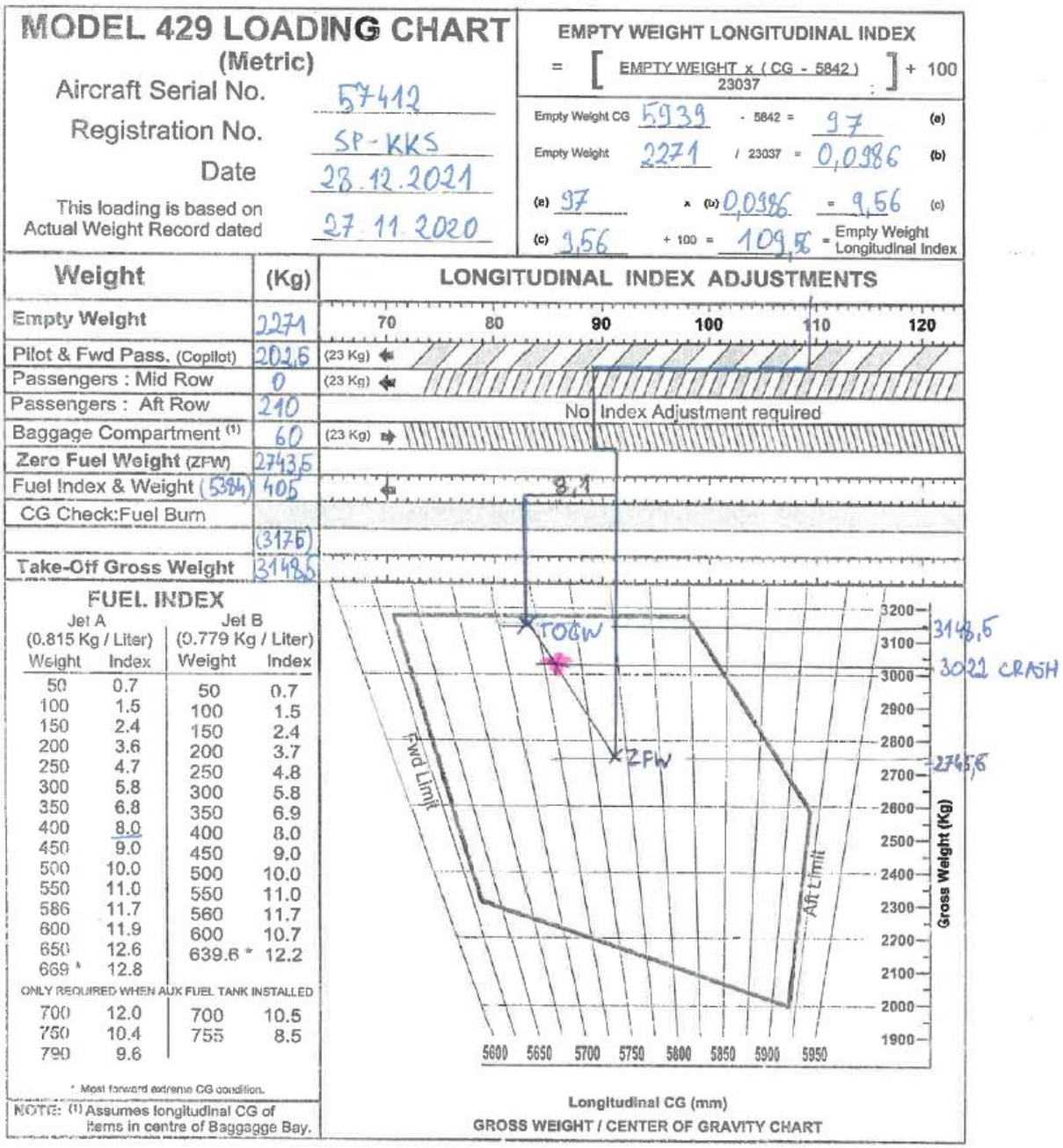

Fig. 7. Bell 429 helicopter loading chart developed by the PKBWL Investigation Team based on known and estimated mass data on the accident flight day [source: PKBWL]

The weight and center of gravity of the helicopter were within the limits specified in POH.

1.7. Meteorological information

The flight was performed from Zagwiździe n. Opole to EPPY helipad. The pilot planned to perform the flight under VFR at night in G-Class airspace.

