

FINAL REPORT

ACCIDENT 2022/1340



State Commission on Aircraft Accidents Investigation (PKBWL)

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FINAL REPORT

ACCIDENT

OCCURRENCE NO – 2022/1340

AIRCRAFT – ULTRALIGHT AMPHIBIA, N27ZX

DATE AND PLACE OF OCCURRENCE – 29 MAR 2022, Jezioro Kłeckie

(52°38'08.10"N 017°27'23,66"E)



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

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

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

The Commission does not apportion blame or liability.

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

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

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

WARSAW 2022

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Abbreviations

AFM/IUwL	Airplane Flight Manual
ATOM	Actual Take-Off Mass
BFU	German Federal Bureau of Aircraft Accident Investigation
BRS	Ballistic Recovery Systems
CG	Center of Gravity
CofR	Certificate of Registration
EASA	European Aviation Safety Agency
EW	Empty Weight
FAA	Federal Aviation Administration
FTS	Flight Training Supplement
FIS	Flight Information Service
IIC	Investigator in Charge
Lb	Pound (lb)
LMT	Local Mean Time
METAR	Meteorological Aerodrome Report
MTOM	Maximum Take-Off Mass
NTSB	National Transportation Safety Board
PPL(A)	Private Pilot Licence (aeroplanes)
RPM	Rotations Per Minute
RWY	Runway
SEP(L)	Single Engine Piston (Land)
SEP(S)	Single Engine Piston (Sea)
TSN	Time Since New
ULC	Civil Aviation Authority of the Republic of Poland (Urząd Lotnictwa Cywilnego)

UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VML	Correction for defective distant, intermediate and near vision
WBR	Weight and Balance Report

General Information

Occurrence reference number:	2022/1340			
Type of occurrence:	ACCIDENT			
Date of occurrence:	29 March, 2022			
Place of occurrence:	JEZIORO KŁECKIE			
Type and model of aircraft:	Ultralight amphibian aeroplane, ULTRALIGHT AMPHIBIA			
Aircraft registration marks:	N27ZX			
Aircraft user/operator:	Private			
Aircraft Commander:	PPL(A)			
Number of victims/injuries:	Fatal	Serious	Minor	None
	1	-	-	-
Domestic and international authorities informed about the occurrence:	ULC, EASA, BFU, NTSB			
Investigator-in-charge:	Roman Kamiński			
Investigating authority:	State Commission of Aircraft Accidents Investigation (PKBWL)			
Accredited Representatives and their advisers:	ACCREP – NTSB			
Document containing results:	FINAL REPORT			
Safety recommendations:	NONE			
Addressees of the recommendations:	Not applicable			
Date of completion of the investigation:	9 November, 2022			

Synopsis

On 29 March 2022, the pilot (German citizen) of the Aventura II aircraft, N27ZX identification marks, began preparations for the flight at the EPLS aerodrome at 09:00¹ hrs LMT.

CCTV camera recording from EPLS shows that the pilot personally prepared the plane for flight, started the engine, tested it, and then taxied to RWY 23 and at 10:17 hrs took off.

Around 15:20 hrs near Jezioro Kłeckie (lake located in Wielkopolska Voivodeship), the witnesses noticed a plane that arrived from the south. The plane first made a right turn at a low altitude, then steep turn to the left and around 15:24 hrs, during descent, it collided with the water surface. The plane overturned and partially submerged (Fig. 1). Several minutes after the collision, the plane sank.

Witnesses notified the emergency services about the accident. After arrival of divers from the State Fire Service, the plane was located in the water, and the pilot was found in cockpit. After recovery of the pilot, a resuscitation action was undertaken, but it was unsuccessful.



Fig.1. Wreckage of the N27ZX airplane photographed from a drone at the beginning of the rescue operation [source: Internet]

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

Roman Kamiński	Investigator-in-charge (PKBWL);
Jacek Bogatko	Team member (PKBWL member);
Grzegorz Pietraszkiewicz	Team member (PKBWL member).

¹ All times in the Report are in LMT. LMT = UTC + 2 h.

Cause of the occurrence:

The most likely cause of the accident was exceeding of the maximum bank angle during turn, in the conditions when engine power was reduced due to carburettors icing, which resulted in aircraft stall and spin.

Contributing factor:

Significant wind speed, which caused turbulence behind terrain obstacles that resulted in an increase of the aircraft bank angle.

PKBWL has not proposed safety recommendations after the investigation.

1. FACTUAL INFORMATION

1.1. History of the flight

On 29 March 2022, at 09:00 hrs, the pilot (German citizen) of the Aventura II aircraft, N27ZX registration marks, began preparations for the flight at the EPLS aerodrome. He informed that he planned to perform a recreational flight with landings on several lakes, but did not provide the names of the lakes and did not indicate the time of return to EPLS.

