

# FINAL REPORT

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ACCIDENT 2022/2700



State Commission on Aircraft Accidents Investigation (PKBWL)

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# FINAL REPORT

## ACCIDENT

OCCURRENCE NO – 2022/2700

AIRCRAFT – Airplane, Cessna C-152, SP-AKW

DATE AND PLACE OF OCCURENCE – 2 June, 2022, Rębielice Królewskie



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 2023**

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## Abbreviations

<b>AGL</b>	Above ground level
<b>ARC</b>	Airworthiness Review Certificate
<b>CAVOK</b>	Cloud and Visibility OK <sup>1</sup>
<b>CofA</b>	Certificate of Airworthiness
<b>CRS</b>	Certificate of Release to Service
<b>EASA</b>	European Aviation Safety Agency
<b>ELT</b>	Emergency Locator Transmitter
<b>FIS</b>	Flight Information Service
<b>ft</b>	Feet
<b>HT</b>	Head of Training
<b>kt</b>	Knot – nautical mile per hour
<b>LAPL(A)</b>	Light Aircraft Pilot Licence
<b>LMT</b>	Local Mean Time
<b>mth</b>	Motohour
<b>MS</b>	Maintenance Statement
<b>MTOM</b>	Maximum Take-off Mass
<b>NC</b>	Noise Certificate
<b>PANSA/PAŻP</b>	Polish Air Navigation Services Agency
<b>PIC</b>	Pilot-in-Command
<b>RPM</b>	Revolutions per minute
<b>QNH</b>	Query Nil Height
<b>ULC</b>	Civil Aviation Authority of the Republic of Poland
<b>UTC</b>	Universal Time Coordinated
<b>V<sub>A</sub></b>	Manoeuvring speed
<b>V<sub>NE</sub></b>	Never Exceeded Speed

<sup>1</sup> CAVOK is an abbreviation for **Ceiling And Visibility OK**, indicating a visibility of 10 km or more, no cloud below 5,000 ft, no cumulonimbus or towering cumulus at any level, no precipitation, storms, etc.

## General Information

Occurrence reference number:	<b>2022/2700</b>			
Type of occurrence:	ACCIDENT			
Date of occurrence:	2 June, 2022			
Place of occurrence:	Rębielice Królewskie			
Type and model of aircraft:	Airplane, Cessna C-152			
Aircraft registration marks:	SP-AKW			
Aircraft user/operator:	Aeroklub Częstochowski			
Aircraft Commander:	LAPL(A)			
Number of victims/injuries:	Fatal	Serious	Minor	None
	2	-	-	-
Domestic and international authorities informed about the occurrence:	ULC, EASA, NTSB			
Investigator-in-charge:	Ireneusz Boczkowski			
Investigating authority:	State Commission of Aircraft Accidents Investigation (PKBWL)			
Accredited Representatives and their advisers:	Not applicable			
Document containing results:	FINAL REPORT			
Safety recommendations:	NONE			
Addressees of the recommendations:	Not applicable			
Date of completion of the investigation:	28.06.2023			

## Synopsis

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On 2 June 2022 a pilot, holder of LAPL(A) was performing an enroute flight with a passenger on a Cessna C-152 aircraft, SP-AKW registration marks. Most of the time the flight was uneventful, but after about 30 minutes, the plane descended and, accelerating along a trajectory of a gentle but tightening arc, crashed into the ground at high speed. The pilot and passenger died on the spot. The plane was destroyed, no fire occurred.

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

Ireneusz Boczkowski	Investigator-in-Charge;
Jacek Bogatko	Team Member;
Grzegorz Pietraszkiewicz	Team Member.

### **Cause of the occurrence:**

**Uncontrollable spiral resulting in collision with terrain.**

**PKBWL was not able to determine a cause of the spiral.**

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

## 1. FACTUAL INFORMATION

### 1.1. History of the flight

On 2 June 2022, the pilot planned an enroute flight with a Cessna 152 airplane, SP-AKW registration marks from EPRU aerodrome. The pilot agreed the flight with the official of the flying club, but did not inform about the intention to take a passenger.

When taking over the airplane for the accident flight, the pilot did not check fuel quantity and incorrectly entered it in the airplane technical log.

On the EPRU aerodrome and in the area of the planned flight route, the weather was suitable to perform flights (Fig. 1).



Fig. 1 Cessna 152 airplane (SP-AKW) prior to taxiing [source: Aeroklub Częstochowski]

Before 17:30 hrs LMT<sup>2</sup>, the pilot left the briefing room and together with the passenger (member of his family), went to the airplane. When the passenger was seated in the cockpit, he helped her fasten the seat belts. The pilot performed a pre-flight inspection of the airframe and checked the oil level, and then checked the closing the cockpit door on the passenger side. The pilot took his place in the cockpit at 17:40 hrs, then, after starting the engine, he taxied from the hangar of the aeroclub to the waiting point in front of the concrete RWY 26. The take-off took place at 17:44 hrs.

After leaving the EPRU ATZ, at 17:53 hrs, the pilot made contact with FIS Kraków, informing about his position at the WHISKEY point (west of the EPRU) and reported his intention to fly towards Wieluń, and then return to the take-off aerodrome. The FIS provided the value of the QNH and asked the pilot to report return to EPRU. The pilot did not confirm the message. During the onward flight, he did not maintain radio communication. The plane passed the town of Kłobuck and then continued its flight towards Krzepice (flight recording from the FLARM<sup>3</sup>, Fig. 2).

