# FINAL REPORT

## ACCIDENT 2022/3285

STATE COMMISSION ON AIRCRAFT ACCIDENTS INVESTIGATION

UL. CHAŁUBIŃSKIEGO 4/6, 00-928 WARSZAWA | EVENT NOTIFICATION 500 233 233

# FINAL REPORT

## ACCIDENT

### OCCURRENCE NO. – 2022/3285

### AIRCRAFT – Cessna TU206G, OK-ROY

### DATE AND PLACE OF OCCURRENCE – 24 June 2022, EPBA

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 the air 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 may 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

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# Symbols and abbreviations

| | |
|---|---|
| **AC/SP** | **Aircraft** |
| **AGL** | Above Ground Level |
| **AIP** | Aeronautical Information Publication |
| **AMM** | Airplane Maintenance Manual |
| **AMSL** | Above Mean Sea level |
| **ARP** | Aerodrome Reference Point |
| **CAVOK** | Cloud and Visibility OK[1] |
| **DOW** | Dry Operation Weight |
| **EASA** | European Aviation Safety Agency |
| **FAA** | Federal Aviation Authorities |
| **IIC** | Investigator-in-Charge |
| **kt** | knot – nautical mile per hour |
| **LAPL** | Light Aircraft Pilot Licence |
| **METAR** | Meteorological Aerodrome Report |
| **mth** | Motohour |
| **NTSB** | National Transportation Safety Board |
| **PDT** | Technical Log Book |
| **PIC** | Pilot-in-Command |
| **QNH** | Query Nautical Height |
| **rpm** | Revolutions per minutes |
| **RWY** | Runway |
| **SCAAI** | State Commission on Aircraft Accidents Investigation |
| **SEP(L)** | Single Engine Piston (Land) |

[1] A weather status when visibility is at least 10 km, there are no clouds below 5000 feet, like for ex. CB (Cumulonimbus clouds) and TCU (towering cumulus), no precipitation, thunderstorms etc.

| | |
|---|---|
| **SPO** | Specialised Operations |
| **UACP** | Certificate of qualifications of the ultralight aircraft pilot |
| **UAP(L)** | Ultralight Aircraft Pilot (Land) |
| **ULC** | Civil Aviation Authority of the Republic of Poland |
| **UTC** | Universal Time Coordinated |
| **UZPLN** | Ústav pro odborné zjišťování příčin leteckých nehod |
| **VFR** | Visual Flight Rules |
| **WGS84** | World Geodetic System 1984 |

# General Information

<table>
<tr><td>Occurrence reference number</td><td colspan="4">2022/3285</td></tr>
<tr><td>Type of occurrence</td><td colspan="4">ACCIDENT</td></tr>
<tr><td>Date of occurrence</td><td colspan="4">24 June 2022</td></tr>
<tr><td>Place of occurrence</td><td colspan="4">EPBA</td></tr>
<tr><td>Type and model of aircraft</td><td colspan="4">Cessna TU206G</td></tr>
<tr><td>Aircraft registration marks</td><td colspan="4">OK-ROY</td></tr>
<tr><td>Aircraft User/Operator</td><td colspan="4">Private company</td></tr>
<tr><td>Pilot in Command</td><td colspan="4">CPL(A)</td></tr>
<tr><td rowspan="2">Number of victims/injuries</td><td>Fatal</td><td>Serious</td><td>Minor</td><td>None</td></tr>
<tr><td>0</td><td>0</td><td>6</td><td>0</td></tr>
<tr><td>Domestic and international authorities informed about the occurrence</td><td colspan="4">ULC, EASA, UZPLN, NTSB</td></tr>
<tr><td>Investigator-in-Charge</td><td colspan="4">Michał Ombach</td></tr>
<tr><td>Investigating Authority</td><td colspan="4">State Commission on Aircraft Accidents Investigation (PKBWL)</td></tr>
<tr><td>Accredited Representatives and their advisers</td><td colspan="4">None</td></tr>
<tr><td>Document containing results</td><td colspan="4">Final Report</td></tr>
<tr><td>Safety recommendations</td><td colspan="4">None</td></tr>
<tr><td>Addressees of the recommendations</td><td colspan="4">Not applicable</td></tr>
<tr><td>Date of completion of the investigation</td><td colspan="4">28.11.2022</td></tr>
</table>

# Summary

On June 24, 2022, the Cessna TU206G took-off from EPBA aerodrome with 5 parachute jumpers on board. During the take-off, the engine shut down. The pilot made an emergency landing outside the airfield. As a result of the collision with the ground, and then with the fence of the property, the plane sustained serious damage. The pilot and the jumpers suffered minor injuries.

The investigation of the event was carried out by a research team consisting of:

| | |
|---|---|
| Michał Ombach | team leader (SCAAI); |
| Jakub Cichocki | team member (SCAAI). |

**Cause of the occurrence:**

**Pilot error of taking-off with an empty fuel tank.**

**Contributing factor:**

The pilot's routine, consisting in not using a checklist – actions to be performed before take-off.

SCAAI has not proposed any safety recommendations.

# 1. FACTUAL INFORMATION

## 1.1. History of the flight

On 24 June 2022 the aircraft operator (private company) organized commercial parachute jumps in tandem. Take-offs took place from the Aleksandrowice aerodrome in Bielsko-Biała (EPBA). The jumps took place from an altitude of 3000 m AGL. The jumpers were lifted to the ceiling by a Cessna TU206G aircraft.