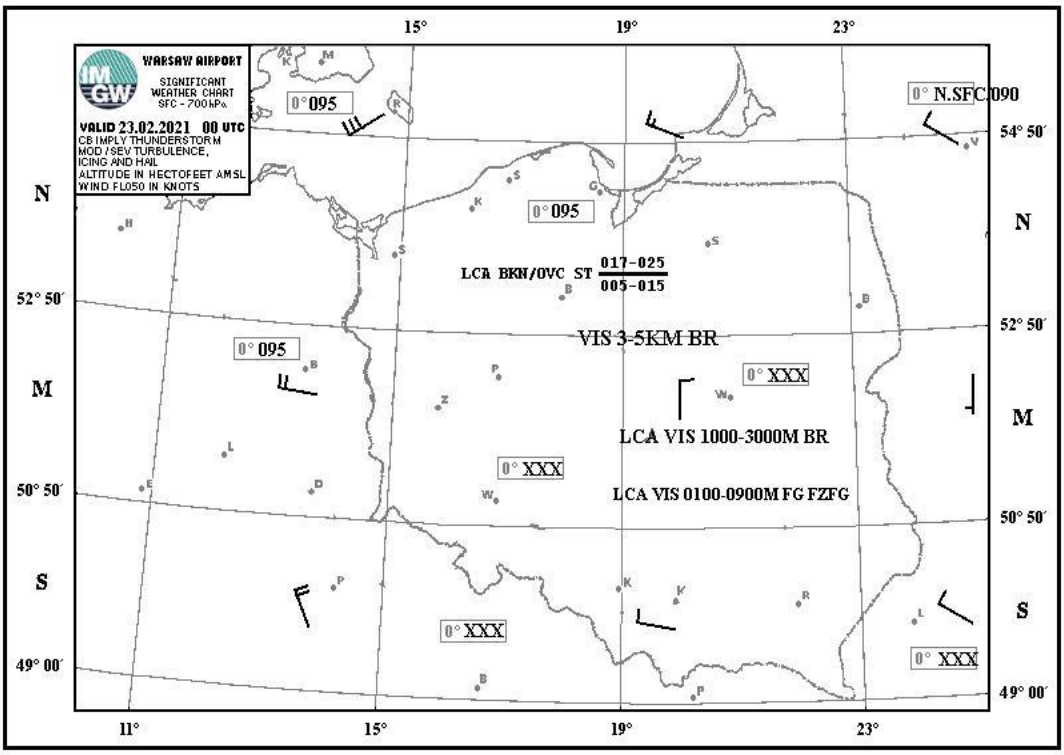

Fig. 8. Area forecast [source: Institute of Meteorology and Water Management]

On the day of the accident, the general weather situation in Poland was shaped by a vaste 1033 hPa high pressure area with the center over Southern Europe, stationary in nature, with warm and stable air masses.

Fig. 9. Map of Poland divided into AIRMET sectors. The red line shows the helicopter flight route [source: Institute of Meteorology and Water Management]

In the take-off area (area A2) and in the accident area (area A5), the visibility was 3-5 km, limited by fog. Locally, it was even lower, from 1000 to 100 m due to mist and freezing fog. In the southern part of the country, in the A5 region, the sky was cloudless, with the exception of Beskidy region in which there was 3-4/8 to 5-7/8 stratocumulus cloud cover with bases of 2500-3000 ft. The forecast cloud cover did not concern the planned landing destination. The 0° C isotherm was forecast at 10500-11000 ft, but in some places the air of 0° C temperature might have been located close to the ground surface. There was also a low speed wind from the west in the southern parts of Poland.

At the accident time, in EPWR, the following weather conditions were observed: weak wind, visibility 3500 m, ground fog, low dew point deficit and a cloudless sky. In EPKT, for the time of the accident, the following weather conditions were forecast: weak wind, visibility 400 m (limited by fog) with periodic fluctuations in visibility deteriorating to 100 m with a cloudless sky.

At the accident time, in EPKT, the following weather conditions were observed: weak wind, deteriorating visibility not exceeding 400 m, freezing fog and a small dew point deficit.

Table 6. EPKT helipad TAF

TAF EPKT 222330Z 2300/2324 25004KT 0400 FG NSC TEMPO 2300/2308 0100 FZFG OVC001 BECMG 2308/2311 CAVOK=

It was forecast that during the planned flight the temperature would drop even below 0°C, the relative humidity would be at a very high level (almost 100%) and the wind speed would reach 5 m/s. Visibility was supposed to be about 500 m and it was supposed to decrease.

The above conditions contributed to the formation of the radiation fog. This type of fog is created at night, mainly close to the morning, as a result of night heat radiation under constant weather equilibrium conditions, with a low wind speed up to about 5 m/s. During a cloudless night, the ground cools down significantly, as a result of which the air close to the ground also cools down in the same manner. A drop in the air temperature causes a decrease in the pressure of saturated vapor, as a result, the relative humidity increases, and when the dew point temperature is reached, the water vapor condenses to form fog. Temperature inversion occurs during the generation of radiation fog.

1.8. Aids to navigation

The helicopter was equipped with an integrated, IFR-certified, glass cockpit avionics; Garmin GTN750 and GTN650 navigation instruments. It was also equipped with a four-axis autopilot, weather radar and TCAS.

1.9. Communications

During the flight, the pilot did not maintain communication with FIS.

1.10. Helipad information

EPPY helipad is located in Piasek, 3 km north-east of Pszczyna - geographical coordinates: 50°00'23" N, 018°57'44" E. The helipad has two take-off and landing directions (27 and 09) and a runway with asphalt and concrete surface. 27-09 The landing area is a square of 24x24 m dimensions. The elevation of the helipad is 247 m.

The helipad is intended for helicopter take-offs and landings performed in accordance with VFR during the day. There is no designated airspace to protect air operations from the EPPY.

The helipad had lighting that was activated remotely by the pilot, it was turned on during approach (the remote switch was found on the helicopter deck).

Fig. 10. Distance between the accident site and the helipad [source: www.google.pl]

