FINAL REPORT

ACCIDENT 2022/3434

STATE COMMISSION ON AIRCRAFT ACCIDENTS INVESTIGATION

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

FINAL REPORT

ACCIDENT

OCCURRENCE NO. – 2022/3434

AIRCRAFT – Aero AT-3 R100, SP-PBC

DATE AND PLACE OF OCCURRENCE – 30 June 2022, Witanowice

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 2023

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Symbols and abbreviations

A/C, SP	Aircraft
AGL	Above ground level
AMSL	Above Mean Sea level
ATPL(A)	Airline Transport Pilot Licence
CAVOK	Cloud and Visibility OK[1]
EASA	European Aviation Safety Agency
ELT	Emergency locator transmitter
ft	Feet
QNH	Query Nautical Height
METAR	Meteorological Aerodrome Report
mth	Motohour
FIS	Flight Information Service
FM	Flight Manual
IIC	Investigator in Charge
kph	Kilometres per hour
kt	Knot – nautical mile per hour
LAPL	Light Aircraft Pilot Licence
LMT	Local Mean Time
MTOM	Maximum Take-off Mass
PIC	Pilot-in-Command
PPL(A)	Private Pilot Licence (aeroplanes)
RPM	Revolutions per minute
SEP(L)	Single Engine Piston (Land)
SPL	Sailplane Pilot Licence

[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.

TMA	Terminal Control Area
ULC	Civil Aviation Authority of the Republic of Poland
UTC	Universal Time Coordinated

General Information

<table>
<tr><td>Occurrence reference number</td><td colspan="4">2022/3434</td></tr>
<tr><td>Type of occurrence</td><td colspan="4">ACCIDENT</td></tr>
<tr><td>Date of occurrence</td><td colspan="4">30 June 2022</td></tr>
<tr><td>Place of occurrence</td><td colspan="4">Witanowice</td></tr>
<tr><td>Type and model of aircraft</td><td colspan="4">Aero AT-3 R100</td></tr>
<tr><td>Aircraft registration marks</td><td colspan="4">SP-PBC</td></tr>
<tr><td>Aircraft User/Operator</td><td colspan="4">Silesian University of Technology</td></tr>
<tr><td>Pilot in Command</td><td colspan="4">PPL(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>0</td><td>1</td></tr>
<tr><td>Domestic and international authorities informed about the occurrence</td><td colspan="4">ULC, EASA</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">No</td></tr>
<tr><td>Addressees of the recommendations</td><td colspan="4">None</td></tr>
<tr><td>Date of completion of the investigation</td><td colspan="4">9 March 2023</td></tr>
</table>

Synopsis

On 30 June 2022, the pilot of an AT-3 R100 aircraft, registration marks SP-PBC, was performing an en-route flight as part of his ATPL(A) training. After about 1 hour 40 min. from take-off, the engine stopped in flight and attempts to restart it were unsuccessful. The pilot was forced to land in a random hilly terrain. During the landing down to the slope, the plane hit the local land elevation sustaining a substantial damage. The pilot was not injured.

The investigation into the occurrence was carried out by SCAAI Investigation Team consisting of:

Michał Ombach	IIC
Ireneusz Boczkowski	Team Member

Cause of the occurrence:

Engine stoppage in flight due to fuel starvation resulting from selection to feed the engine from an empty tank.

Contributing factors:

1) Landing in hilly terrain in the downhill direction;
2) An attempt to land against the wind, which was weak and from variable directions;
3) Hilly, difficult terrain and lack of the pilot's experience in uphill landings;
4) Stress to the pilot caused by a sudden engine stoppage and time deficit;
5) Change of the decision about landing in the last phase of the approach;
6) Inadequate setting of the fuel quantity on the fuel meter of the left tank prior to the flight, what caused its improper readings during the flight and after landing;
7) Broken fuel valve knob of the right wing fuel tank.

After the investigation SCAAI has not proposed any safety recommendation.

1. FACTUAL INFORMATION

1.1. History of the flight

On 30 June 2022 the pilot planned an en-route training flight from the EPGL aerodrome, through Kaniów, Jordanów, Zakopane, and then on the way back through Nowy Targ, Zator to Gliwice (EPGL). At 9:00 hrs[2], the pilot took over the plane from another pilot, who had performed 2 hr. 35 min. flight. According to his statement, the pilot performed a pre-flight inspection and did not note any failures. He also measured the fuel quantity by submerging a wooden stick in the fuel tanks.

At 09:16 hrs the pilot started up the engine and took-off. The flight was uneventful. When approaching controlled airspace (TMA EPKK) he descended to 2500 ft. After descent, the pilot felt engine vibrations combined with drop in RPM. Attempts to keep engine running did not bring any result and the engine stopped.

The pilot checked both fuel valves for opening, and, according to the procedure, tried to start up the engine twice – unsuccessfully. At an altitude of about 1600-2000 ft AMSL he decided for an emergency landing, choosing, according to his statement, "the nearest and the most appropriate field." The approach to landing was made after a turn of about 180°. While turning the pilot changed his decision, choosing another field, due to its "milder crop". The landing took place in the vicinity of the Witanowice village at 11:01 hrs, across the field and downhill.

As a result of a collision with the ground, the landing gear detached, one propeller blade broke and the aircraft performed an uncontrolled, sudden ground loop around its vertical axis.

The onboard ELT[3] emitted an EMERGENCY signal, which was noted by air traffic control services. The pilot left the cockpit and notified his supervisor and the emergency services by calling 112 and moved away from the plane.

The pilot did not suffer injuries, the plane sustained substantial damage.

The emergency services and police arrived at the scene of the accident.

1.2. Injuries to persons

Tab. 1. Injuries to persons – general data

Injuries	Crew	Others	TOTAL
Fatal	**0**	**0**	**0**
Serious	**0**	**0**	**0**
Minor	**0**	**0**	**0**
None	**1**	**N/A**	**1**

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

[3] ELT (Emergency locator transmitter*)* – transmitter on board an aircraft, having its own power supply, emitting an alarm signal in the event of collision, at the frequency of 406,025 MHz, received by satellites and transmitted to ground stations and search and rescue (SAR) centres

1.3. Damage to aircraft

The plane sustained serious damage (Fig. 1). The nose and main landing gears detached from the aircraft as a result of a collision with the local land elevation and uncontrolled ground loop. The fuselage was deformed and one of the propeller blades broke. The windshield was destroyed and its frame was deformed. The left aileron, lower surface of the wings and fuselage were also damaged.