The pilot arrived at the aerodrome after the plane was taken out from the hangar. He performed a pre-flight inspection, during which he checked the amount of fuel (Avgas 100 LL), finding 50 l of fuel in the left tank and 30 l in the right tank. Then he refueled the plane, adding 40 l of fuel to the left tank only (no fuel was added to the right tank). The total fuel amount was recorded in PDT as 120 l before take-offs.

At 16:20[2] the pilot made the first take-off, with four jumpers on board. The whole flight went well.

After landing, the pilot taxied near the place where the jumpers were picked up and did not turn off the powerplant for the time of boarding. The operation of taking up space in the cabin lasted about 2 minutes. There were 2 tandems (tandem pilots with passengers) and a single jumper on board. The plane then taxied to the threshold of RWY 09, about 300 m away.

The second take-off took place at 17:09, using the full length of the grass RWY 09 (Fig. 1). During the climb, the aircraft engine stopped. Being at an altitude of about 20 m above the ground, the pilot went into a gliding flight and, turining about 40÷45° to the left, made an emergency landing on a small cultivated field adjacent to the airfield (Fig. 2).

During the landing a very hard touchdown took place with a short run ended with a collision with the fence of the property, which resulted in breaking the front landing gear and bending the propeller blades.

The passengers and then the pilot evacuated the plane by leaving the passenger cabin, obscured to take-off by a blind.

All participants in the accident suffered minor bruises. Witnesses of the incident notified the emergency services by calling 112. Fire brigades, ambulance and police arrived at the scene of the accident.

[2] All times in Final Report are in LMT, LMT=UTC+2 h

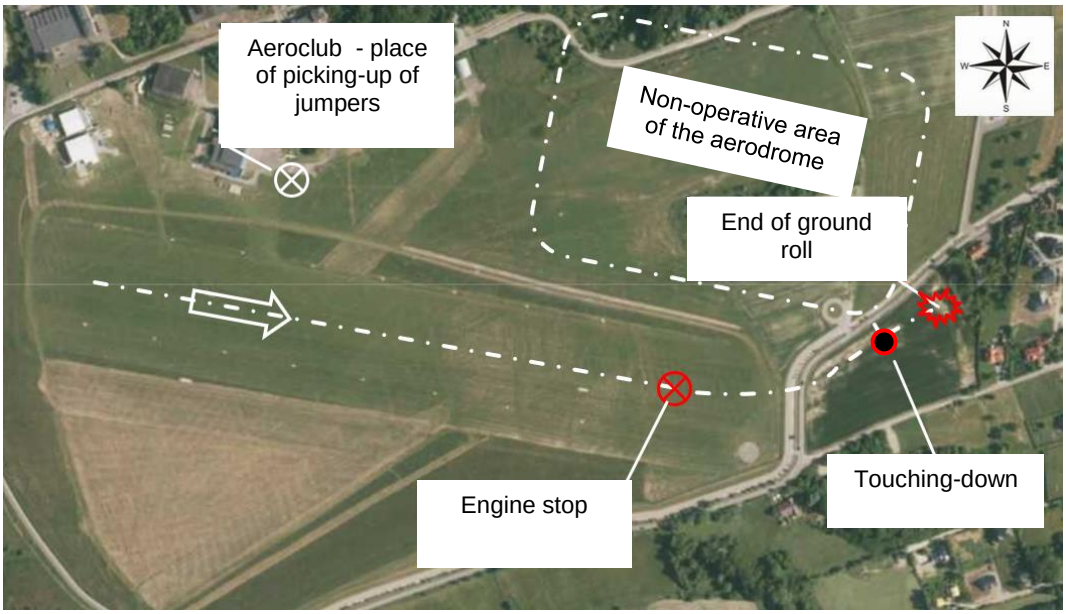


**Fig. 1.** Take-off trajectory and forced landing site [source: Geoportal]


**Fig. 2.** Location of the aircraft after stopping on the fence of the property [source: SCAAI]

## 1.2. Injuries to person

**Tab. 1. Injuries to person – general data**

| Injuries | | Crew | Passengers | Others | TOTAL |
|---|---|---|---|---|---|
| **Fatal** | | **0** | **0** | **0** | **0** |
| **Serious** | | **0** | **0** | **0** | **0** |
| **Minor** | | **1** | **5** | **0** | **6** |
| **None** | | **–** | **–** | **N/A** | **0** |

## 1.3. Damage to aircraft

The plane sustained serious damage (Fig. 3). As a result of a very hard touchdown, the fuselage broke behind the passenger cabin. The elevator drive broke as well.

Undulations of the cover were found on the right side of the fuselage, behind the entrance to the cabin, and cracks in the cover near the connection of the wing struts with the fuselage.

The bench for jumpers was detached from the fasteners on the floor and destroyed. The engine control lever (throttle lever) from the cabin was bent, the engine cowling flaps control lever console broke, and the backrest of the pilot's seat was deformed. The upper hinge of the left cabin door was torn off (cut).

The main landing gear and the fuselage in the front fork mounting area sustained structural damages, and the front fork together with the wheel was broken and pressed into the engine compartment. All 3 propeller blades were destroyed (bent).

The windshield in the cabin was detached from the lower part of the frame.

The tip of the left wing and the right half of the elevator were damaged.