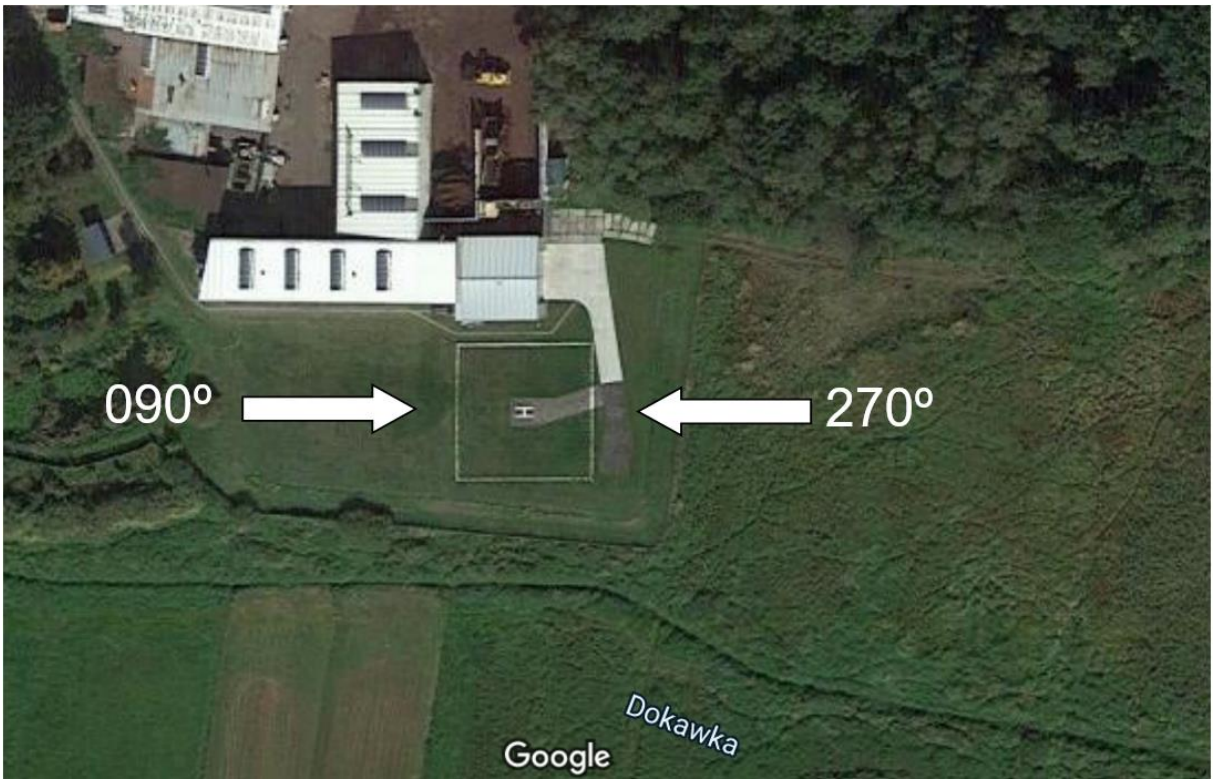

Fig. 11. EPPY Helipad – take-off and landing directions [source: www.google.pl]

1.11. Flight recorders

The helicopter was not equipped with either FDR or CVR, but

was equipped with the following recording devices (as standard):

- ADMM installed in ADIU;
- DCU, recording engine operating parameters via EEC. Each engine had individual DCU and EEC;
- DU in the cockpit (3 pcs total).

PKBWL asked TSB for assistance in reading data from the above devices, which were read by Bell Textron Canada Ltd. under the supervision of TSB. The recorded data were analysed, the results are included in TSB ENGINEERING LABORATORY REPORT LP050/2021.

All data from ADMM, EEC and DCU have been read out. All recorded damage corresponded with the sequence of the helicopter collision with the ground. The data did not show anything indicating that the helicopter systems were malfunctioning.

Data from all three DUs were also successfully read out. On their basis, the course of the last minutes of the flight was visualized (Figs. 12, 13, 14).