CCTV camera recording from EPLS shows that the pilot prepared the aircraft for flight, started the engine, tested it, and then taxied to RWY 23 and at 10:17 hrs took off. After take-off, the pilot did not report any problems with the aircraft.

According to the statement of a witness, who spoke with the pilot via phone around 15:00 hrs, by the time of the conversation the pilot performed landings and take-offs on 13 lakes, and during the conversation he rested at the shore of the lake Jezioro Lednica. In addition, he said that he refuelled the plane with fuel from a canister (20 l) and planned to return to EPLS. However, around 15:15 hrs, the witnesses saw the airplane flying north at low altitude and, according to their assessment at low speed over Jezioro Działyńskie lake (Fig. 2).

Around 15:20 hrs, near Jezioro Kłeckie (lake located in Wielkopolska Voivodeship), the witnesses noticed a plane that arrived from the south. The plane first made a right turn at low altitude over the lake, then a steep left turn and around 15:24 hrs on the descent, it collided with the water surface. The plane overturned and partially submerged (Fig. 1). Several minutes after the collision, the plane sank.

Witnesses notified the emergency services about the accident. After arrival of divers from the State Fire Service, the plane was located in the water, and the pilot was found in cockpit. After recovery of the pilot, a resuscitation action was undertaken, but it was unsuccessful.

On 30 March 2022, it was found that the plane wreckage found in Jezioro Kłeckie lake was an Aventura II aircraft, N27ZX registration marks.

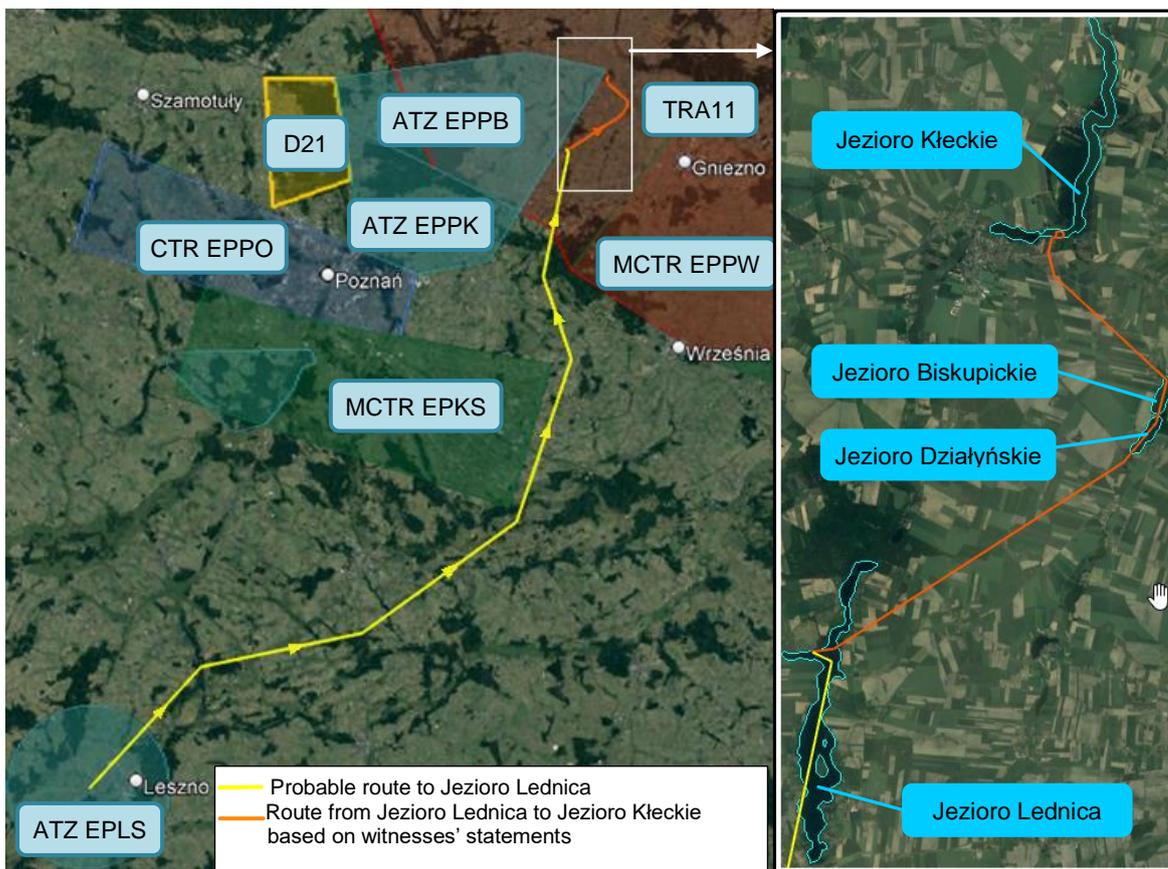


Fig. 2. Recreated flight route [source: PKBWL, Google Earth]