Fig. 1. Damage to the aircraft: a) propeller, b) broken windshield, c) damaged main gear, d) deformed left aileron, e) corrugated structure of the starboard, f) torn fuselage reinforcements for main landing gear [source: SCAAI]

SCAAI inspected the aircraft at the scene. It was determined that:

- the engine compartment was clean, without leakage of operating fluids;
- there was no unsealing (leakages) of the fuel system, the system was unobstructed;
- **the fuel tank in the left wing was empty;**
- the carburetor bowls contained traces of fuel, the floats rested in their lower positions (did not float);
- the vent of the right fuel tank was unobstructed;
- **the fuel valve of the right tank, located in the cabin, was closed** – the plastic knob (handle) was damaged, worn and did not ensure proper valve control

(Fig. 2). The knob was rotating freely on the shaft and only its strong pressing allowed to control the valve;

– about 30 l of fuel was drained from the right wing tank (about 3 l remained in the tank). The total quantity of fuel 30+3 l corresponded to the initial quantity prior to the flight (no consumption because the fuel valve of the right tank was closed during the entire flight).

Fig. 2. Damaged knob of the right tank valve. On the right – the enlarged view of the knob (view from the bottom), groves for the spindle are well visible [source: SCAAI]

1.4. Other damage

The crop was slightly damaged.

1.5. Personnel information (crew data)

Pilot-in-Command (PIC) – male, aged 22, holder of PPL(A) with valid SEP(L) rating and valid medical certificate class 1, 2 & LAPL, with no limitations.

The total flight time on aeroplanes 161 hours 53 min.

The total flight time on AT-3 - 83 hours 32 min. with 129 take-offs.

The pilot also held an SPL license, with the declared total time on gliders about 80 hours.

Tab. 2. Summary of the pilot's last 10 flights

Date)	A/C type	Type of flight	Flight time (HH:MM)	Notes
04.04.2022	AT-3	3/17	2:18	-
29.04.2022	AT-3	3/17	1:59	-
11.05.2022	AT-3	3/17	2:00	-
06.06.2022	AT-3	3/18	2:59	-
09.06.2022	AT-3	3/18	3:23	-
09.06.2022	AT-3	3/18	1:00	-
10.06.2022	AT-3	3/18	3:10	-
11.06.2022	AT-3	3/18	2:35	-

11.06.2022	AT-3	3/18	0:59	-
11.06.2022	AT-3	3/18	1:35	-
30.06.2022	AT-3	3/18	1:47	The accident flight

1.6. Aircraft information

1.6.1 General description

Design description

Aero AT-3 R100 (Fig. 3) is a two-seater, all-metal training aeroplane, Polish design, powered by 100 HP 4-cylinder Rotax 912S engine.

The maximum take-off weight is 630 kg, with an empty weight of approx. 395 kg. The aircraft is equipped with two fuel tanks with a capacity of 51 l each, located in the wings. The aircraft has the EASA type certificate no. A.021. Aero AT company from Mielec is the type certificate holder.

Aircraft basic data:

- type (class) – aeroplane (A);
- design – all metal semi monocoque low wing;
- designation and number of seats – recreational and training aircraft, 1+1;
- registration marks – SP-PBC;
- manufacturer – Aero AT;
- model – AT-3 R100;
- serial no. – AT3-101;
- owner of the aircraft – Silesian University of Technology;
- user – Silesian University of Technology;
- powerplant equipped with propeller;
- number & engine manufacturer and type – 1 x Bombardier-Rotax 912 S2-01;
- number, manufacturer and propeller type – 1 x Elprop 3-1-1P (constant pitch);
- landing gear – tricycle with a nose wheel, fixed.

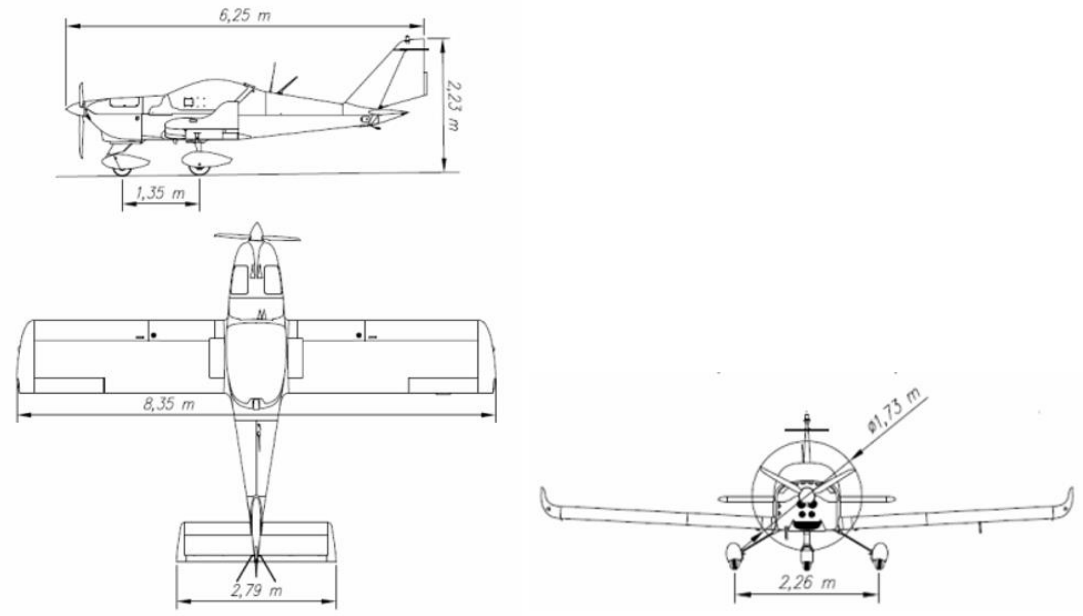

Fig. 3. Aero AT-3 R100, 3D view [source: Flight Manual]

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

- register no. – 5298 (registry of civil aircraft of the Republic of Poland);
- date of entry – 25 August 2020.