<sup>2</sup> All times in the Report are given in LMT, on the day of the accident LMT=UTC+2 h

<sup>3</sup> FLARM (Flight Alarm) – uncertified warning system against collisions with aircraft on which the device is installed. The system, based on accurate GPS data, analyses and predicts the trajectory of the flight, calculating i.a. collision courses and informing the pilot of the aircraft about the risk of a potential collision.





Fig. 2. SP-AKW flight route, created in SeeYou by Naviter [source: FLARM]

On the southern side of the village of Krzepice, the pilot made a circuit over his family house, bypassed the village from the west and directed the plane to the north (towards Wieluń). Then he changed the flight direction to the east, crossing the direction of the approach to the landing strip in Natolin. The pilot continued the flight with a NE heading for a short time, and then made a turn towards the take-off aerodrome.

When the plane was near the village of Rębielice Królewskie, it started a turn to the right, entered a spiral and collided with the ground (at around 18:14 hrs, about 30 minutes after take-off). As a result of the impact, the pilot and passenger died on the spot and the airplane was destroyed.

Approximately at 18:36hrs, rescue services arrived at the scene and secured the area. They notified the Civil-Military Search and Rescue Coordination Center (ARCC) and PKBWL about the accident.

## 1.2. Injuries to persons

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

The pilot and passenger were Polish nationality.



### 1.3. Damage to aircraft

The airplane was destroyed (Fig. 3)



Fig. 3. Airplane wreckage after collision [source: Police]

### 1.4. Other damage

The crop was slightly crushed and contaminated with fuel.

### 1.5. Personnel information (crew data)

Pilot (PIC) - male, aged 58, holder of:

- LAPL(A);
- valid LAPL aero-medical certificate, with VNL limitations (near vision correction);
- general radiotelephone operator's certificate.

The pilot's flight time during LAPL(A) training (ended on 14 February 2022) was:

- 53:33 FH in 296 flights;
- 6:28 FH in 31 solo flights.

The pilot received his license on 10 March 2022.

The list of flights performed by the pilot after obtaining the license is presented in Tab. 2.

Tab. 1. List of flights performed by the pilot after obtaining the license including the accident flight

Date (dd.mm.yyyy)	Aircraft type	Flight type	Flight time (h:min)	Comments
19.03.2022	C 152	Flight with instructor	0:15	3 flights
19.03.2022	C 152	PIC	0:34	3 flights
24.03.2022	C 152	Flight with instructor	0:35	3 flights
24.03.2022	C 152	PIC	0:20	3 flights
09.04.2022	C 152	PIC	0:50	1 flight
01.05.2022	C 152	PIC	0:46	1 flight
10.05.2022	C 152	PIC	0:55	2 flights
14.05.2022	C 152	PIC	0:45	1 flight
29.05.2022	C 152	PIC	0:52	1 flight
02.06.2022	C 152	PIC	0:21	Accident flight with passenger

From the date of obtaining the LAPL(A), the pilot performed 5 hours and 2 minutes of solo flights.

The pilot's total flight time as PIC was 11 hours. 30 minutes.

## 1.6. Aircraft information

### 1.6.1. General information

**Cessna 152** - a two-seat training and tourist airplane manufactured by the Cessna Aircraft Company based in the United States, which is a modernized version of the Cessna 150 (Fig. 4). Often used in aviation basic training. The plane is a high-wing with a classic empennage, all-metal (aluminium), semi-monocoque construction. Trapezoidal wings with a characteristic braces and a positive dihedral angle. Aerodynamic warping of the profile was applied on the outer parts of the wings in order to increase the effectiveness of the ailerons when flying at high angles of attack.

#### SP-AKW airplane basic data:

- serial number – 15283490;
- aircraft owner – Aeroklub Częstochowski;
- aircraft user – Aeroklub Częstochowski;
- engine type – Lycoming O-235 L2C;
- propeller manufacturer and type – 1 x McCauley 1A 103/TCM 6948 (fixed pitch);
- landing gear – tricycle, fixed, with nose wheel.



Fig. 4. Cessna 152, SP-AKW registration marks [source: Internet]

Certificate of Registration – valid on the day of the occurrence:

- register no – 3673 (Polish Register of Civil Aircraft);
- entry date – 8 February 2022.

Certificate of Airworthiness – valid on the day of the occurrence:

- issue date – 15 September 2017;
- valid for unlimited period;
- limitations: none.

Airworthiness Review Certificate – valid on the day of the occurrence:

- issue date – 10 September 2021;
- valid until – 09 September 2022.

Maintenance statement:

- issue date – 14 May 2022.

Certificate of Release to Service:

- issue date – 13 May 2022;
- maintenance type: airframe review (50 h), engine review (50 h / 4 months).

Noise certificate – valid on the day of the occurrence:

- issue date – 11 December 2006;
- valid for unlimited period;
- overflight noise level: 67,4 dB.

Third party insurance – valid on the day of the occurrence:

- valid from – 1 March 2022;
- valid until – 28 February 2023;
- insurant – Aeroklub Częstochowski.

Radio permit for on-board use of aeronautical station:

- valid from – 11 October 2018;
- valid until – 11 October 2028;

Radio permit for use of Emergency Locator Transmitter:

- valid from – 7 September 2016;
- valid until – 6 September 2026 r.

### 1.6.2. Flight time data

Total flight time:	18315,2 mth
Flight time since the last inspection:	46,8 mth
Date of last inspection:	13.05.2022
– with total flight time:	18268,40 mth, 12826 cycles;

carried out by Part-CAO.