1.2. Injuries to persons

Injuries	Crew	Passangers	Others	Total
Fatal	1	-	-	1
Serious	-	-	-	-
Minor	-	-	-	-
None	-	-	-	-

1.3. Damage to aircraft

As a result of the collision with water, the plane was destroyed. The nose part of the fuselage, together with the door and left float separated from the rest of the airframe (Fig. 3 and Fig. 4).



Fig. 3. View of the damaged front part of the fuselage in inverted position
[source: PKBWL]



Fig. 4. View of the detached lower part of the fuselage [source: PKBWL]

1.4. Other damage

None.

1.5. Personnel information (crew data)

Pilot: male, aged 55, holder of a valid PPL(A) and ratings:

- SEP(L) valid until 31 May 2023;
- SEP(S) valid until 31 August 2023.

Aero-medical certificate – class II with VLM limitation, valid until 18 March 2024.

Total flight time – over 4000 FH

Accident aircraft type flight time – about 60 FH

1.6. Aircraft information

1.6.1. General information

The sport amphibious airplane „Aventura II” is produced by Aero Adventure Aviation in the United States of America and sold as a kit for amateur-built aircraft.

Construction:

Two-seat high wing monoplane of a mixed, metal-composite structure.

The truss structure wing is made of aluminium, covered with fabric (Dacron). The wingtip floats are made of polyethylene.

The boat-shaped fuselage is made of fiberglass.

Classic landing gear, retractable during landing on water. The aircraft is equipped with a Rotax 912ULS 74 kW (100 HP) engine and a three-blade backward-mounted (pusher) propeller and the BRS 5 1200 VLS ballistic recovery systems.



Fig. 5. Aventura II aircraft general view [source: Internet]

1.6.2. Service life data

AIRFRAME – Aventura II:

Serial number	AA2A0105;
Manufacture Date	January 2006;
CofA validity Date	March 2023;
CofA for experimental amateur plane (FAA) issued on	22 January 2006;
TSN and maintenance	No data.

ENGINE – Rotax 912 ULS2:

Serial number	6623110;
TSN and maintenance	No data.

PROPELLER – IVOPROP CORP.:

Serial number	(1562) 602-1451;
TSN and maintenance	No data.

No aircraft documents were found in the recovered wreckage. According to a witness statement (a German citizen), all documents and manuals were on board.

Pursuant to the regulations in force in the USA, the aircraft owner is responsible for the maintenance.

1.6.3. Aircraft weight and balance

Weight and Balance Report (WBR):

– Issue date:	24 January 2006;
– MTOW:	1430 lbs (649 kg);
– EW	940 lbs (426 kg).

The WBR was sent by NTSB.

Actual Take-Off Mass values calculated by PKBWL for flight performed on 29 March 2022:

a) fuel:	
– unleaded gasoline 95:	88 l (68 l in fuel tank + 20 l in canister)
– mass:	65 kg (143 lbs);
– pilot:	about 70 kg (176 lbs);
– baggage:	about 5 kg (11 lbs);
– EW:	426 kg (940 lbs).

Based on the above data, the following was calculated:

– ATOM:	about 576 kg;
– CG:	108”.

According to the WBR, the CG value should be between **101'' and 113''**.

1.7. Meteorological information

The flight was performed in daylight, in VMC.

METAR for EPPO aerodrome located 40 km south-west of the accident site:

METAR EPPO 291430Z 35007KT 9999 BKN041 09 / M01 Q1007 =

According to the data provided by the State Fire Service, the ambient temperature in the area of Jezioro Kłeckie at 15:30 hrs was 7°C.

At the request of PKBWL, the Institute of Meteorology and Water Management sent meteorological data of 29 March 2022 from 10:00 to 16:00 from meteorological stations in Leszno, Kórnik, Poznań and Gniezno.

The information received from the Institute of Meteorology and Water Management shows that at the Climatological Station in Gniezno, located 15 km from the accident site, at 15:00 hrs and 16:00 hrs, the following meteorological data were recorded:

Time	Ambient temperature [°C]	Relative humidity [%]	Wind direction [°]	Wind speed [m/s]	
				Average	Maximum
15:00	7,5	63	255	5	8
16:00	8,3	62	246	4	8

1.8. Aids to navigation

Not applicable.