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

- date of issue – 20 April 2022;
- date of expire – 19 April 2023 r.

Confirmation of release to service (CRS):

- date of issue – 28 June 2022.

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

- date of issue – 25 November 2019;
- date of expire – without time limit;
- noise level at take-off 71,5 dB.

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

- validity from – 14 November 2021;
- validity to – 13 November 2022;
- insuring entity – Silesian University of Technology.

1.6.2 Life cycle data

<u>Aircraft – Aero AT-3</u>

Total Time Since New (TTSN)	1 292,7 mth
Time since last maintenance	7,7 mth
Date of the last maintenance	28.06.2022 r.

- after TTSN 1285,0 mth, 3018 landings;
- conducted by Part CAO.

1.6.3 Maintenance

The maintenance was carried out by approved Combined Airworthiness Organization Part CAO.

1.6.4 Weight and balance

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

- date of issue – 15 November 2019;
- BW[4]: 394,6 kg;
- center of gravity location - empty aircraft (X_{SC}): 0,277 m, which is 21,8% SCA[5];
- moment: $M_{empty\ a/c}$= BW x X_{SC}=109.3 kgm.

Center of gravity location X_{SC} – limits:

- datum[6]: wing's leading edge;
- **front limit x_{sc}: 0,292 m** after datum;
- **real limit x_{sc}: do 0.394 m** after datum;
- or **16÷31% MAC**;

Fuel (fuel status during emergency landing):

- Mogas Pb 95: 33 l;
- density at temp. 15°C: 720÷775 kg/m^3;
- Q_{fuel}: 23,76 kg (at density of 720 kg/m^3);
- Moment calculation: $M_{fuel.}$= -0.257 (arm) x $Q_{fuel.}$; $M_{fuel.}$= (-) 6,12 kgm

Pilot:

- $Q_{pil.}$: 75 kg;
- moment: $M_{pil.}$= 0.60 (arm) x $Q_{pil.}$; $M_{pil.}$=45 kgm

Total moment in reference to the datum: $M_{a/c}$+(-)M_{fuel}+$M_{pil.}$=148.2 Nm

On the basis of the above calculations and the guidelines of IUwL Chapter 6 the weight of the aircraft (for landing) and the position of the center of gravity during the forced landing were calculated:

[4] BW (Basic Weight) – is the weight of the aircraft ready to fly and includes the weight of its structure, fluids, equipment as well as unusable amount of fuel but without fuel and crew
[5] MAC – mean aerodynamic chord
[6] Datum – virtual vertical reference plane from which the distances (arms) are measured, on which the forces generated by the individual component masses of the aircraft act and against which the position of the center of gravity is calculated

- **TOW[7]=493,4 kg** (136,6 kg below MTOM);
- **X_{SC}=0,300 m (23,7% MAC).**

The center of gravity of the aircraft was within its prescribed limits.

1.7. Meteorological information

At the time of the accident, a METAR for the Kraków-Balice airport (EPKK), located 24 km away from the accident site, was as follows:

METAR EPKK 300900Z VRB02KT CAVOK 30/19 Q1014

- date: 30.06.2022;
- time: 09:00 UTC;
- wind direction: variable;
- wind speed: 2 kt;
- visibility: over 10 km, no clouds below 1500 m;
- ambient temperature: 30ºC;
- dew point: 19ºC;
- QNH: 1014 hPa.

The weather had no effect on the occurrence.

1.8. Aids to navigation

Not used

1.9. Communications

The pilot-maintained radio communication on Kraków FIS frequency of 119,275 MHz.

1.10. Accident site information

WGS 84 coordinates of the place of occurrence:

49° 55' 38.902" N; 19° 32' 13.767" E, Witanowice (Fig. 4)

[7] TOW (Take-Off Weight) – aircraft weight during take-off. In this particular case, it is the weight during the emergency landing

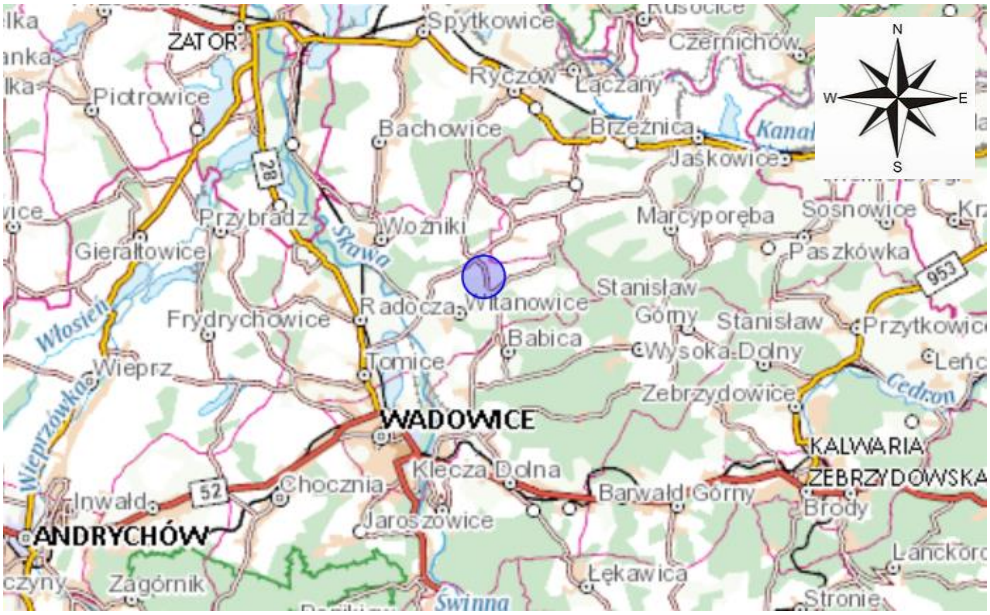

Fig. 4. Landing site [source: Geoportal]

The landing took place in the crop, across the field and downhill (Fig. 5).

Fig. 5. Location of the aircraft in the crop field (view towards S-E) [source: SCAAI]

1.11. Flight recorders

The accident aircraft was not equipped with on-board Annex 13 flight recorders. No recorder was required under applicable law.