**Fig. 3.** Damage to the aircraft: a) broken fuselage, b) left wing tip damage, c) skratches on the bottom part of fuselage and main landing gear, d) bend on the throttle lever, e) bent prop blades, f) broken front undercarriage fork, pressed into engine compartment [source: SCAAI]

The damaged aircraft was inspected twice. It was determined that:

- the engine compartment was clean, without leakage of operating fluids;
- there were no unsealing (leakages) or squashing of the fuel system;
- all fuel drains were open;
- the vents of the fuel tanks were open and not clogged;
- fuel samples taken from drainage on the left wing and on the bottom of the fuselage on its left side, were clean – no water particles or other pollution were found;
- it was impossible to take fuel samples from the drainage on the right wing and on the bottom side of the fuselage – the fuel did not flow;
- after disconnecting the fuel system (rubber line) on the fuel distributor on the engine, it was only found that the installation was damp but there was no fuel in the line;
- the amount of fuel poured from the tank in the left wing was approx. 90 l;
- the amount of fuel in the tank in the right wing was 0 l (zero) – the tank was empty and dry.

Just after the emergency landing, photo documentation was made, which allowed to note the setting of engine control devices in the cabin (Fig. 4).

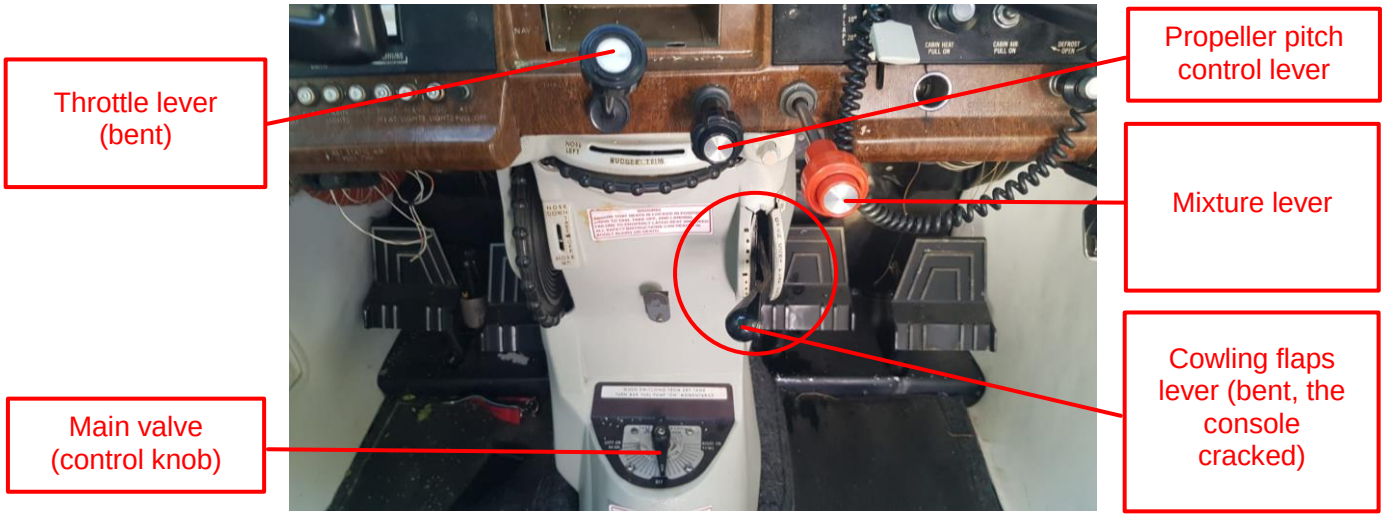


**Fig. 4.** Setting of engine control devices after an emergency landing [source: SCAAI]

**The control knob for the fuel valves** - the outflow of fuel from the tanks - was in the "OFF" position (closed valves), according to the pilot's statement. This was the correct position to prevent the occurrence of a fire after an emergency landing – closed valves cut off the fuel supply to the engine compartment.

**The throttle lever** (curved, bent upwards) was in the "fully back" position (choked rpm).

**The propeller pitch control lever** (in the middle) remained in the "fully forward" position and this was the right position for take-off/landing (low pitch).

**The mixture control lever** (handle in red) was completely retracted (to the "lean" position), which corresponds to the process of shutting down the engine. It was the correct position to touch down and prevent a possible fire.

In addition, **the engine cowling flaps control lever** (engine cooling in flight) was curved and its plastic casing was cracked.

## 1.4. Other damage

The agricultural cultivation was slightly affected as well as the fence with which the plane collided.

## 1.5. Personnel information (crew data)

Pilot-in-command (PIC) – aged 24 with the following qualifications:

- CPL(A) licence with valid SEP(L) entry;
- certificate of qualifications of the ultralight aircraft UACP with valid UAP(L);

– medical certificate class 1, 2 & LAPL, with limitations TML12[3] & VDL[4].

The total flight time of the pilot on the planes was 952 hours.

The total time on the Cessna C206 type was about 700 hours. On the C206 aircraft with a supercharged engine (with a compressor), the pilot was flying since the year of occurrence. However, he had some previous experience on the Cessna C182 Turbo Skyline.

The pilot was approved to throw parachute jumpers. He remained in the current training.