### 1.6.3. Mass and balance

Weighing Report – valid on the day of the occurrence:

- issue date – 10 May 2017;
- BW<sup>4</sup>: 536,08 kg (**1181 lb**);
- arm (X<sub>SC</sub>): 781,23 mm;
- moment: M<sub>empty airplane</sub> = BW x X<sub>SC</sub> = 418,8 kg\*mm (**36,3 lb\*in**).

Fuel (preflight fuel quantity):

- Avgas 100LL: quantity approx. 76 l<sup>5</sup>;
- density at 15°C: 720÷775 kg/m<sup>3</sup>;
- Q<sub>fuel</sub>: 54,7 kg (for 720 kg/m<sup>3</sup> density) (**120 lb**).

Pilot and passenger:

- Q<sub>pil</sub>: 88 kg; Q<sub>pas</sub>: 79 kg; Q<sub>TOTAL</sub>: 167 kg (**368 lb**).

Based on the above calculations and the guidelines of aircraft flight manual Chap. 6 aircraft weight (for take-off) was calculated:

- **TOW<sup>6</sup>=757,6 kg = 1670 lb.**

which was 0,2 kg above MTOM (757,4 kg) provided in aircraft flight manual;

Moments were read from the chart provided in the aircraft flight manual:

- for fuel: 5,0 lb\*in;
- for pilot and passenger: 14,4 lb\*in;

The total moment is:

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<sup>4</sup> BW – Basic Weight

<sup>5</sup> Airplane technical log data

<sup>6</sup> TOW – Take-Off Weight



$$M_{\text{airplane}} + M_{\text{fuel}} + M_{\text{pilot}} = 55,7 \text{ lb} \cdot \text{in.}$$

Based on the envelope of the center of gravity location, the location of the center of gravity of the airplane for take-off was graphically determined. (Fig. 6).

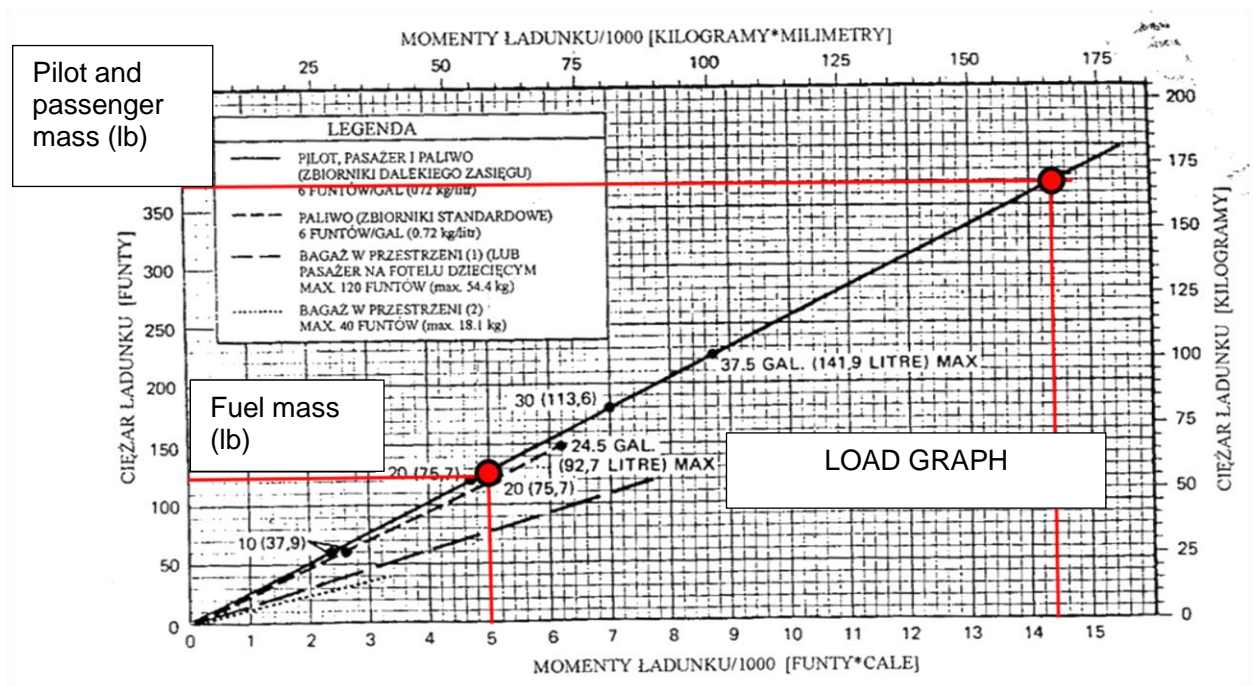


Fig. 5. Graphical determination of moments acting on the crew and fuel [source: aircraft flight manual]