The aircraft was equipped with a built-in Garmin GTN 650 navigation system with G500 TXI touch screen and MVP-50 Engine Monitor for monitoring and recording the operating parameters of the powerplant. It was impossible to read out the data from the Garmin device. Engine data and some flight parameters (i.e. AGL height, ground speed, route coordinates) were recorded by the MVP-50 system, which helped to determine the circumstances and analyze the course of the occurrence.

1.12. Wreckage and impact information

The accident site is shown in Fig. 5. The aircraft preserved its integrity. No part detached from the aircraft inflight. The left wheel along with the part of its fork, a propeller blade and some debris of the windshield, which detached after the impact, were found near the aircraft.

1.13. Medical and pathological information

No physiological factors nor incapacity were found, that could have affected the pilot's performance.

1.14. Fire

No signs of inflight or post impact fire were detected. However, the scene was secured by the State Fire Service.

1.15. Survival aspects

Due to collision with the local land elevation the fuselage of the aircraft was deformed. It did not cause the deformation of the pilot's seats nor adjacent floor in the cockpit. The windshield was destroyed – its sharp edges posed a threat to the pilot's health.

The pilot had his seat belts fastened, which protected him against injuries. The pilot left the aircraft on his own.

1.16. Tests and research

No tests or specialist examinations were conducted.

1.17. Organizational and management information

The pilot performed the training flight as part of his ATP(L) course at the Aviation Training Center of the Silesian University of Technology.

1.18. Additional information

The type-certificate holder (which is the aircraft manufacturer) informed SCAAI that all users of the aircraft were advised to check the fixing of the fuel valve knobs. None of the users reported any problems related to the valve knob.

1.19. Useful or effective investigation techniques

Standard investigation techniques were applied.

2. ANALYSIS

2.1. Flight analysis (selected parameters)

The electronic flight data measurement system (on-board computer) recorded the course of the flight. Fig. 6 shows a barometric altitude and a GPS speed recording from

the entire flight. Attention should be drawn to the a/c descent (from 10:45 hrs) to avoid entering into the EPKK TMA.

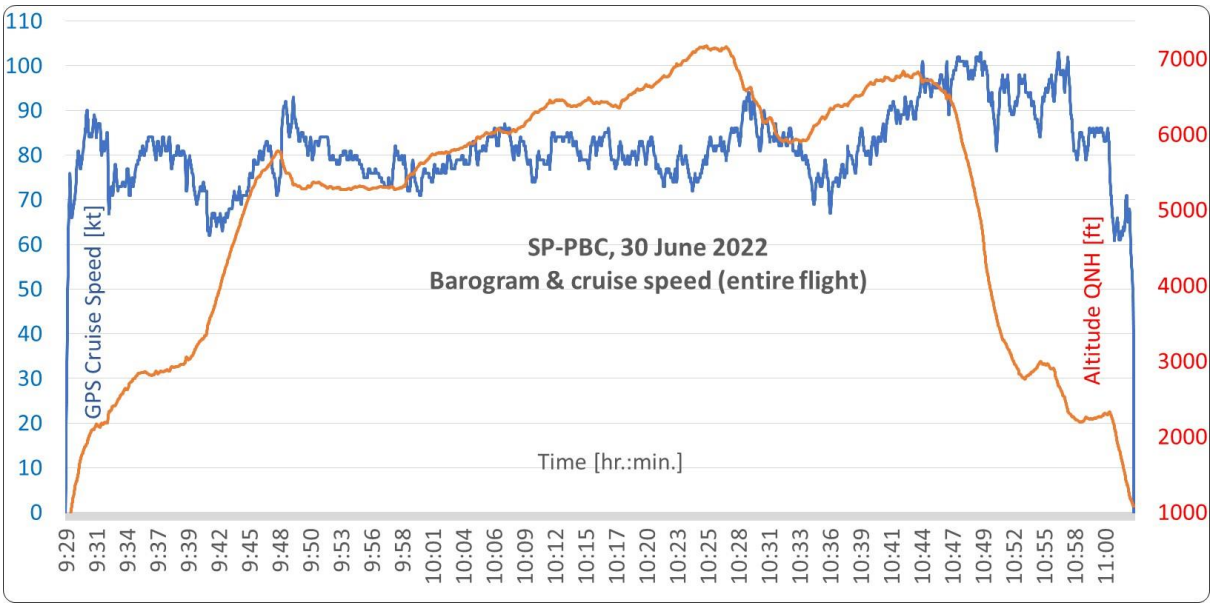

Fig. 6. Barometric altitude and ground speed record of the entire flight [source: SCAAI]

The aircraft was equipped with a system of visualization and recording of engine parameters (Electronic Engine Controller MVP-50). The pilot was reading the data on the display in the cockpit. Among others, the information about the fuel flow, fuel pressure and its quantity in the left and right tank (Fig. 7). After the occurrence, the following data were noticed on the display.

Fig. 7. Graphic illustration of the operating parameters of the powerplant, fuel status according to the MVP-50 after landing [source: SCAAI]

The user of the AT-3 raised a concern of incorrect indications of the fuel quantity in a/c tanks. In the investigated case, after the occurrence, the MVP-50 was indicating 15 l of fuel in left tank, but in fact the tank was empty (0 l), while the right tank indicator was indicating 45 l (in fact it was 33 l) – see Fig. 7.

In order to clarify the user doubts, the Investigation Team analyzed the relevant technical solutions and procedures, as described below.

In order to reliably check the fuel quantity prior to a flight, the manufacturer provides a tubular hand meter, scaled from 10 to 50 l, every 10 l. Prior to a flight, the pilot should measure the quantity of fuel in each tank with the hand meter, and then set this quantity on the flow meter indicator.

The fuel quantity indicated by the system during a flight depends on the quantity entered prior to the flight, as the measurement system subtracts the quantity of fuel used from the quantity entered prior to the flight.

The pilot explained that he measured the quantity of fuel in accordance with the pre-flight inspection procedure according to FM, item 4.4.2. However, he did not explain whether he entered the correct data into the system. The information on necessity and way of entering data into the system is displayed on the screen (refer to Fig. 7).

The quantity of fuel prior to the flight, according to the record from the on-board technical log and the statements of reliable witnesses was 64 liters: 31 l in the left tank and 33 l in the right tank. This was sufficient to perform the planned en-route flight.