**Tab. 2. Last 10 flying days prior to the occurrence**

| Date | A/C type | Type of flight | Flight time (HH:MM) | No. of landings / Notes |
|---|---|---|---|---|
| 04.06.2022 | C206 | PARA*) | 1:29 | 4 |
| 05.06.2022 | C206 | PARA, ENR*) | 9:03 | 14 |
| 11.06.2022 | C206 | ENR, PARA | 5:47 | 13 |
| 12.06.2022 | C206 | PARA | 2:46 | 6 |
| 14.06.2022 | C206 | PARA | 1:30 | 6 |
| 15.06.2022 | C206 | PARA | 1:25 | 5 |
| 17.06.2022 | C206 | PARA | 2:45 | 6 |
| 18.06.2022 | C206 | PARA | 4:52 | 10 |
| 19.06.2022 | C206 | PARA | 3:45 | 7 |
| 22.06.2022 | C206 | PARA | 2:20 | 10 |
| 24.06.2022 | C206 | PARA | 0:24 | 1 / the flight before the accident, on the day of the occurrence |
| 24.06.2022 | C206 | PARA | 0:01 | The flight ended in the accident |

*) PARA – flight related to skydivers activity; ENR – en-route flight

There were 5 people in the passenger compartment of the aircraft: three qualified parachute jumpers (including 2 tandem pilots) and 2 passengers – customers who bought the tandem parachute jumps. The passengers were fastened with harnesses with their pilots.

All parachute jumpers had the required qualification (tandem pilots with the Tandem[5] entry and appropriate medicals, without restrictions).

All participants of the flight were entered on the Departure Loading List before the flight, where (aot) they were assigned to their dedicated tandem pilots.

[3] TML – the period of validity of the medical certificate is limited to the duration as shown on the medical certificate
[4] VDL – correction for defective distant vision, the duty to wear corrective lenses and carry a spare set of spectacles
[5] The privilege to perform the jumps with a passenger

## 1.6. Aircraft information

1.6.1 General information

Design description

The Cessna TU206G „Stationair" aircraft (Fig. 5) is powered by 285 HP, turbocharged Continental TSIO-520-M engine. The aircraft has been granted with the FAA type certificate no. A4CE. The Textron Aviation Inc. remains the type certificate holder.

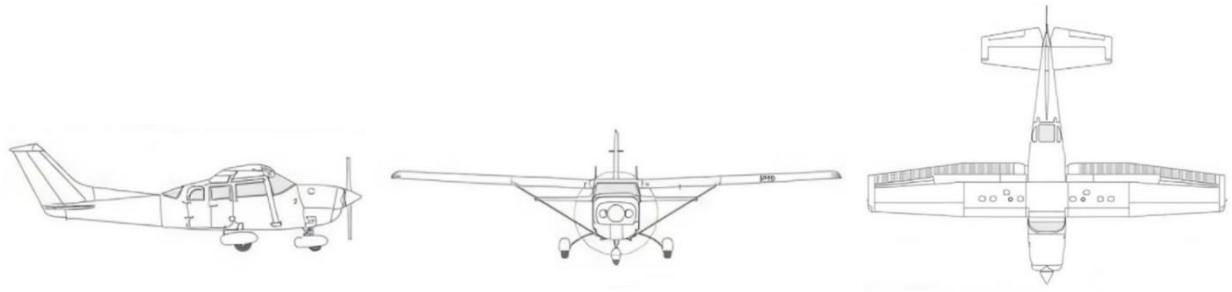

**Fig. 5.** Cessna TU206G, 3D view [source: Internet]

With regard to the affected aircraft, the right pilot's seat and all passenger seats were dismounted, and a plastic blind was installed in place of the passenger compartment door. This made it possible to take up to 5 parachute jumpers on board. Jumpers took their places on the floor and on a specially designed bench, attached to the cabin floor.

Aircraft basic data:

- type (class) of the aircraft – aeroplane (A);
- design – full metal half-sheel design with wings supported by struts;
- designation and number of seats – recreational and training aircraft, 2+4 or 1+5;
- registration marks – OK-ROY;
- manufacturer – Cessna Aircraft Company;
- model – T206G;
- serial no. – U206-05613;
- owner of the aircraft – private company;
- user – private company;
- powerplant equipped with propeller;
- number & engine manufacturer and type – 1 x Continental TSIO-520-0M;
- number, manufacturer and prop type – 1 x McCauley D3A34C402/90DFA-10;
- undercarriage – tricycles, not retracted, with front wheel.

Registration certificate (CofR) – valid on the day of occurrence:

- no. in registry – 6158 (registry of civil aircraft of Czech Republic);
- date of entry – 21 August 2016

Certificate of airworthiness (CofA) – valid on the day of occurrence:

- date of issue – 15 October 2016;
- validity – without time limit.

Airworthiness review certificate (ARC) – valid on the day of occurrence:

- date of issue – 22 November 2021;
- date of expire – 21 November 2022.

Confirmation of release to service (CRS):

- date of issue – 13 May 2022.

Maintenance statement (MS):

- date of issue – 26 May 2022.

Noise certificate (NC) – valid on the day of occurrence:

- date of issue – 15 September 2016;
- date of expire – without time limit;
- noise level at take-off 77,4 dB.

Certificate of insurance (CofI) – valid on the day of occurrence:

- validity from – 26 June 2022;
- validity to – 25 May 2023;
- insurer – operator (private company).

### 1.6.2 Utilization data

Aircraft – Cessna T206G

| | |
|---|---|
| Total time since beginning of exploitation | 4845,0 mth |
| Time since the last maintenance | 150,8 mth |
| Date of the last maintenance | 13.05.2022 |
| – done at total time | 4 694,2 mth |
| – conducted by Part 145. | |

### 1.6.3 Maintenance

The maintenance was carried out by approved maintenance organization Part 145.