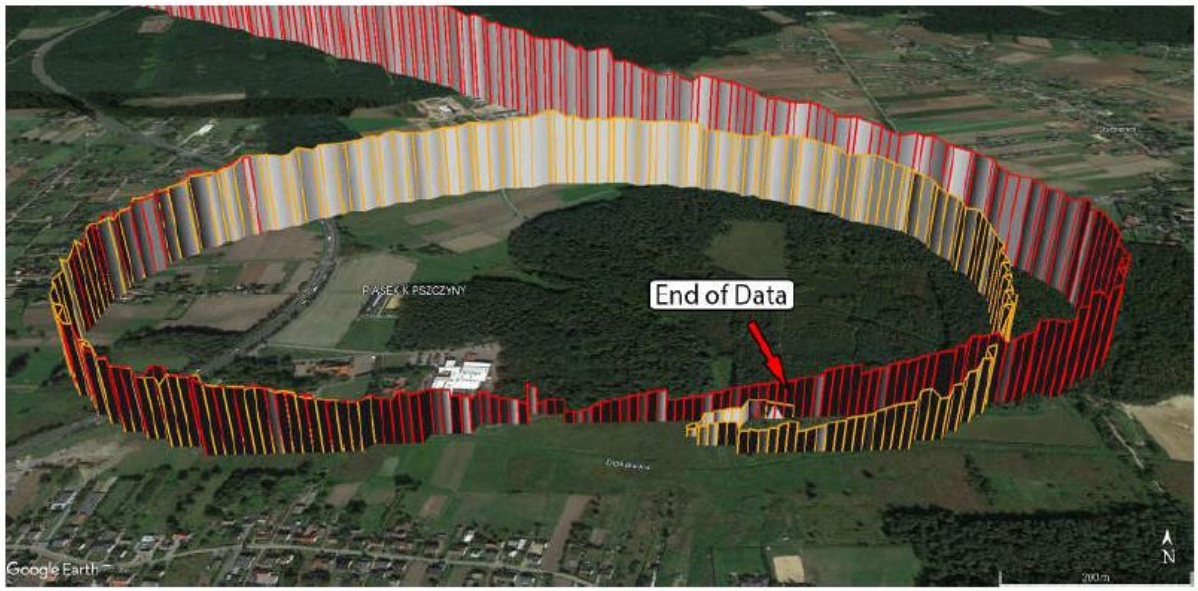

**Fig. 12. Helicopter flight profile (last minutes)
[source: TSB Engineering Laboratory Report LP050/2021]**

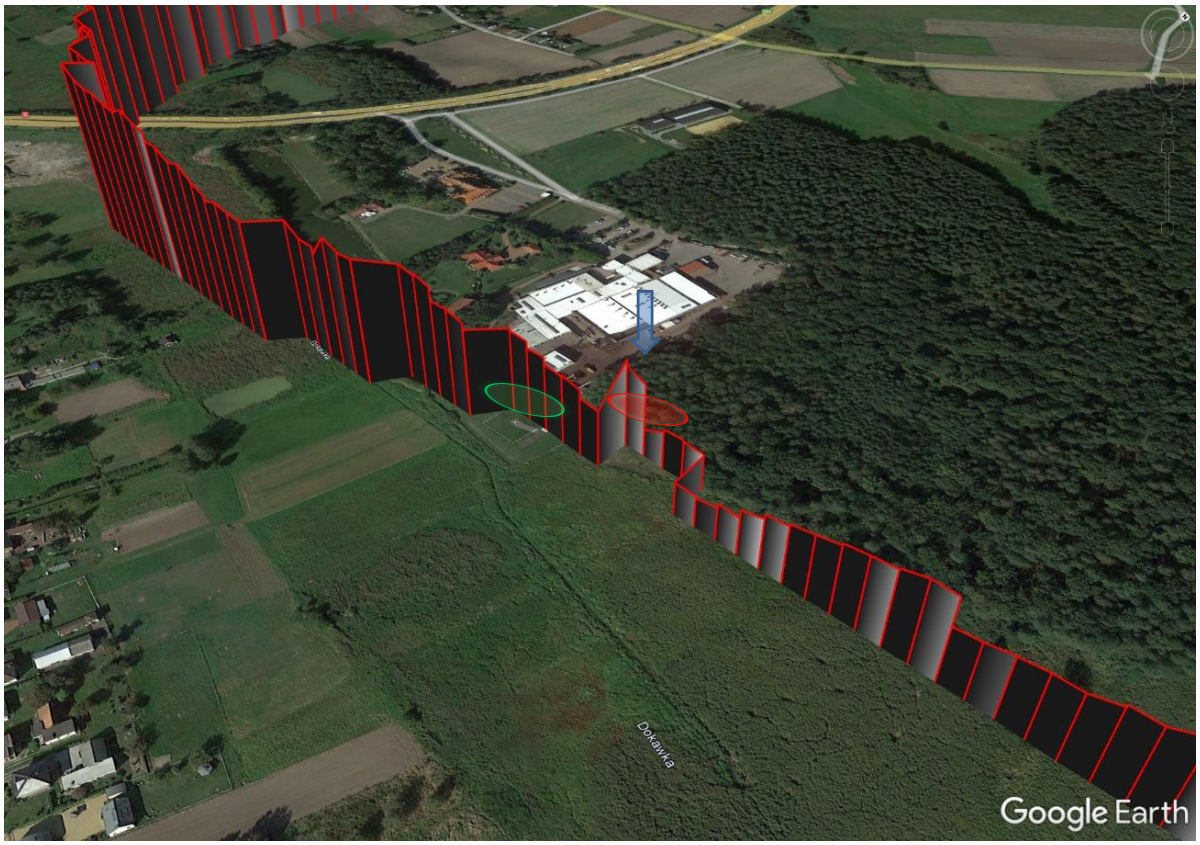

Fig. 13. Helicopter flight path: the place of the first approach to landing is marked with a red circle, the place of intended landing is marked with a green circle, the place of exceeding the TQ is marked with a blue arrow [source: PKBWL]

Fig. 14. Second approach flight path: the accident site is marked with a white circle, the place of the second approach is marked with a yellow circle, the place of the first approach is marked with a red circle, the place of intended landing is marked with a green circle, the place of turning on the landing light is marked with a white triangle, and the second exceeding of the TQ is marked with a white arrow [source: PKBWL]

During the second attempt to land, the pilot turned on the landing light, which, in the presence of fog, caused a temporary loss of visibility by the pilot (according to the passenger's statement, everything outside turned "completely white").

The pilot aborted the landing and made a right turn by about 160° with a simultaneous steep climb (second exceeding of the TQ), which, in the lack of visibility, probably led to loss of spatial orientation.

A few seconds later, the helicopter with a nose down pitch of about 17° (Figs. 19, 20) collided with trees and then with the ground.

The pilot knew the location of the helipad and the surrounding terrain conditions well. He knew that the helipad was at the end of the forest boundary running from east to west direction. He couldn't see the ground because of the fog, but he could see the treetops and probably tried to find the helipad by reference to those visual cues. However, during the first attempt, he got too close to the forest boundary and as a result aborted the landing.

During the second approach, the pilot still did not see the ground, he flew west and reached a small clearing among the trees, which he could have mistakenly taken as the end of the forest, and in that place, he was looking for a helipad.

In the accident flight ADMM recorded two TQ limit exceedances:

– at 22:56:07 hrs TQ reached105.6% of the permissible value for maximum continuous power;

– at 22:58:31 hrs TQ reached 108.5% of the permissible value for maximum continuous power.

Between the two above-mentioned exceedances, during 2 minutes and 30 seconds, the torque records on the shaft of the engine No. 1 and No. 2 were within permissible limits – 54.2% and 54.3%, respectively.

The lowest GSs were recorded at:

– 22:56:06 hrs (1 second before the first TQ exceedance) GS_1 = 4,13 kt;
– 22:58:30 hrs (1 second before the second TQ exceedance) GS_2 = 6,00 kt.

1.12. Wreckage and impact information

The general view of the accident site is shown in Figs. 15, 16, 17 and 18.

All the wreckage of the helicopter was found at the edge of the forest, in one area of several hundred square meters. No part of the helicopter was found to detach from it prior to collision with trees.

A few seconds before the accident, flying with a heading of about 270°, the helicopter made a right turn of about 160° in climb, and then, in a straight diving flight it collided with trees at a speed of about GS≈50 kt (Figs. 19 and 20).

The main rotor blades hit the treetops and were damaged while cutting next trees. Then the helicopter collided with the ground at a speed of GS≈66 kt, then overturned on the left side.