The quantity of fuel read out from the display after the occurrence was 60 l (the sum of the indication values for both tanks, see Fig. 7), which did not correspond to the real fuel consumption during 1 hr. 46 min. flight, which was exactly 31 l. The engine consumed all fuel from the left tank. The fuel from the right tank was not used because its valve was closed during the entire accident flight.

Fig. 8 shows fuel consumption during the entire flight according to data obtained from the electronic engine controller. These data can only be treated qualitatively because neither the initial nor the final fuel quantity was consistent with the measurement by the hand meter during preflight inspection and after the landing.

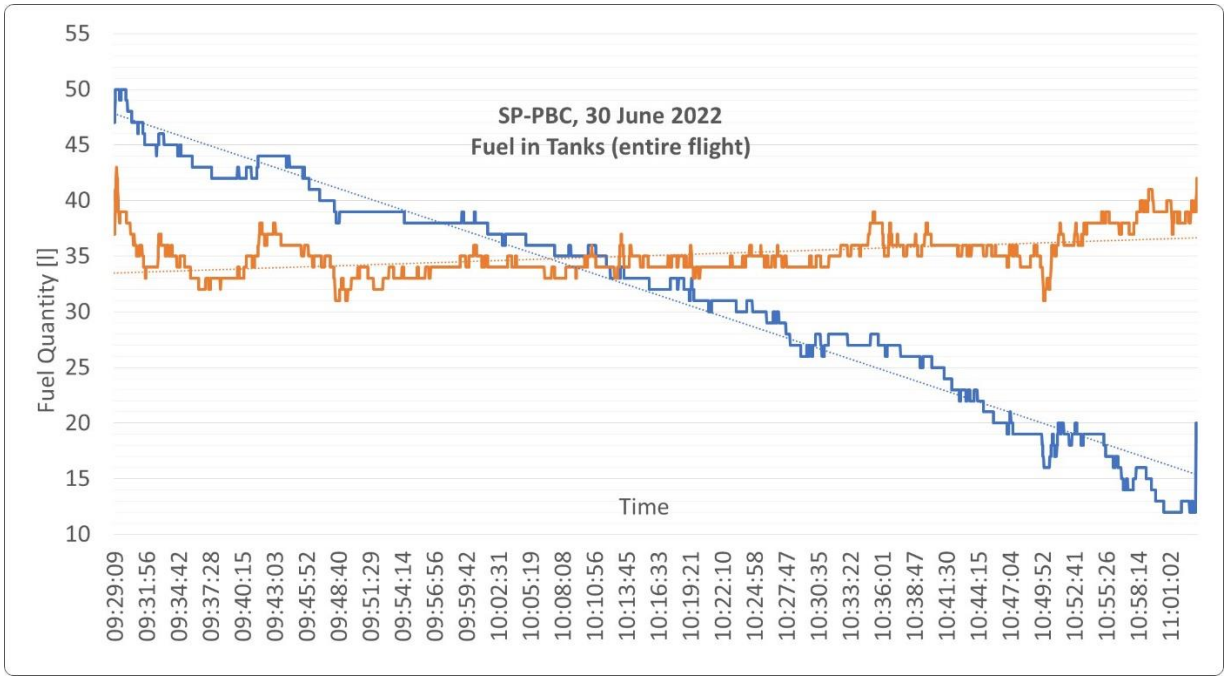

Fig. 8. Fuel consumption during the entire flight according to the electronic system. Dotted lines show the trend [source: SCAAI]

The trend dotted lines show that the system was not consuming fuel from the right tank (orange on the chart) but only from the left, where the fuel quantity is systematically decreasing. It is consistent with the actual course of the flight.

Despite closed fuel valve in the right tank (orange in Fig. 8), the fuel quantity in this tank was slowly increasing. That was due to the return of excess fuel only to the right tank. According to the manufacturer data, at 4000 RPM the return rate is 3.3 l/h and at 5000 RPM - 3.0 l.

During the entire flight the pilot did not notice that the engine was consuming fuel only from the left tank.

It may be assumed, that prior to the flight, when opening the fuel valves, the pilot did not notice that opening the right valve required much less force that in the case of the left one. In fact, the right valve remained closed and only the knob on the steel tube was rotated.

Based on the recordings of the MVP-50 electronic engine controller, the following data were established:

- engine start-up: 9:16 hrs;
- fuel status at start-up: 50 l – left tank, 35 l – right tank;
- engine inflight stoppage: 11:01:16 hrs;
- fuel quantity at the engine stoppage: 12 l – left tank, 37 l – right tank (close to the quantity at the take-off time);
- first attempt to start the engine inflight: 11:01:33 hrs;
- second attempt to start the engine: 11:01:53 hrs.

The engine RPM and fuel flow from 11:00:00 hrs, i.e. about 1 minute prior to the engine stoppage until 11:03:24 hrs, were analyzed. The plots are shown in Fig. 9.

At 11:01:05 hrs, the engine RPM began to drop and 11 seconds later the engine stopped. The pilot made two unsuccessful attempts to start it, what was marked with red ellipses (Fig. 9).

The fuel flow rate, from a value of about 20 l/hr began to increase to 160 l/hr at 11:01:05 hrs. This was an error of the system, which evidently measured the air flow instead of fuel – the air was sucked by the fuel pump from the empty fuel tank.