### 1.6.4 Mass and balance

Maximum take-off weight of the aircraft:1633 kg.

Weight and balance report – valid on the day of occurrence:

- date of issue – February 2020.
- DOW: 954,66 kg;
- Center of gravity location of the empty aircraft ($X_{SC}$): 0,94732 m;
- moment: $M_{empty\ a/c}$= DOW x $X_{SC}$=904,37 kgm

## 1.7. Meteorological information

At the time of the accident, a METAR was sent to the Kraków-Balice airport (EPKK), located 64 km away, with the following content:

METAR EPKK 241500Z 08012KT 050V140 CAVOK 28/11 Q1012=

- date: 24.06.2022 r.;
- time: 15:00 UTC;
- wind direction: 80°;
- wind speed: 12 kt;
- wind variable between 50 and 140°;
- visibility: over 10 km, no clouds below 1500 m;
- ambient temperature: 28ºC;
- dew point: 11ºC;
- QNH 1012 hPa.

At the time of the incident, typical summer weather prevailed at the Aleksandrowice aerodrome: a moderate wind was blowing from the east, visibility was above 10 km, the sky was covered in 1/8 with disappearing cumulus clouds (Fig. 2), and the ambient temperature in the shade did not exceed 28° C.

The weather had no effect on the occurrence.

## 1.8. Aids to navigation

Not used

## 1.9. Communications

The pilot conducted radio communication on the EPBA airport frequency 118,330 MHz.

## 1.10. Aerodrome information

EPBA aerodrome – Bielsko-Biała/Aleksandrowice (Fig. 6), general information:

a) ARP – WGS-84 coordinates: 49°48'18"N, 019°00'07"E;
b) Permitted air traffic: VFR;
c) Operator: Aeroclub of Poland;
d) Working hours: to be established with operator;
e) Air traffic services (ATS): – none, contact to Bielsko Radio 122,330 MHz;
f) Rescue and firefighting service: none.

Meteorological information provided by Central Bureau of Meteorological Forecasts in Krakow.

EPBA aerodrome is located on a plateau and surrounded by a fence separating the maneuvering/take-off area from the surrounding bike lane. On the eastern side (towards the take-off) and south-east, the terrain gently, and then quite quickly falls. The above features and a very dense residential buildings (houses and apartment

blocks) exclude the possibility of a safe emergency landing after rejected take-off or at the aerodrome approach.

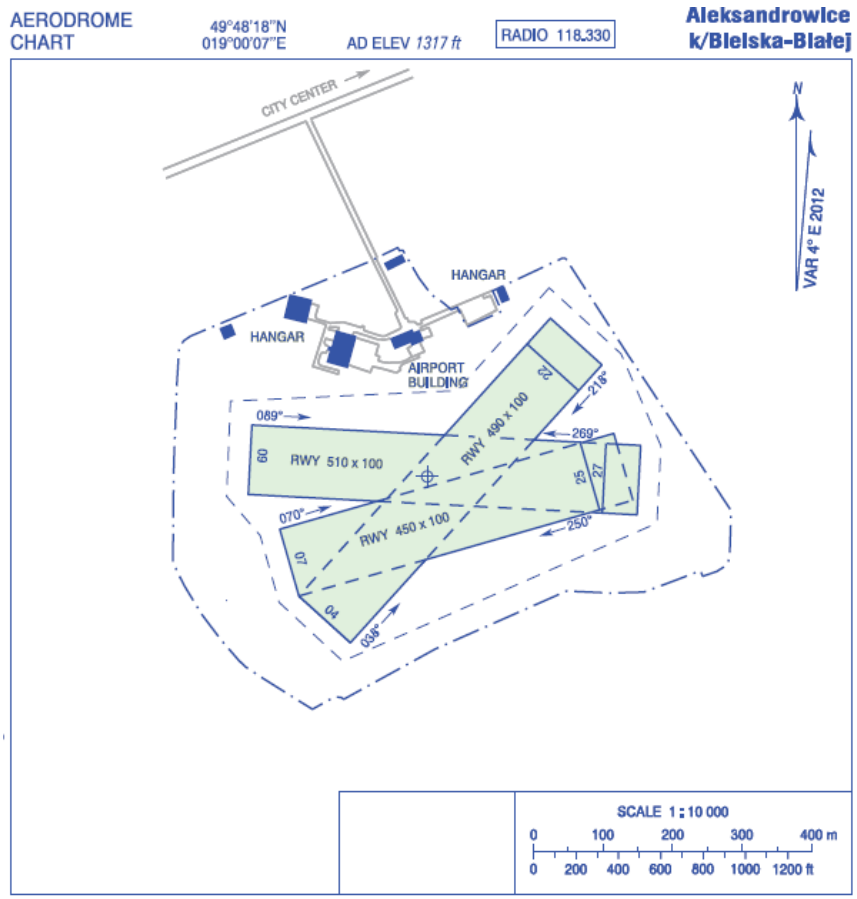


**Fig. 6.** EPBA aerodrome [source: AIP Polska]

## 1.11. Flight recorders

The aircraft that suffered the accident was not equipped with on-board recorders. Any type of on-board recorder was required under applicable law.