Fig. 15. Accident area – the blue arrow indicates the direction of the flight, EPPY helipad is marked with a green circle [source: PKBWL]

Fig. 16. Accident area – the blue arrow indicates the direction of the flight, the red circle indicates the accident place [source: PKBWL]

Fig. 17. Accident area – the blue arrow indicates the direction of the flight, the red circle marks the accident place [source: PKBWL]

Fig. 18. Accident area – the red ellipse shows the dispersion of the main elements of the helicopter wreckage [source: PKBWL]

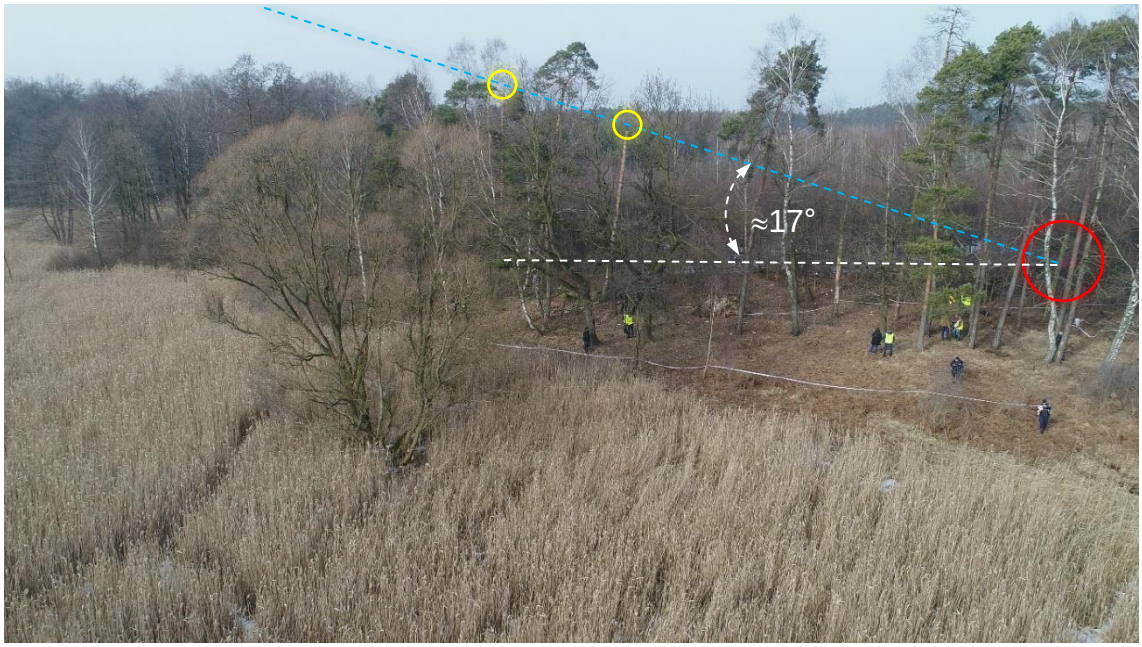

Fig. 19. Accident site – vertical plane through the helicopter flight path: the blue dotted line connecting two boughs with cut tops (yellow circles) shows the angle of descent (about 17°), the helicopter wreckage is marked with the red circle [source: PKBWL]

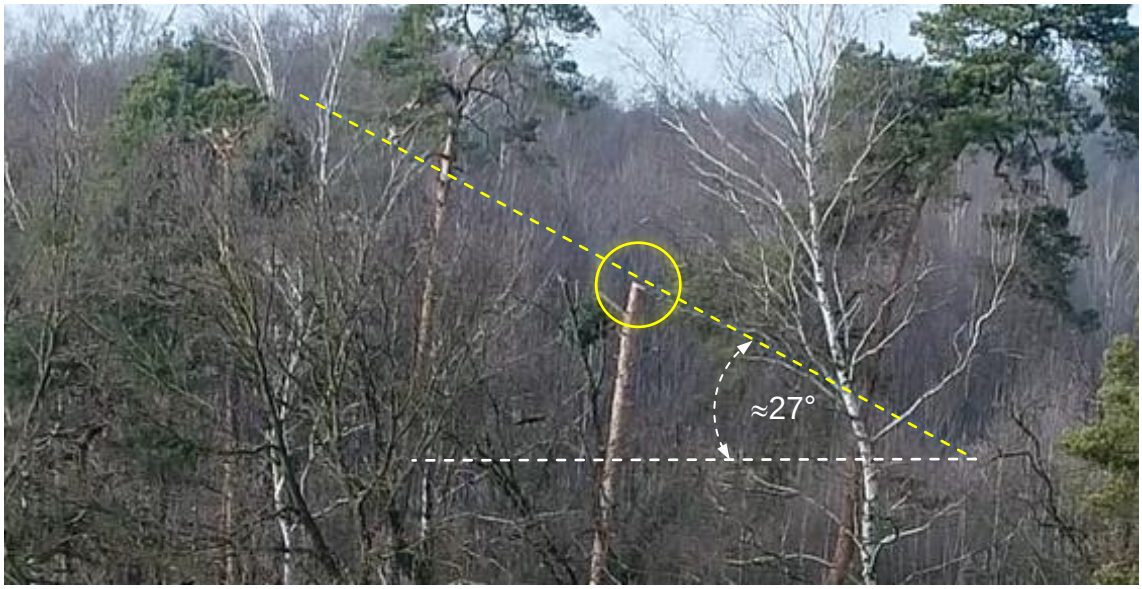

Fig. 20. Accident site – close-up of the cut bough (yellow circle) with the cutting plane marked (dashed yellow line) at an angle of approx. 27° [source: PKBWL]

1.13. Medical and pathological information

As a result of the accident, the pilot and the passenger in the cockpit died on the spot due to extensive, internal multi-organ injuries. Passengers seated in the passenger cabin suffered serious injuries, requiring hospitalization for several months.

No evidence of any disease, incapacity or physiological factors which might have affected the performance of the pilot was found.

1.14. Fire

The accident resulted in sooting and fire. During a detailed examination of the wreckage in the area of the vent cover and the left engine cowl, a place showing signs of fire exposure was revealed. The fuel tanks did not leak.