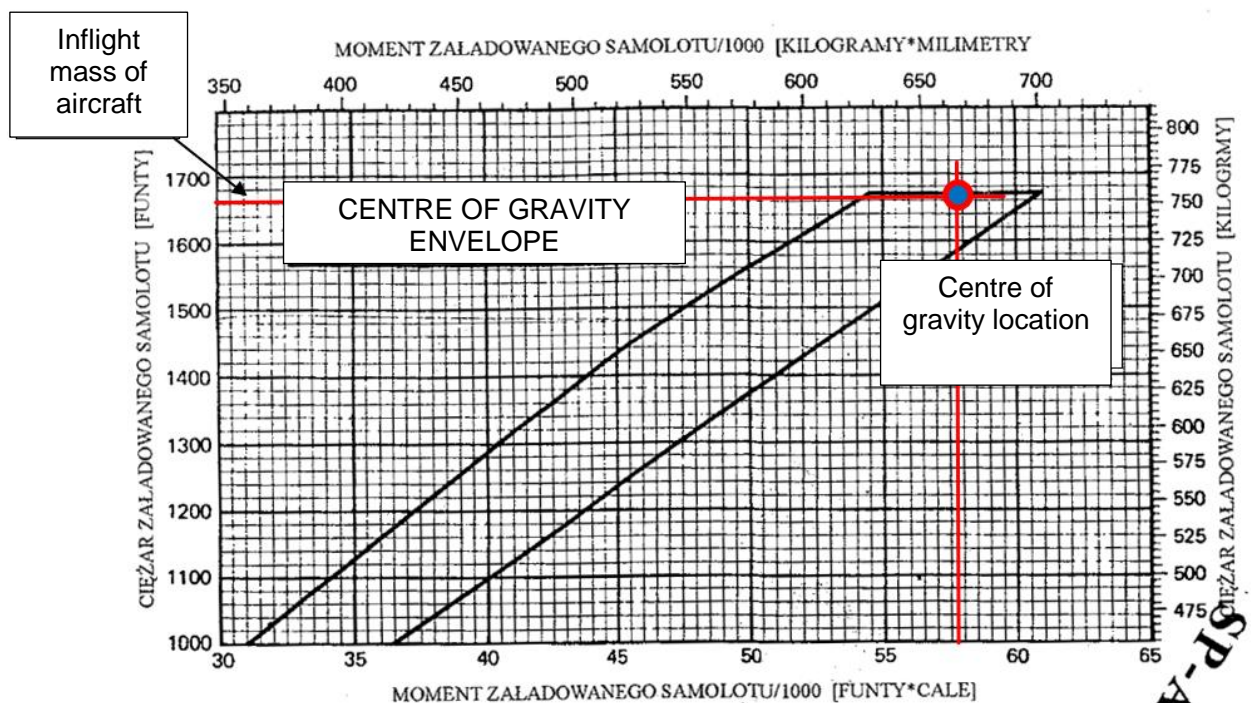


Fig. 6. Graphical determination of the location of the centre of gravity of the airplane for take-off [source: aircraft flight manual]

The airplane centre of gravity for take-off was within the prescribed limits.

### 1.7. Meteorological information

At 18:00 hrs the weather station in Częstochowa recorded the following data:

- wind: direction – 300°, speed – 3 kt;
- temperature: 19,1°C;
- dew point temperature: 12,1°C;
- visibility above 30 km;
- no phenomena.

The weather was appropriate to perform the flight. The decreasing thermals and the associated air turbulence could negatively affect the passenger's well-being during the flight.

### 1.8. Aids to navigation

No aids to navigation were used.

### 1.9. Communications

The airplane was equipped with a GARMIN GNC 255B on-board radio, a Bendix/King KT 74 transponder and a Fast Find 220 portable ELT.

During the flight, the pilot maintained radio communication with Rudniki Radio on the frequency of 122.800 and with FIS Kraków on the frequency of 119.275 MHz.

### 1.10. Accident site information

The airplane collided with level terrain and crashed about 50 m from the south-western edge of the forest located on the north-eastern side of Rębielice Królewskie (World Geodetic System '84: 51°00'16"N; 018°51'39"E).

### 1.11. Flight recorders

The accident airplane was not equipped with certified flight recorders. No type of recorder was required under applicable regulations.

The aircraft had a built-in FLARM anti-collision system, which records some flight parameters, on the basis of which the course of the flight was reconstructed. This recording ended several seconds before the plane collided with the ground.

### 1.12. Wreckage and impact information

The accident site is shown in Fig. 7. The airplane crashed into the ground (a farmland) at high speed and was destroyed. The force of the impact ruptured the structure, causing the destruction of each part of the airframe.

During the impact with the ground, fuel was sprayed into the air, but no fire occurred.