In the analysis of the event, the footages from two video cameras at the disposal of parachute jumpers were used. In addition, an airport surveillance camera recorded the emergency landing of the aircraft.

## 1.12. Wreckage and impact information

The place of the accident is shown in Fig. 1. The aircraft kept its integrity. No part detached from the aircraft in flight.

At the moment of engine speed drop, the pilot increased the bank of the aircraft to the left wing, moved to subcritical angles of attack (the nose below the horizon) and turned by about 40÷45° to the left. The wings alignment to the horizontal occurred just at the impact on the ground, in a deep stall, as evidenced by the bell ringing in the cabin while flying in conditions of lift loss.

After hitting the ground, the pilot tried to keep the direction of roll-out away from the bike lane. The roll-out, in an arc (Fig. 7 and Fig. 8), ended with a collision with the metal

fence. In relation to the preceding hard touchdown, contact with the fence caused a minor damage to the aircraft structure.

The rapid deceleration on the roll-out was caused by the minimum touchdown speed, torsion of the bottom part of fuselage and propeller. And above all – by high cultivation (grain). The pilot used wheel brakes also.

**Fig. 7.** View of the plane, bike lane and traces of roll-out in the grain [source: SCAAI]

**Fig. 8.** View in the opposite direction to the landing, from the place where the aircraft stopped. EPBA aerodrome is on the right, just behind the bike lane [source: SCAAI]

## 1.13. Medical and pathological information

The pilot's performance has not been found affected by physiological factors or any incapacity.

## 1.14. Fire

No traces of fire were detected after an emergency landing. However, the scene of the incident was secured by the State Fire Service.

## 1.15. Survival aspects

During the emergency landing and then collision with the fence, the fuselage of the aircraft broke and deformed. The structure of the passenger compartment was only slightly affected. With the exception of the pilot, none of the participants in the accident was fastening seat belts.

The immediate, correct reaction of the pilot to the engine shutdown during take-off and his skills (resulting from continuous training on this aircraft) allowed to reduce the consequences of the accident to a minimum.

## 1.16. Tests and research

Following the pilot's suggestion that the fuel valve could have been set towards the "tank in the left wing" (where the fuel was located), an attempt was made to analyze the recorded movie in order to confirm or exclude this possibility.

The area of the cabin where the fuel valve is located was partially visible on one of the footages, in 5th s from the moment of beginning the ground roll. An attempt to determine clearly in what position the valve was during the take-off – failed. The details of the area of interest were invisible.

In order to determine whether the valve (Fig. 9) was operational, both tanks were refueled – then the valve were working properly.


**Fig. 9.** Fuel valve in the cockpit – the valve knob (in black) controls the fuel supply from the tanks to the engine compartment [source: SCAAI]

The drainage systems of both fuel lines were open, and the vents of the tanks were not clogged in any way. The fuel system was not damaged at the time of the incident or during the transport of the wreckage to the hangar. The diagram of the fuel installation is shown in Fig. 10.