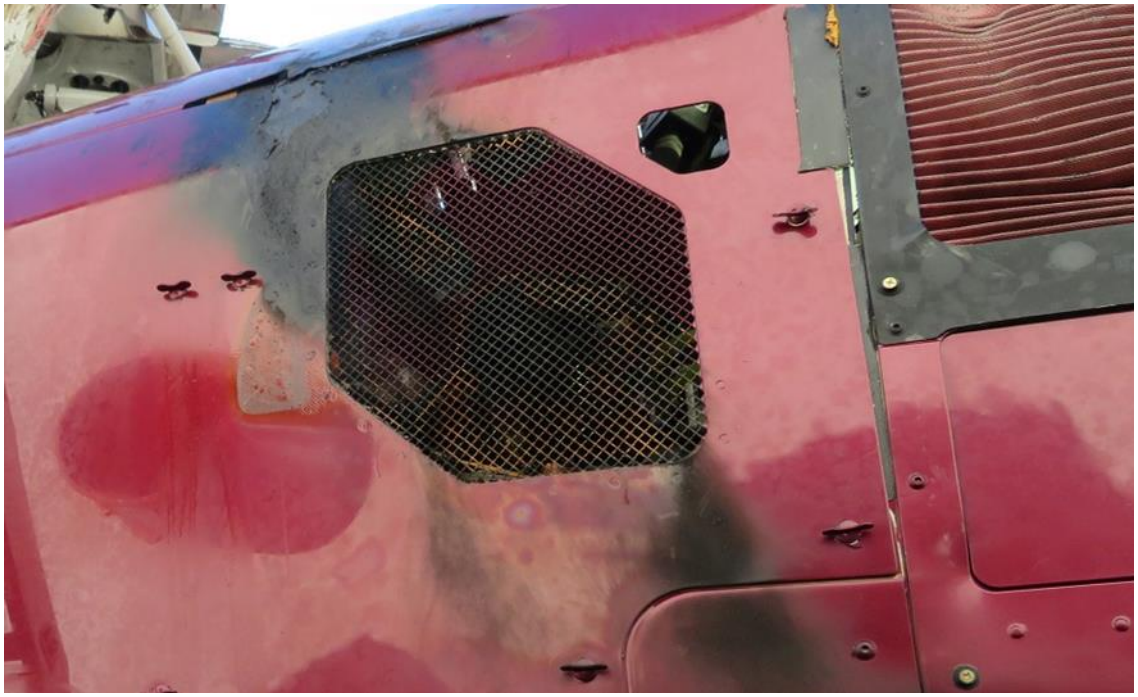

Fig. 21. Signs of fire found in the area of the left engine cowl [source: PKBWL]

Fig. 22. Left engine cowl [source: PKBWL]

The composite, left engine cowl was partially burnt. Signs of fire in the form of soot and burning of fuel line covers were also revealed.

The source of the sooting of the left engine cowl was an oil leak from the damaged oil system on hot engine parts. The nature of the damage is shown in Figs. 21, 22 and 23. The fire extinguished by itself.

Fig. 23. Signs of local fire in the area of the left engine - view after the engine cowl removal [source: PKBWL]

1.15. Survival aspects

The fatal victims occupied the two front seats in the cockpit. Each helicopter seat is factory-fitted with 4-point seat belts. The main belt is the lap belt, attached in the area where the seat is connected to the backrest. The lap belt is joined with two shoulder belts, holding the seated person vertically and attached to the structure behind the back of the seated, at the height of his neck.

The pilot and the passenger sitting next to each other had only lap belts fastened, which had been cut during the rescue operation. The shoulder belts remained intact because they were unfastened during the accident. The passengers sitting in the passenger cabin had the lap and shoulder belts fastened.

At the moment of the collision with the ground, the persons on-board were subjected to a high forward overload. The persons sitting in the cockpit, who had only the lap belts fastened, remained in their seats, but their torsos were moved forward and down (towards the knees) as a result of the inertia force. Thus, their chests collided with the helicopter cyclics (which is evidenced by damaged cyclics and injuries of the pilot and the passenger sitting in front).

All seats inside the helicopter were in good condition after the accident. The brackets attaching the seats in the cockpit to the floor were partially deformed. It proves that the structure of the seats absorbed some of the energy of the helicopter collision with the ground.

Fig. 24. Bell 429 cockpit seats after the accident [source: PKBWL]

Passengers seated in the rear seats were seriously injured. They got out of the wreckage unaided, before the arrival of the emergency services. The emergency services appeared at the accident site about 30 minutes after the occurrence and provided medical aid to the injured.

Due to damage to the external antenna of the ELT transmitter during the accident, there was no signal from the transmitter.

1.16. Tests and research

During the investigation the following actions were carried out:

1) General examination of the helicopter wreckage and the accident site, immediately after the accident.
2) Examination of the helicopter wreckage in the storage place, including:
   a) detailed examination of the entire wreckage;
   b) checking the kinematic continuity of the control systems;
   c) assessment of the condition of engines and their external damage;
   d) checking the cleanliness of the filing indicators of the main gearbox and engines;
   e) draining fuel from the tanks;
   f) taking fuel and engine oil samples for possible tests;
   g) checking the compliance of engine components and its accessories with documentation of continuing airworthiness;

h) removal and protection of electronic units recording engine operating parameters and helicopter flight parameters.

3) Read out and analysis of data from devices listed in item 1.11 (performed in cooperation with TSB and the helicopter manufacturer).

No evidence of any malfunction that might have contributed to the accident was found.

1.17. Organizational and management information

The aircraft operator was a private company with headquarters in Piasek near Pszczyna. By the time of the accident, the company had two Bell helicopters: Bell 407 GX and Bell 429.

The pilot, who was killed in the accident, was employed in the above-mentioned company and performed flights for the operator on both helicopters.

Continuing airworthiness management was ensured by a CAMO organization certified by the President of the Civil Aviation Authority of Poland.

1.18. Additional information

The most likely flight route from the take-off place in Zagwiździe to the accident site near Piasek helipad was recreated, based on the radar recording.