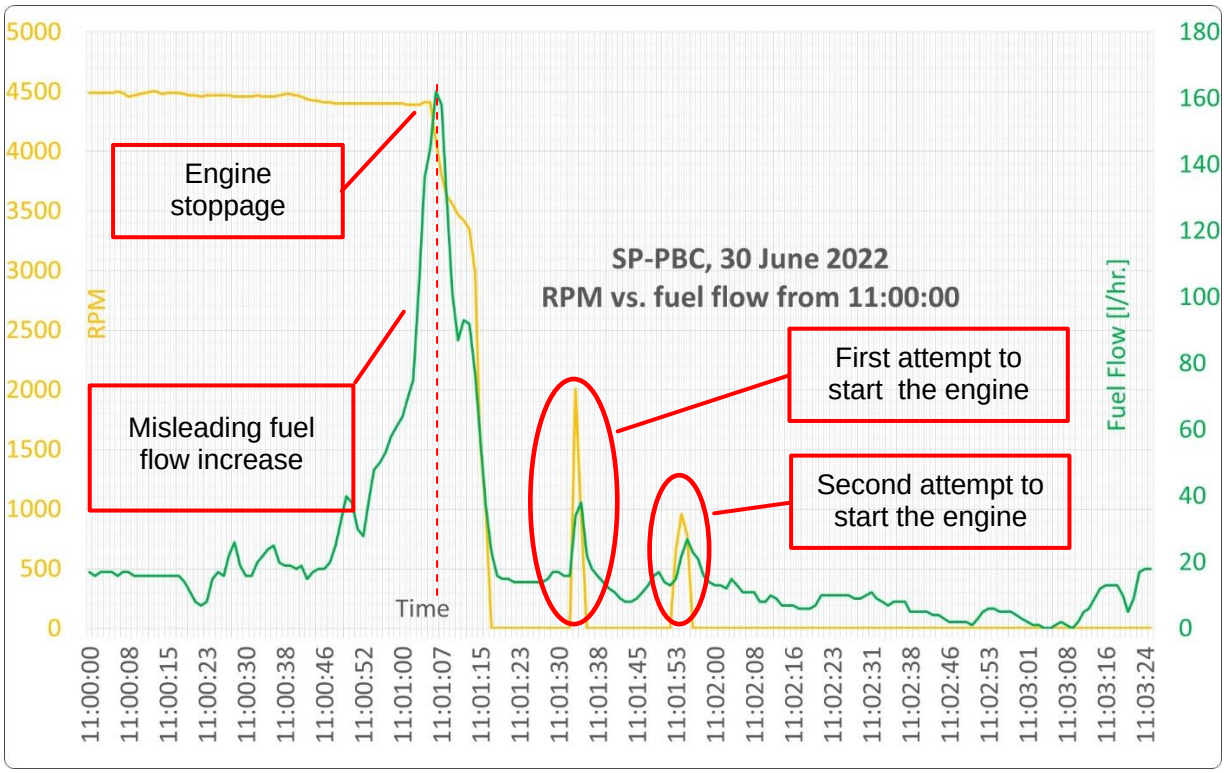

Fig. 9. Graphical illustration of fuel consumption in the final phase of the flight [source: SCAAI]

The accident flight was the second one of that day. The onboard computer records of the first flight (flight time 2 hr. 35 min.), were analyzed. It was established that the engine was consuming fuel from both tanks what means that both fuel valves were open.

According to the training procedures and FM guidelines the students are obliged to close the fuel valves after a flight. During flight both fuel valves should be open and closing one of them in flight should be applied for alignment the fuel levels in both tanks.

Therefore, the valve knob was damaged either at the time of its forceful closing after the first flight (by the first student) or during opening prior to the second flight.

The type certificate holder informed that valves from the same supplier (but smaller in size) have been used by Aero AT for several years in the wheel brake system. No faults were reported related to their operation.

Also, until the occurrence described in this report, the type owner did not record any faults related to the fuel valves.

2.2. Analysis of the landing after the engine stoppage

The engine stopped at 11:01:16 hrs. It is marked in Fig. 10 with a green vertical line. The figure shows the ground speed (red curve)[8] and a barogram (blue curve), starting at 11:00:00 hrs. Place of the collision with the ground (11:03:18 hrs) was marked with a red dot. The aircraft came to rest about 3 seconds after the touchdown which occurred at a ground speed of about 48 kt (89 kph).

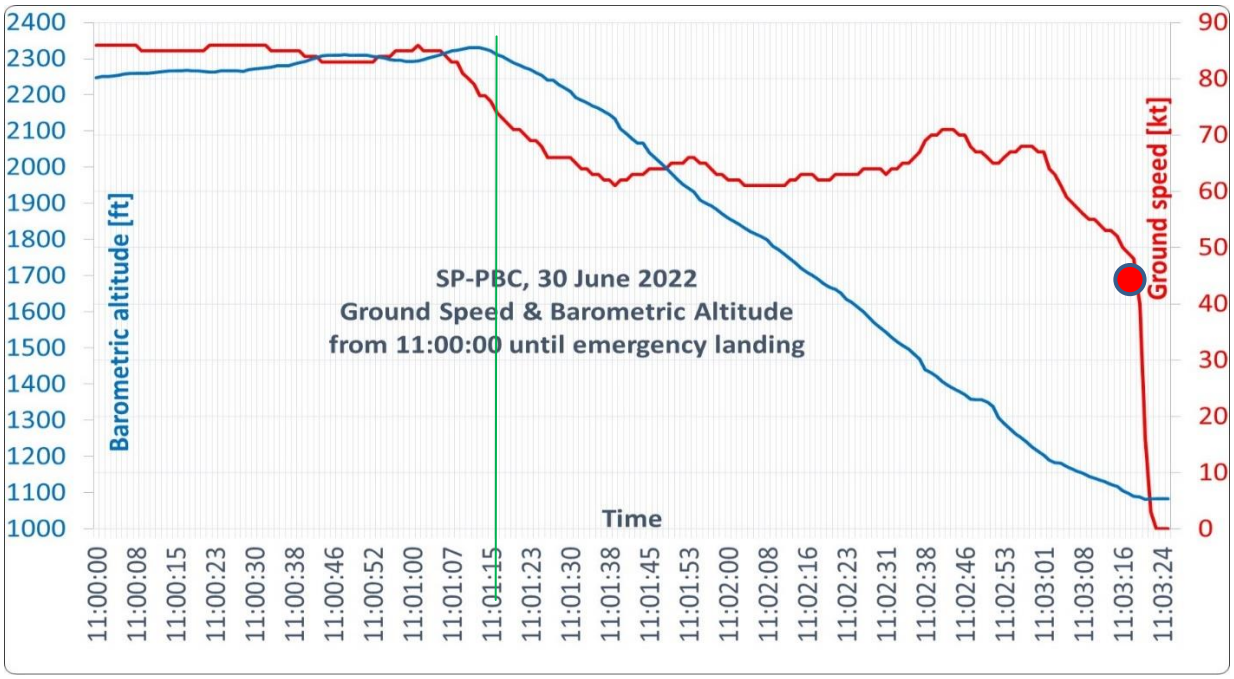

Fig. 10. GPS ground speed and barometric altitude records from 11:00:00 (6 seconds before the engine stoppage) until landing [source: SCAAI]

The probable glide path for landing, after the engine stoppage, is shown in Fig. 11.