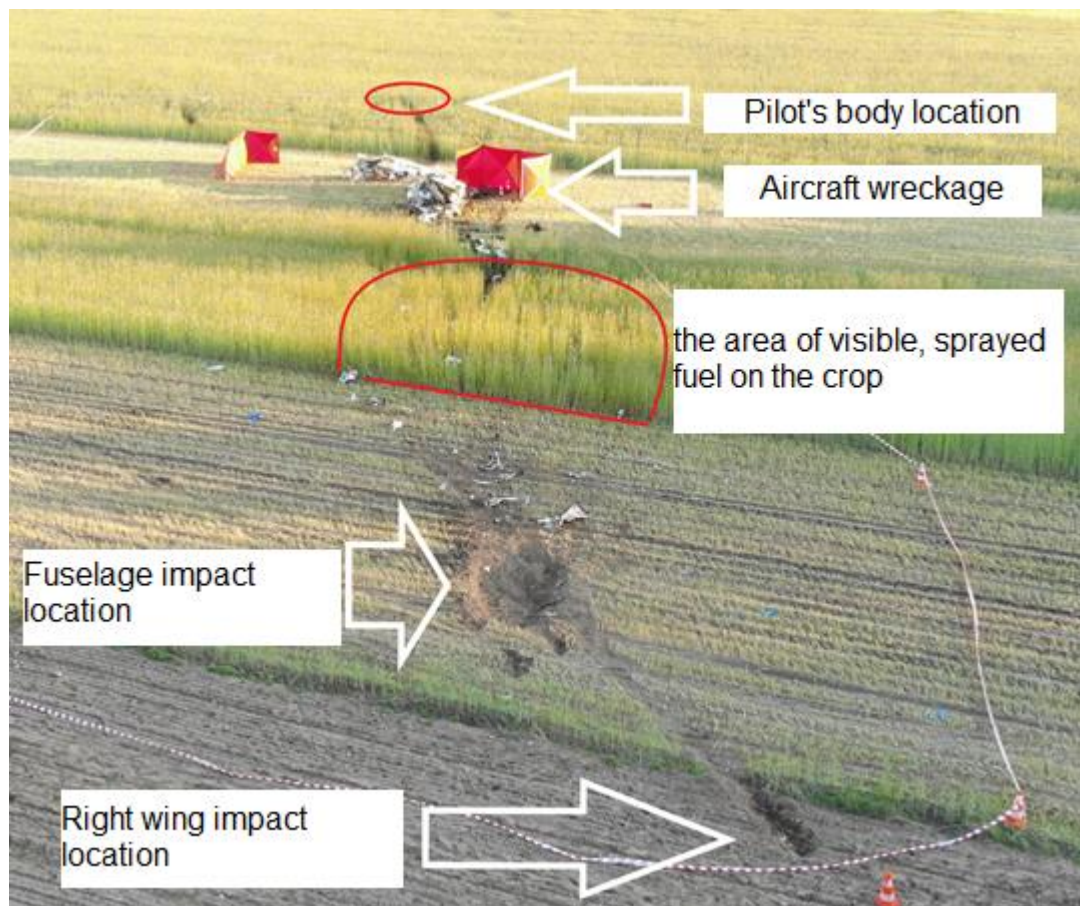


Fig. 7. Accident site [source: Police UAV/drone]

### 1.13. Medical and pathological information

The injuries of the pilot and passenger resulted from very high inertia force during the collision, which led to extensive body damage.

During the autopsy, no narcotic drugs, psychotropic substances, psychoactive substances or alcohol in any form were detected in the pilot's body.

### 1.14. Fire

No signs of inflight fire were detected. After the collision with the terrain, the fuel from the ruptured tanks was sprayed into the air, and the engine went into the soft ground, then was detached and moved beyond the area of the fuel spray. The fire did not occur because there was no contact of the sprayed fuel with hot elements of the engine.

The accident site was secured by the State Fire Service.

### 1.15. Survival aspects

Both the pilot and the passenger had their seat belts properly fastened. The nature of the collision with the ground and the destruction of the structure precluded the survival of the people on board.



## 1.16. Tests and research

### Engine and fuel fillers caps tests

Tests of the engine, propeller and fuel fillers caps were carried out by the Department of Aircraft Propulsions from the Institute of Aviation.

Conclusions of the tests:

- no damage prior to the impact was found which could have affected the operation of the engine;
- no engine seizing was found;
- propeller blades deformations indicate that the engine was operating upon collision with the ground;
- all found engine damage resulted from a strong impact with the ground;
- damage to the ignition system elements, torn magnetos and electrical harness, did not allow to assess the condition of the system prior to the impact;
- damage to the fuel system components, i.e. torn hoses and rods, crushed carburetor, broken throttle, did not allow to assess their condition prior to the accident;
- the condition of the cylinders, pistons and rings (one oil ring was jammed, there was a large amount of carbon deposits on the pistons and upper edges of the cylinders) indicated normal wear of the engine;
- the condition of the propeller blades indicated the operation of the propeller during the impact with the ground;
- cracking of the fitting of the left wing fuel filler cap was caused by hitting the ground and it could have caused the cap seal to fall off.

### Fuel test

The fuel test was carried out in Kraków by the Oil and Gas Institute - National Research Institute, Department of Petroleum Analysis. Three samples of Avgas 100LL fuel, taken on the day of the incident, were tested:

- the first sample was taken from the aerodrome fuel distributor, which served to refuel the accident plane;
- the second sample was taken from the fuel line located in the wreck of the accident plane;
- the third sample was taken from the fuel settler of the accident plane.

All samples had color and density characteristic of AVGAS 100LL.

Samples one and two met the requirements of DEF STAN 91-090 Issue 5, "Aviation Gasoline: AVGAS 100LL".

The third sample (fuel sediment) did not meet the requirements of the above specification in terms of vapour pressure. The report of the Oil and Gas Institute stated that the probable reason of that was unsealing of the jar in which the sample for testing was delivered. The unsealing contributed to the evaporation of the lightest gasoline fractions, which led to an increase in density and a decrease in vapour pressure, below the specification requirements.

The test results confirm that the airplane engine was fed with the correct fuel.

### **Flight route**

The PEGASUS\_21 system data were available for PKBWL to analyse the route and flight parameters.

A damaged FLARM device was found in the wreckage of the aircraft. It was sent to the manufacturer (LX Navigation from Slovenia). The data stored in the memory was successfully downloaded, which allowed reconstructing and analysing the course of the flight, but without its final phase. Recording ends at 18:13:30 hrs, when the system only recorded the altitude (see Fig. 8).

### **1.17. Organizational and management information**

The airplane was owned by Aeroklub Częstochowski and was used in airplane training section.

The aeroclub defined the rules for making aviation equipment available to pilots. They state that in order to perform flights with passengers, it is necessary to obtain the consent of the director of the aeroclub or the head of training and enter the passenger on the list. The pilot did not follow those guidelines by taking a passenger on board. The Commission found that he had also previously violated this rule by taking another family member for a flight.

### **1.18. Additional information**

On the day of the occurrence, the airplane made four flights. Prior to the accident flight, the aircraft was used by three pilots, and their flights lasted approximately 50 minutes. Prior to the third flight, the plane was refuelled to full - 96 l (19 l of fuel was added). After that flight, the pilot updated the fuel level by entering the quantity of 76 litres in the airplane technical log. According to aircraft flight manual, Cessna 152 consumes 24 litres of fuel for 1-hour flight. The quantity of fuel in the fuel tanks was sufficient for a 3-hour flight.