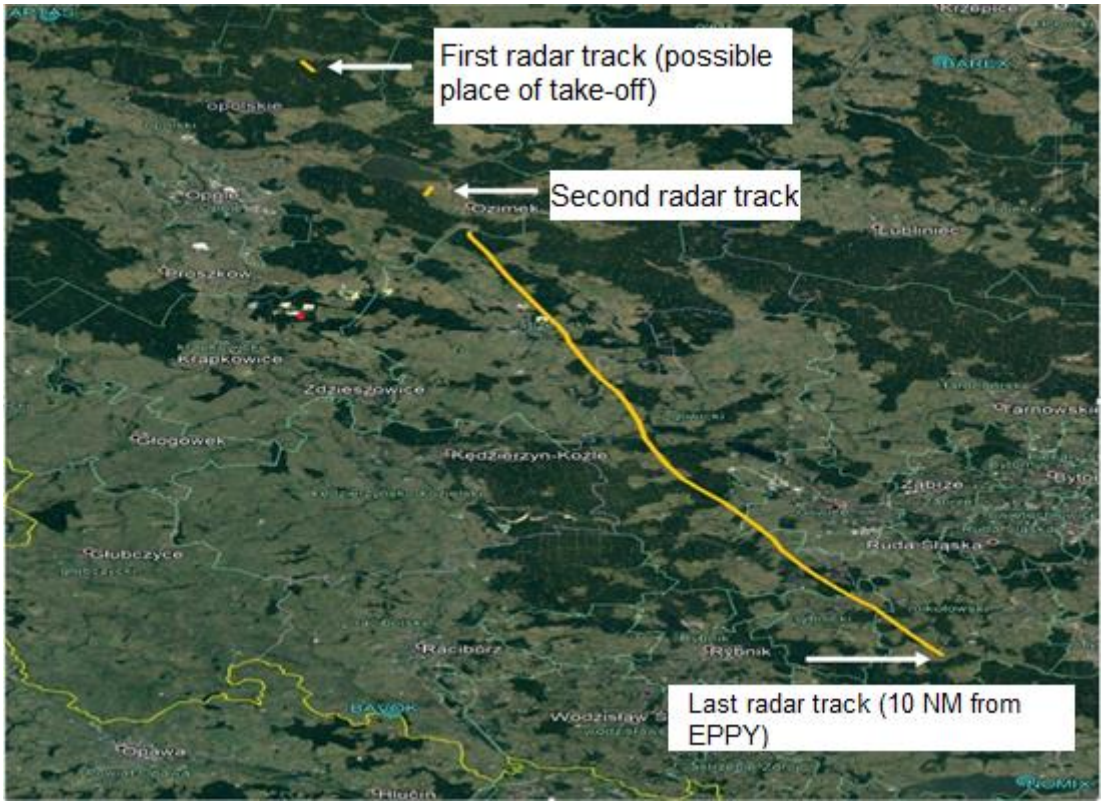

Fig. 25. Radar markers partly recreating the flight route [source: Polish Air Navigation Services Agency, Google Earth]

At 23:27:56 hrs the SP-KKS helicopter appeared for the first time on the radar of the PEGASUS_21[2] system. The rapidly increasing altitude and speed indicated that it took place just after take-off, near the town of Zagwiździe.

At 23:28:44 hrs the radar contact was lost, and then at 23:34:30 hrs the primary radar signal appeared again, indicating (with high possibility) that it was the SP-KKS helicopter. Since then, the signal had been continuously tracked until 23:51:36 hrs, when the radar contact was lost 10 NM north of the EPPY helipad.

1.19. Useful or effective investigation techniques

Standard investigation techniques were applied.

2. ANALYSIS

2.1. Flight operations

2.1.1. Pilot's qualifications

The pilot had the proper qualifications and license to perform flights on the Bell 429 helicopter. Taking into consideration the pilot's total flight time (4900 FH), his experience can be assessed as high. However, it should be noted that despite a large flight time on helicopters, including Bell helicopters, the pilot's experience on the Bell 429 was minimal. In addition to the 8 FH of training on the Bell 429, which he completed 3 months before the accident, he had about 30 FH on this type.

2.1.2. Operational procedures

According to the witnesses' statements, the pilot checked the weather/meteorological conditions prior to the flight.

2.1.3. Weather conditions

On the day of the accident, it was forecast that during the planned flight the temperature would drop below 0° C, the relative humidity would be at a very high level (almost 100%), and the wind speed would reach 5 m/s. Visibility that day was predicted to be about 500 m and it was supposed to drop. The above conditions favoured the formation of radiation fog.

The take-off occurred in meteorological conditions above the VFR minima, however, at the planned landing destination, radiation fog was expected, which would hinder a safe landing.

The weather forecasts were consistent with the actual conditions, which was confirmed EPPY helipad CCTV recordings.

During the pre-flight preparations, the pilot had access to current weather forecasts, which he had analysed according to witnesses (he informed the helicopter owner about the deteriorating weather conditions in the area of the helipad).

[2] Air traffic management system of the Polish Air Navigation Services Agency.

Around 00:00 hrs, the crew of a HEMS helicopter, performing a training flight in the area of the accident, noticed the ground fog and therefore aborted the exercise and returned to the take-off helipad (EPKM), where it landed safely at 00:17 hrs. The HEMS flight was performed with the use of NVG.

During the arrival at the planned landing destination, the helicopter entered in intense mist and freezing fog. It was impossible to continue the flight under VFR with the required visibility of at least 800 m. In that case, change in the flight route and landing in a different place should have been performed. Performing a VFR approach below the VMC was contrary to the applicable rules.

2.1.4. Regulations

In Aeronautical Information Publication Poland in VFR ENR 1.2 (c) point specifies that that night visual flights may be performed providing that, inter alia, the following requirements are complied with:

1) **if leaving the vicinity of a helipad, a flight plan shall be submitted in accordance with SERA.4001(b)(6) Appendix to the Regulation No. 923/2012[3];**
2) **flights shall establish and maintain two-way radio communication on the appropriate ATS communication channel, when available;**

When determining the minimum visibility according to VFR, it is specified that:

Helicopter flights may be performed in flight visibility less than 1500 m, but not less than 800 m, if the manoeuvre speed is adequate to observe other traffic and any obstacles in time to avoid collision.