[8] These data come from the GPS, which means the speed is a ground speed (measured relative to the ground).

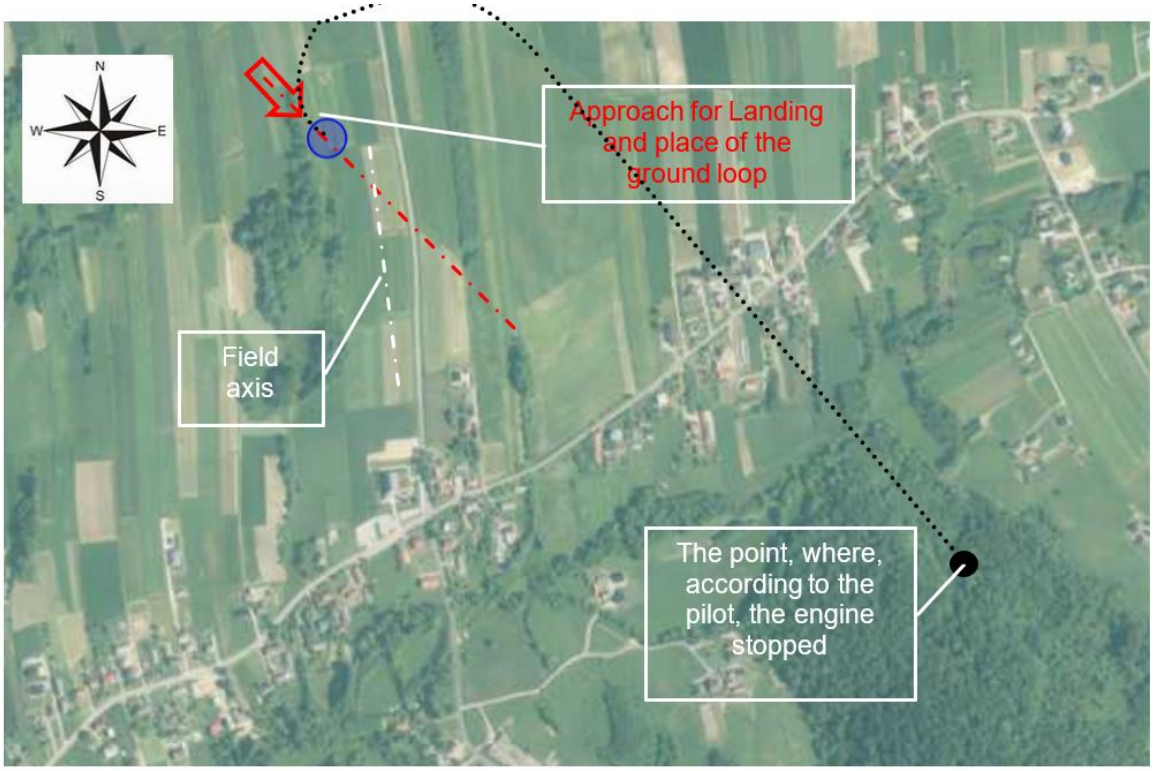

Fig. 11. Probable glide path prior to landing [source: SCAAI, background: Geoportal]

The aircraft flew across the valley, over a public road. The slope of the terrain is several percent. The difference in elevation between the bottom of the valley and the emergency site was several dozen meters.

An attempt to land up-wind (on the day of the occurrence the wind was weak and variable) was inappropriate. The aircraft, heading uphill, was quickly losing height and after the last turn was too low.

As a result, in a flare phase, the aircraft hit the field elevation with its landing gear (Fig. 12). A little (sharp) angle of impact (between the a/c longitudinal axis and the line of the field elevation) prevented a turnover of the aircraft, but the nose and left leg of the landing gear separated, which was followed by separation of the right leg.

Slowing down, the aircraft "slipped" into a crop, made a ground loop of about 150° and came to rest about 20 m further. The ground loop was due to the moment generated by collision of the landing gear with the land elevation.

The flaps for touchdown were set to 15° instead of 40°, as per procedure 3.6.1 of the Flight Manual.