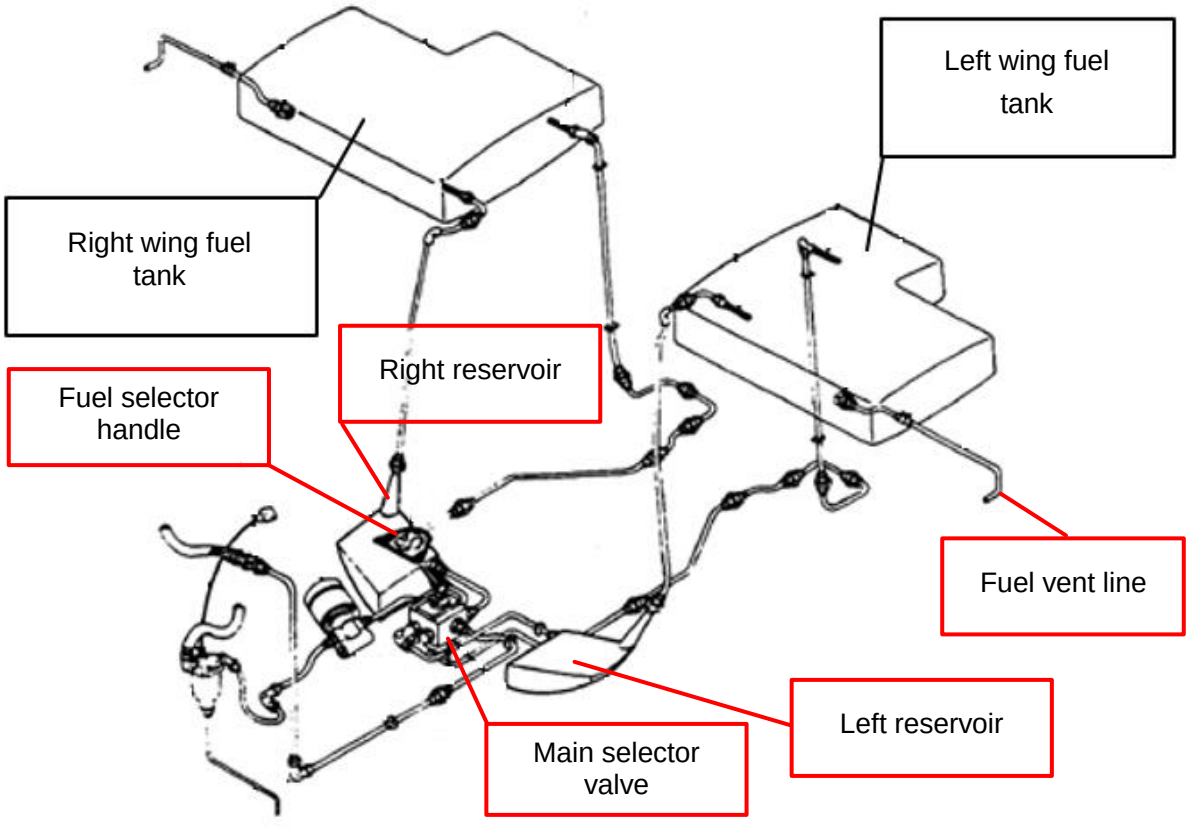


**Fig. 10.** Diagram of the fuel instalaltion of C206 aircraft [source: AMM]

To check whether the valve of the fuel line of the right wing was not hanged in the "Open" position (as requested by the aircraft operator), the following test was made: with the tank in the left wing emptied, the empty tank in the right wing was refueled. With the fuel valve closed (off position), the fuel did not flow. However, the flow appeared each time the valve was opened to the "right tank" position and disappeared immediately after its closure. The valve worked properly.

The above test excluded also the situation that the valve of the fuel line of the right wing could be permanently open (i.e. hanged), which could lead to continuous fuel consumption from the right tank, also when the knob in the cabin was set to the left tank.

The tank fuel line valve in the left wing was also fully operational.

The main valve knob was therefore set – during both flights – to the tank in the right wing (contrary to Fig. 9), in which there was only 30 l of fuel, which allowed for at most one flight.

### 1.17. Organizational and management information

A private company licensed for SPO operations – dropping parachute jumpers was the organizer of flights and parachute jumps, including tandem jumps

### 1.18. Additional information

None.

### 1.19. Useful or effective investigation techniques

Standard test methods were used.

## 2. ANALYSIS

### 2.1. Take-off and Landing

The run-up, airborne and the first phase of the aircraft climb with jumpers on board proceeded in a correct manner. The total decrease in engine power and consequently its stopping occurred during a gentle climb, just after take-off: after airborne and reaching the altitude of about 20 m.

After 25 s from the first move (beginning of run-up), the aircraft was about 150 m from the fence surrounding the aerodrome on its eastern end and – accelerating – the speed of about 55÷60 kt (102÷111 km/h). This speed was determined on the basis of video footage recorded by the camera of one of the jumpers (Fig. 11).

It was impossible to land straight ahead on aerodrome runway – the plane was approaching its edge.

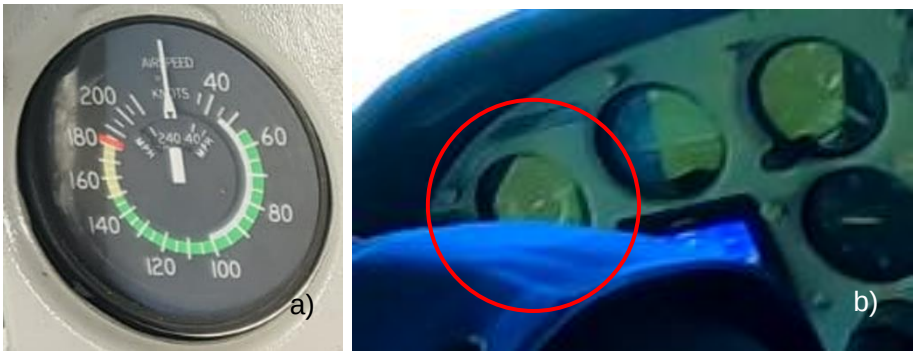


**Fig. 11.** a) Airspeed indicator (ASI) with its marking, installed in OK-ROY, b) ASI readings recorded in 27 s of flight, i.e. 2 s after engine power loss [source: video footage recorded by the camera of one of the jumpers]

Turning or turning back to the non-usable, north-eastern part of the aerodrome (see Fig. 1) was impossible due to the low altitude and low flight speed (just above the stall speed[6]). An attempt to turn back to the runway would result in a stall in a turn and a collision with the ground, most likely within the street and bike lane surrounding the aerodrome.

When landing straight ahead, in the collision direction, there was an asphalt road, trees, residential buildings and uneven, rapidly descending terrain with numerous obstacles.

The pilot was able to manage an emergency landing on a small grain field, just behind the aerodrome fence. The total length of the field in the direction of landing was about 170 m, but the available length to stop after touchdown was 3 times smaller.

A safe landing is impossible to be managed directly out of the EPBA aerodrome.

## 2.2. Fuel system

Recordings from video cameras used by parachute jumpers allowed for the selection of frames, on which the fuel status in both tanks and the flow meter indication during take-off and when the engine is turned off are visible.

The situation in 7 s[7] from the beginning of ground roll is shown in Fig. 12. There was a minimum amount of fuel in the right tank – the fuel meter pointer was in the extreme left position and the fuel flow was very high, which was in accordance with the engine operating conditions at full take-off power.

[6] As per the FM of Cessna T206 the stall speed with flaps 20° for MTOW is ca. 50 KIAS (93 km/h).
[7] Footage from the cameras from the passenger compartment only randomly shows the instrument panel.