### **1.19. Useful or effective investigation techniques**

Standard investigation techniques were applied.

## **2. ANALYSIS**

### **2.1. Records and mechanical condition of the aircraft**

The operational data of the aircraft were analysed, the continuing airworthiness records were reviewed and the airplane technical log entries were verified. There were no entries indicating that earlier airframe defects had been identified, including defects in the airplane control system.

After the pre-flight inspection, the accident pilot completed the airplane technical log without comments as to its airworthiness and decided to perform the flight.

The analysis of the aircraft records and the results of engine, propeller and fuel tests indicate that the powerplant was operational and operated until the collision with the ground.

## **2.2. Pre-flight preparations**

FCL.105. A LAPL(A), item b(1) (with which the pilot should be familiar) indicates that in order to perform flights with passengers, the pilot is required to obtain a minimum PIC flight time of 10 hours from the moment of obtaining the license. The head of training of the Aeroklub Częstochowski stated that he reminded the pilot of the obligation to meet this requirement and that, in accordance with the practice applied in the Częstochowa Aeroclub, he would be allowed to perform flights with passengers after the test flight.

From the date of obtaining the LAPL(A) license, the pilot performed 5 hours 2 minutes solo flights, and such a solo flight time did not entitle him to fly with passengers.

The pilot did not perform a test flight allowing him to fly with passengers at Aeroklub Częstochowski.

The pilot did not comply with the rules of flying Aeroklub Częstochowski aircraft, did not complete the passenger list and did not obtain its approval by an authorized person.

Prior to the accident flight, the pilot entered himself in the flight schedule and incorrectly completed the airplane technical log by entering 96 litres of fuel instead of 76. Despite this error, the aircraft was filled with a sufficient quantity of fuel to perform the planned flight.

Prior to taking the seat in the cockpit, the pilot fastened the passenger's seat belts, performed the pre-flight inspection of the airplane, checked the oil level in the engine and closed the cabin door on the passenger side. Once in the cockpit, he switched on the BEACON light, started the engine, and taxied to the runway 26 holding point.

## **2.3. Flight course analysis**

The flight analysis was carried out based on data from FLARM, which records selected flight parameters, including route, altitude (barogram), GPS speed and rate of climb.

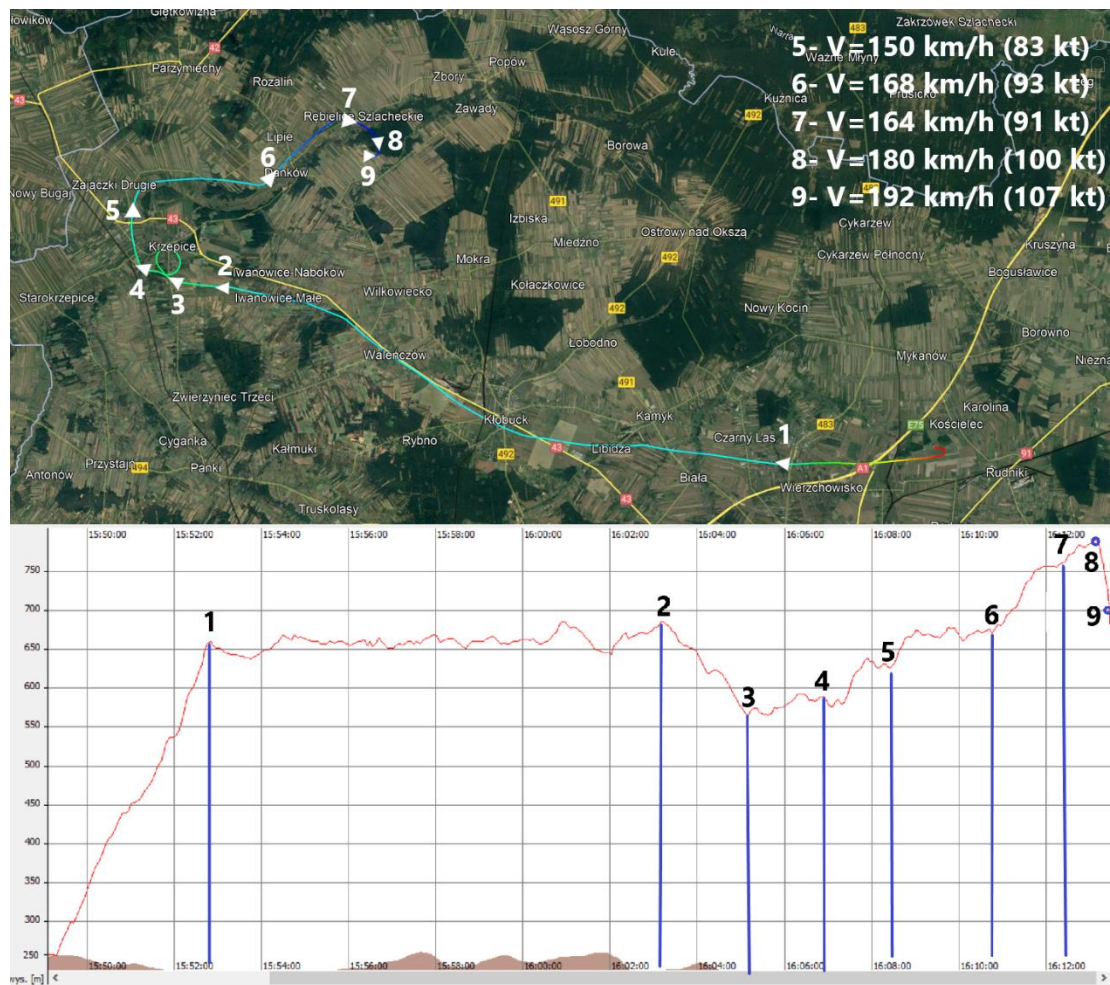


Fig. 8. Flight route, altitude and speed in selected places (times given in UTC) [source: FLARM]

The FLARM flight data (Fig. 8), radio correspondence with the FIS and witnesses' statements were used to carry out the following analysis.