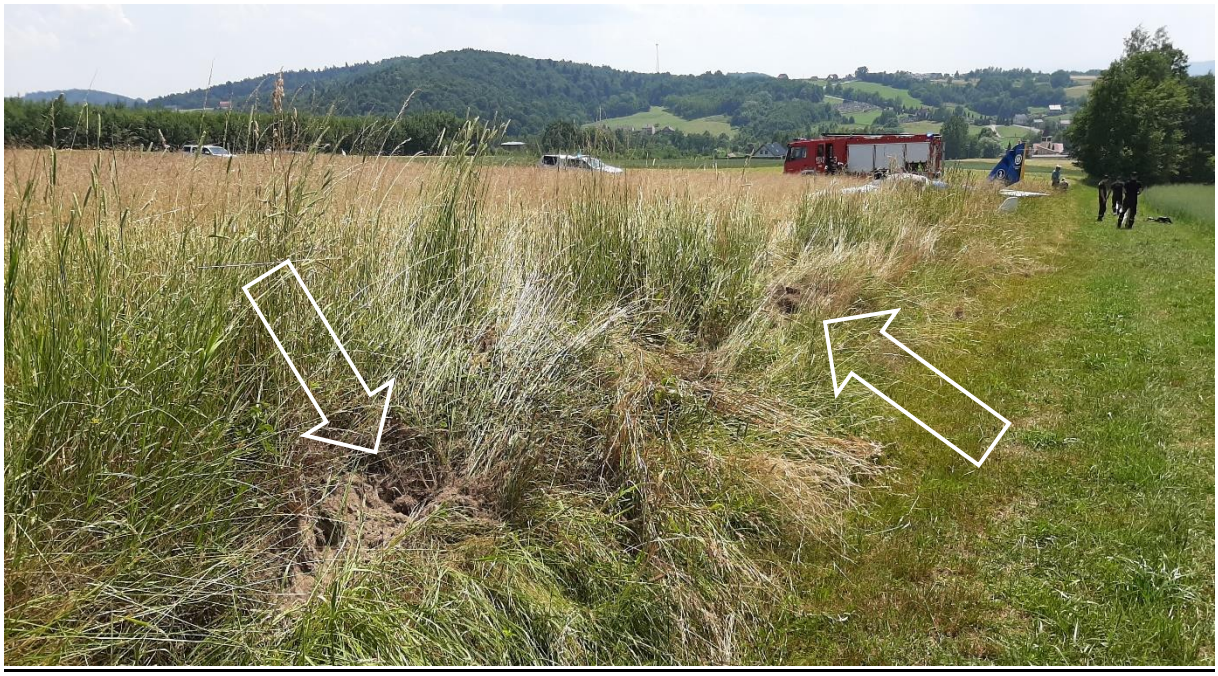

Fig. 12. Traces left by the landing gear at the local field elevation [source: SCAAI]

The most important rule for any landing in a hilly terrain is to land up-hill, regardless of the wind conditions. In case of the investigated accident such a possibility existed: to make an approach from above the village, along a large field and against a gentle slope (Fig. 13, black dotted line).

The pilot did not follow the procedure no. 3.6.1 of the Flight Manual before landing: he did not switch-off the battery, the alternator and magnetos, as well as he did not close the fuel valves.

The pilot also did not unlock the cabin locks prior to the touchdown (this is also stipulated in the Flight Manual) which resulted in the fact that it was impossible to unlock the deformed canopy on the ground. The pilot left the cockpit through the broken windshield. He also failed to tighten his seatbelts prior to the emergency landing.

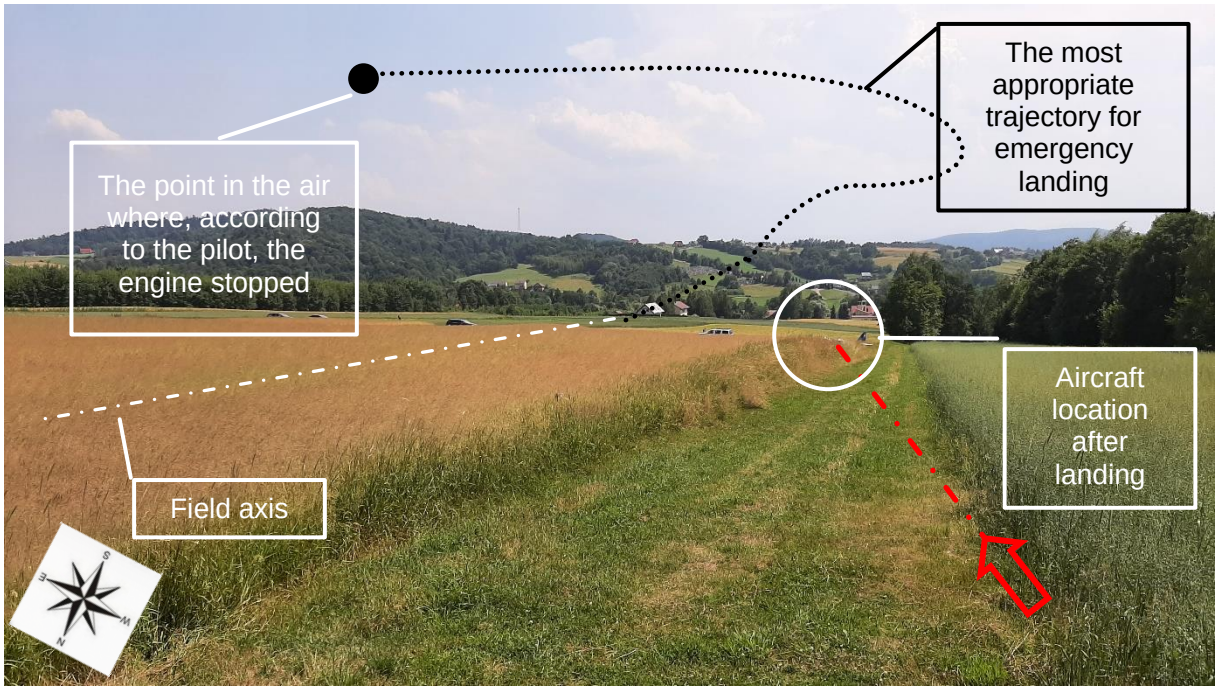

Fig. 13. View from the approach direction (indicated by a red arrow). White circle shows the position of the aircraft in crop [source: SCAAI]

The risk of the fire was high: serious damage to the airframe, high ambient temperature and very dry crop. The fuel leak and fire were avoided only by providence, probably due to the fact that there was no fuel in the left tank as well as in the engine compartment.

3. CONCLUSIONS

3.1. Findings

1) The pilot had the required qualifications to perform the flight.
2) The aircraft had the required documentation.
3) The weight and centre of gravity were within the prescribed limits.
4) The fuel valve of the right tank was closed during the entire flight – the engine consumed fuel only from the left tank.
5) The quantity of fuel in the left tank was not sufficient to perform the planned en-route flight.
6) Prior to the flight, the fuel quantity indicated by the left tank fuel meter was inadequate.
7) The engine stopped due to fuel starvation.
8) The pilot incorrectly chose the direction of emergency landing and did not configure the aircraft for landing as required by the FM.
9) The pilot did not suffer injuries.

3.2. Cause of the occurrence

Engine stoppage in flight due to fuel starvation resulting from selection to feed the engine from an empty tank.

3.3. Contributing factors

1) Landing in hilly terrain in the "downhill" direction;
2) An attempt to land against the wind, which was weak and from variable directions;
3) Hilly, difficult terrain and lack of the pilot's experience in uphill landings;
4) Stress to the pilot caused by a sudden engine stoppage and time deficit;
5) Change of the decision about landing in the last phase of the approach;
8) Inadequate setting of the fuel quantity on the fuel meter of the left tank prior to the flight, what caused its improper readings during the flight and after landing;
6) Broken fuel valve knob of the right wing fuel tank.

4. SAFETY RECOMMENDATIONS

None.

5. APPENDICES

None.

THE END

Investigator in-charge

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(signature on original)