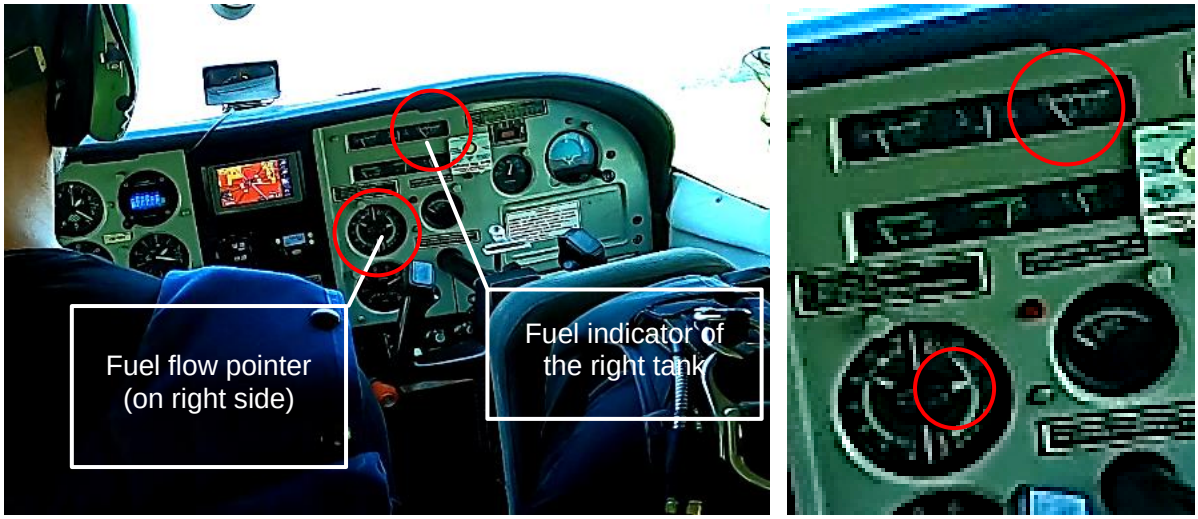


**Fig. 12.** View of the instrument panel in 7 s from the beginning of run-up. The figure on the right shows the enlargement of a fragment of the instrument panel and marks the fuel meter and flow meter [source: video footage recorded by the camera of one of the jumpers]

Fig. 13 shows the flow meter readings in 27 and 28 s after the beginning of the run-up, and therefore 2÷3 s after the engine shuts down. A decrease in fuel flow to zero is visible, which means that the engine did not receive fuel. This resulted in propeller rpm decreasing to the speed of wind-milling and shutting down of the engine.


**Fig. 13.** Drop of readings on the flow meter: the red arrow shows the position of the instrument pointer [source: video footage recorded by the camera of one of the jumpers]

The above facts, in combination with the complete lack of fuel in the right wing tank, prove that during the previous flight and the take-off ended in an accident, the fuel valve in the cabin was set in a position that allowed fuel to be drawn only from the right tank.

The amount of fuel in this tank, found during the pre-flight inspection (30 l according to the pilot's statement), was sufficient to perform at most one full flight (flight with jumpers to an altitude of 3000 m AGL, take-off at 16:20, landing at about 16:44, flight time about 24 min, fuel consumption about 30 l).

It should be noted that during the pre-flight inspection (before the first flight), the pilot checked the fuel status directly in the tank, measuring its level with the pin shown in Fig. 14.

**Fig. 14.** Wooden pin with cut scale, used to check the amount of fuel in the tank [source: SCAAI]

# 3. CONCLUSIONS

## 3.1. Findings

1) The pilot held a license and privileges to perform the flight in accordance with the applicable regulations.
2) The pilot had a proper, valid aero-medical certificate.
3) The pilot was rested before the flights.
4) The user and owner of the aircraft was a legal entity.
5) Weather conditions allowed for flights.
6) The pilot was not under the influence of alcohol or other intoxicants.
7) The aircraft had the required documentation
8) The maintenance records of the aircraft indicated that it was equipped and operated in accordance with applicable regulations and approved procedures.
9) The maximum take-off weight of the aircraft has not been exceeded.
10) The center of gravity of the aircraft was within the prescribed limits.
11) No evidence was found of any malfunctions or failures of the aircraft that could have contributed to the accident.
12) No part of the aircraft has separated from it during the flight.
13) The kinematic continuity of the control systems prior to the hard landing was preserved.
14) All damage to the aircraft resulted from hard landing, decelerating and collision with the fence.
15) During flights on the day of the incident, the fuel valve in the cabin was set to draw fuel from the tank in which the amount of fuel was insufficient to perform the planned flights.
16) The engine of the aircraft stopped due to the lack of fuel supply.
17) The technical failure was not the cause of the event.

18) The circumstances of the accident as well as terrain conditions did not give a chance to land without damage to the aircraft.
19) All parachute jumpers until the hard landing (collision with the ground) were not aware of the accident that was to occur.
20) Apart from general bruises, none of the persons on board was injured.
21) As a result of the occurrence, no third parties were injured. The damage to the infrastructure (field cultivation, fencing of the property) was a minimum.

### 3.2. Cause of the occurrence

**Pilot error of taking-off with an empty fuel tank.**

### 3.3. Contributing factor

The pilot's routine, consisting in not using a checklist – actions to be performed before take-off.

## 4. SAFETY RECOMMENDATIONS

SCAAI has not proposed any safety recommendations.

## 5. APPENDICES

None.

**THE END**

*Investigator in-charge*

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*(Signature on original)*