After take-off, the airplane gained about 430 m altitude<sup>7</sup> (point 1) and flew towards Krzepice (section 1-2). Then he descended to about 345 m (section 2-3) and made a circuit around the southern side of the village of Krzepice (section 3-4). The nature of this circuit (constant radius and constant speed) indicates that the pilot was in control of the airplane and that the circling was intentional. After the circling, the aircraft departed on a heading of 15° with altitude gain (section 4-5). Up to this point, the flight speed was approximately 145 km/h (80 kt).

From 18:08:30 hrs the flight speed and altitude gradually increased (section 5-8). The highest altitude, about 580 m, was reached by the plane at 18:13:06 hrs (point 8), then it made a right turn, from which it went into a spiral. The flight speed recorded by FLARM at 18:13:26 hrs (point 9) was 192 km/h and the descent rate was 8.4 m/s.

In the last recorded position of the airplane at 18:13:30 hrs FLARM recorded only the flight altitude of 459 m, did not record the flight speed and the descent rate. The collision with the ground occurred in the direction of approx. 200°.

<sup>7</sup> All altitudes are given in AGL.

After performing a circuit south of the town of Krzepice and departing with a heading of  $15^\circ$  (point 4 Fig. 8), the flight record shows the progressive acceleration of the airplane and altitude gain (Fig. 9).

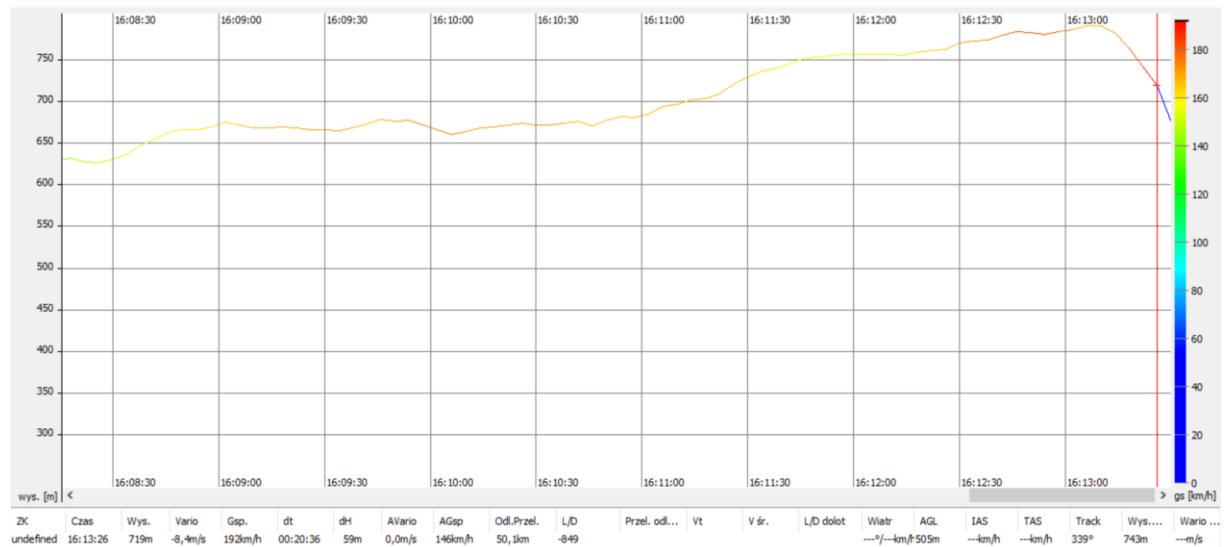


Fig. 9. Flight barogram from 18:08 hrs do the end of the recording [source: SeeYou]

Flying a Cessna 152 with speed above 150 km/h, in climb phase, requires the throttle to be fully or nearly fully open.

The reason for the increase in speed could be unlocked (friction-protected) throttle grip. In such a case, the throttle automatically shifts to high engine speed.

After gaining altitude, the flight to Krzepice was performed at a speed of about 145 km/h, more or less at a constant altitude. Before the village of Krzepice, the pilot lowered the flight altitude, and during the descent the flight speed did not increase, which indicates that the pilot reduced the engine speed. Probably for this purpose, he may have unlocked and retracted the throttle grip, and then did not lock it.

Further recording of the flight shows that the flight altitude and speed began to increase gradually. This may indicate that after reducing the speed, the pilot released the throttle grip, but did not lock it, and therefore it was moved by the spring, causing the engine speed to increase.

However, this does not explain entering the airplane into a turn (point 7 in Fig. 8), during which the plane went into a spiral and, losing altitude, collided with the ground.

The analysis of the traces and scattering of the aircraft wreckage indicates that the contact of the fuselage with the ground occurred at a speed estimated at over 200 km/h, at an angle of about  $30^\circ$  and with a roll angle of about  $45^\circ$  to the right.