The flight was planned at night, and the length of the selected flight route was about 120 km and did not run close to the take-off place. Therefore, the submission of a flight plan for that flight was mandatory, which was not done.

The submission of a VFR flight plan in uncontrolled Class G airspace provides the aircraft with emergency service. Maintaining radio communication with flight information services, although not obligatory on such flights, can significantly reduce the time of initiating a search and rescue operation.

2.1.5. Aids to navigation and helipad

The pilot did not maintain communication with FIS during inflight. This was not mandatory, but the recommendation above, "**flights shall establish and maintain two-way radio communication on the appropriate ATS communication channel, when available**" clearly indicates that such action would be appropriate.

During the arrival to the planned landing destination, the helicopter flew in intense fog and freezing mist. It was impossible to continue the flight without the visibility of the ground and required visibility of at least 800 m. After encountering worse weather conditions than specified in the regulations, the flight route had to be changed so that

[3] SERA.4001 Submission of a flight plan; b) **A flight plan is submitted**; 6) **before each flight scheduled to be performed at night, if this involves leaving the vicinity of the airport**.

it was possible to land in a different place. Performing a VFR approach below the VMC did not comply with the regulations.

2.2. Survivability

2.2.1. Rescue and firefighting services actions

The rescue and firefighting services arrived at the accident site approximately 30 minutes after receiving the notification. Reaching the wreckage and the injured was difficult due to problems with locating the accident site in a wooded area and due to limited visibility caused by fog.

2.2.2. Survival aspects

The casualties sat in the two front seats (in the cockpit) of the helicopter. Each of the seats in the Bell 429 helicopter was factory-fitted with 4-point seat belts. The pilot and the passenger sitting next to him were wearing only their lap belts at the time of the accident. The passengers sitting in the cabin had their lap and shoulder belts fastened.

The helicopter collided with the ground with low vertical speed (evidenced by the angle of descent in Figs. 19 and 20) and a forward speed of GS≈66 kt (122 km/h).

The pilot and the front passenger died on the spot as a result of internal multi-organ injuries resulting from the collision of their torso with the control sticks.

Despite extensive damage, the cockpit retained its shape. The seats in the cabin, which partially absorbed the impact force, remained permanently attached to the helicopter structure.

If the pilot and passenger had their shoulder seat belts fastened, there was a high possibility that they would have survived the accident.

Fig. 26. Pilot's seat: visible, broken control stick, marked with a yellow circle. [source: PKBWL]

Fig. 27. The front passenger's seat: visible, broken control stick, marked with a yellow circle. [source: PKBWL]

3. CONCLUSIONS

3.1. Findings

3.1.1. Aircraft

1) The helicopter was certified, equipped and operated in accordance with applicable regulations.
2) The helicopter was insured.
3) After the accident, the helicopter's tanks contained approximately 350 litres of Jet A-1 fuel.
4) At the time of the take-off the helicopter was airworthy.
5) The mass and center of gravity were within permissible limits.
6) No evidence of failures or irregularities in helicopter operation that could have affected the occurrence was found.
7) Before the collision with the trees, the structure of the helicopter was intact.
8) All helicopter damage was the result of the collision with trees and ground.
9) The fuel that remained in the aircraft tanks was not contaminated.

3.1.2. Pilot

1) The pilot had a valid license and qualifications to perform the flight in accordance with the applicable regulations.
2) The pilot had a valid aero-medical certificate.
3) The pilot had little experience in performing flights on Bell 429 helicopter.

3.1.3. Flight operations

1) The pilot had access to current weather forecasts and was aware of the worsening weather conditions.
2) The pilot had a preview of the landing site from a CCTV camera located on the hangar.
3) The weather forecasts were consistent with the actual weather conditions in the area of the planned landing.
4) After encountering the meteorological conditions below the minima provided for VFR flights, the pilot resumed the scheduled flight.
5) Weather conditions affected the course of the occurrence.
6) The pilot did not maintain radio communication with ATS during the flight.
7) Performing a night VFR flight out of the vicinity of the helipad without submission of a flight plan and atmospheric landing approaches below the required minima did not comply with the applicable regulations.

3.1.4. Operator

1) The aircraft operator was a private limited liability company.

3.1.5. Planned landing destination

1) The EPPY helipad (certified for daytime flights) was equipped with lighting that could be turned on remotely.
2) During approach attempts, the helipad lighting was turned on.

3.1.6. Flight recorders

1) The helicopter was not equipped with FDR and CVR recorders. It was not required according to the applicable regulations.
2) The helicopter was equipped with various types of flight data recording devices.
3) Data read from the above mentioned devices installed aboard the helicopter allowed to reconstruct and analyse the course of the occurrence.

3.1.7. Medical aspects

1) No evidence of inability to operate or physiological factors influencing the performance of the pilot was found.

3.1.8. Survivability

1) The pilot and the passenger sitting in the cockpit did not have the shoulder belts fastened, which significantly reduced their chances of survival.
2) The pilot and the passenger sitting in the cockpit died on the spot.
3) The passengers sitting in the cabin, left the wreckage unaided, despite serious injuries.
4) The arrival of the rescue services at the accident site after about 30 minutes did not affect the chances of survival of the pilot and passenger sitting in the cockpit.
5) The rescue services provided first aid to the injured passengers at the accident site.

3.2. Causes of the accident

1) **Pilot's error consisting in attempt to land without having terrain in sight.**
2) **Pilot's loss of spatial orientation during approach after turning on the landing light in dense fog.**

3.3. Contributing factors

1) **Continuation of flight despite deterioration of the weather conditions below the VFR minima.**
2) **Patches of radiation fog covering the landing area.**
3) **Little experience of the pilot in flying the Bell 429 aircraft.**

4. SAFETY RECOMMENDATIONS

PKBWL has not proposed any safety recommendation after completion of the investigation

5. ANNEXES

None.

THE END

Investigator-in-Charge

Signature on original

.....