The airplane in the right spiral probably continued its flight until the collision along the trajectory shown in Fig. 10 (light blue section).





Fig. 10. Approximate trajectory of the final phase of flight [source: PKBWL]

Witnesses stated that the airplane was turning to the right, rolled to the right, and in this configuration crashed into the ground. However, they did not confirm that the plane made a full circuit. The discrepancy between the witness statements and the FLARM record is probably due to the fact that the witnesses did not observe the entire course of the final phase of the flight. PKBWL determined, that the recording of the FLARM does not raise any doubts. Witnesses' statements were treated as supplementary.

## 2.4. Cause of the spiral

In order to determine the cause of the spiral in the final phase of the flight, the following hypotheses were analysed.

### 2.4.1. Lack of fuel in the fuel tanks

The plane did not catch fire after it collided the ground. The reason could have been be the lack of fuel in the tanks, which would result in the inability to continue the flight and the need to make an emergency landing.

During the inspection of the accident site on the day of the accident, the fuel filler cap of the left tank was not found. There was a suspicion that it may have been improperly closed and the fuel was sucked from the tanks during the flight, however, on the next day the cap was found. In addition, a witness who was at a short distance from the scene stated that during the collision of the aircraft with the ground fuel was sprayed and the smell of fuel was noticeable in the air for a long time. Fuel spray in the air is also proved by a large area of contaminated crop (Fig. 7). The fire probably did not occur because, after the tanks were ruptured, the fuel sprayed in the air did not come

into contact with the hot elements of the engine, which separated from the airplane fuselage and rested about 45 m from the crop contaminated with fuel.

Based on witness statements, engine, propeller and fuel examinations, it can be concluded that the engine was operating at the moment of impact with the ground.

The pilot did not report any problems with the engine to the FIS.

The hypothesis of the lack of fuel in the fuel tanks and the need to make an emergency landing is not confirmed by the facts and has been excluded.

#### 2.4.2. Intended low pass

The initiation of the turn on descent, and then the transition to a spiral, could have been aimed at effectively losing altitude and accelerating the aircraft to a low pass. However, the high speed and the climb at the start of the turn rather contradict this assumption. It can be assumed that the pilot, wanting to make a low pass, would lose altitude, as he did short of Krzepice, i.e. in a straight/direct flight, reducing the engine speed.

If the pilot had wanted to make a low pass by performing a spiral, his little flight experience could have led to loss of control of the airplane and a collision with the ground. Such a hypothesis is probable and cannot be completely ruled out.

#### 2.4.3. Health problems of the pilot

The pilot's health problems could have caused the spiral and collision with terrain.



Fig. 11. Final flight route segment

The analysis of the recording of the final part of the flight route, about 6 minutes 20 seconds after passing the village of Krzepice, shows that the pilot made four turns (Fig. 11). This could indicate that the pilot hesitated whether to fly to the Natolin airstrip or to the EPRU airfield. On the final turn to the right, the airplane entered a spiral ending in collision with the ground.



As a reason for performing the flight with turns, the pilots health problems, e.g. the occurrence of a heart attack, were considered. In such a situation, he could experience anxiety or a panic attack. The pilot's behaviour in such a case would have probably been chaotic. It can be assumed that the pilot would try to increase the flight altitude, which would improve his sense of safety. Increasing the flight speed would allow for faster arrival to a safe landing site. In this area, the Natolin airstrip was the closest, and the EPRU take-off airfield was next.

In Fig. 11, the yellow lines show the possible flight routes (A, B and C) that allowed to land on Natolin airstrip. If the pilot had lost consciousness during the final turn, the plane would most likely have gone into an uncontrollable spiral, which would have resulted in a collision with the ground. Witnesses did not observe any actions to avoid the collision with the ground.

The hypothesis of the pilot's health problems may explain the reason for the spiral flight trajectory, but no sufficient evidence has been obtained in the course of the investigation to substantiate it.

#### **2.4.4. Passenger interference with the flight controls**

The collision of the airplane with the ground could have occurred as a result of the passenger interference with the airplane controls.

If the passenger would have felt fear during the descent and acceleration of the plane in a spiral, she could block the controls. However, the pilot definitely had physical advantage over the passenger, and in the cockpit they sat next to each other, which gave him more control over the passenger's behaviour. Most likely, in such a situation, the pilot would have reacted in time and would not have allowed interference with the control of the aircraft.

The hypothesis of the passenger interference with the controls does not reliably explain the final course of the flight.

### **3. CONCLUSIONS**

#### **3.1. Findings**

- 1) The pilot had valid rating to perform solo flights, but did not meet the legal requirements to perform flights with a passenger.
- 2) The pilot was not under the influence of alcohol, drugs or stimulants.
- 3) The airplane had the required records.
- 4) The loading and longitudinal balance of the airplane were within the limits described in the aircraft flight manual.
- 5) No defects in the airframe or power unit that could have influenced the occurrence and course of the accident were detected.
- 6) The fuel in the aircraft tanks complied with the relevant standards.
- 7) The quantity of fuel was sufficient to perform the planned flight.
- 8) The airplane engine was operating until it collided with the ground.
- 9) The collision with the ground occurred in an uncontrollable spiral.
- 10) The pilot and passenger died on the spot.

11) The plane was destroyed.

### **3.2. Cause of the accident**

**Uncontrollable spiral resulting in collision with terrain.**

**PKBWL was not able to determine a cause of the spiral.**

## **4. SAFETY RECOMMENDATIONS**

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

## **5. ANNEXES**

None.

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**THE END**

*Investigator-in-Charge*

*Signature on original*

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