1.9. Communications

After leaving the EPLS ATZ, the pilot did not maintain communication with FIS.

1.10. Place of occurrence information

The plane collided with the Jezioro Kłeckie surface in the area with 52°38'08.10"N 017°27'23.66" E coordinates. Jezioro Kłeckie is located north-east of the village of KłECKO n. Gniezno.

Lake length along the center line	7700 m
Area	209,7 ha
Elevation of water surface	99,8 m AMSL
Lake width	135-315 m
Maximum depth	12,5 m
Average depth	4,7 m
Width in the place of occurrence	200 m
Depth in the place of occurrence	4,5 m



Fig. 6. Jezioro Kłeckie [source: Google Earth, March 2021 r.]

1.11. Flight recorders

The aircraft was not equipped with flight recorders.

1.12. Wreckage and impact information

The plane collided with the surface of the lake at an angle of about 80° to the longitudinal axis of the plane.

As a result of the impact with water, the front part of the fuselage separated from the aircraft, and the truss structure of the wing made of aluminium tubes was damaged. Some of the tubes have bent and the thinnest ones have been torn off. The dacron wing skin was torn open in several places and pierced by the thinnest tubes.

Parts installed outside the engine (air filters, carburetors) and two propeller blades were damaged.

1.13. Medical and pathological information

During the medical tests, no factors were found that could have affected the pilot's health and could have contributed to the accident.

1.14. Fire

Fire did not occur.

1.15. Survival aspects

As a result of the collision with water and sustained injuries, the pilot was killed on the spot. The pilot's seatbelts were fastened.

The accident aircraft was equipped with the BRS 5 1200 VLS ballistic recovery systems. The pilot did not activate the BRS system, which in that situation could significantly increase his chances to survive.

1.16. Tests and research

1.16.1. Recordings

After replaying the aerodrome CCTV recordings, PKBWL established the following facts:

- 22 March 2022 - Aventura II aircraft arrived at EPLS from Germany;
- 23 March 2022 - the pilot returned to Germany in another plane flown by his friend;
- 27 March 2022 - the pilot flew WT-9 Dynamic airplane to EPLS;
- 28 March 2022 - the pilot and passenger performed a 30 minute flight from EPLS on Aventura II airplane;
- 29 March 2022 the pilot began preparations for flight around 09:00 hrs, then performed an engine test, taxied to RWY 23 and took off at 10:17 hrs.

The pilot had rented a place in the hangar by the end of August 2022 and intended to perform flights in Poland from EPLS.

Prior to March 2022, the pilot was taking off from Germany and flying in Poland, landing on the Odra river and several lakes.

1.16.2. Fuel

Based on the CCTV recordings and the statements of witnesses, it was established that the plane was refuelled with 95 unleaded gasoline at EPLS on 22 and 28 March 2022. The mechanic who witnessed refuelling on 28 March 2022 informed PKBWL that the plane was refuelled with 68 l of fuel (to full tank capacity).

In addition, there was a 20-liter fuel canister on board the plane.

1.16.3. Airframe

During the inspection of the accident site on 30 March 2022, it was found that the airframe elements were damaged to the extent that would allow the assessment of its mechanical condition before the accident.

No aircraft damage that had occurred prior to the accident and that could affect the flight was detected.

No damage to the control systems that could have prevented its control was detected. The landing gear was retracted.

During the inspection, it was found that the airframe was more damaged on its left side, that is evidenced by:

- separated left float from the airframe after collision with water (Fig. 7.);



Fig. 7. Separated left float [source: PKBWL]

- Broken hinge of the front spar of the left wing (Fig. 8).



Fig. 8. Broken hinge of the front spar of the left wing [source: PKBWL]

- Much greater deformation of the left side of the front part of the fuselage and cockpit compared to the right side.

During inspection of the cockpit, the settings of the following elements was determined:

- fuel valve – open;
- electric fuel pump switch – off;
- throttle control lever – retracted;
- carburetor heating switch – off (Fig. 9);
- main electric power switch – off;
- turn indicator – left turn (Fig. 10).



Fig. 9. Carburetor heating switch in off position [source: PKBWL]



Fig. 10. Turn indicator indicating left turn [source: PKBWL]

1.16.4. Engine

During the inspection of the accident site on 30 March 2022, it was found that only few components installed on the engine (air filters, carburetors) were mechanically damaged due to collision with water. All electric cables, hoses and pipes of the fuel, lubrication and cooling systems were in good mechanical condition. No damage to the engine control system was found (Fig. 11).

The mechanical condition of all spark plugs was checked. Spark plugs were installed on the engine in accordance with the manufacturer's recommendations, and their mechanical condition did not raise any concerns.

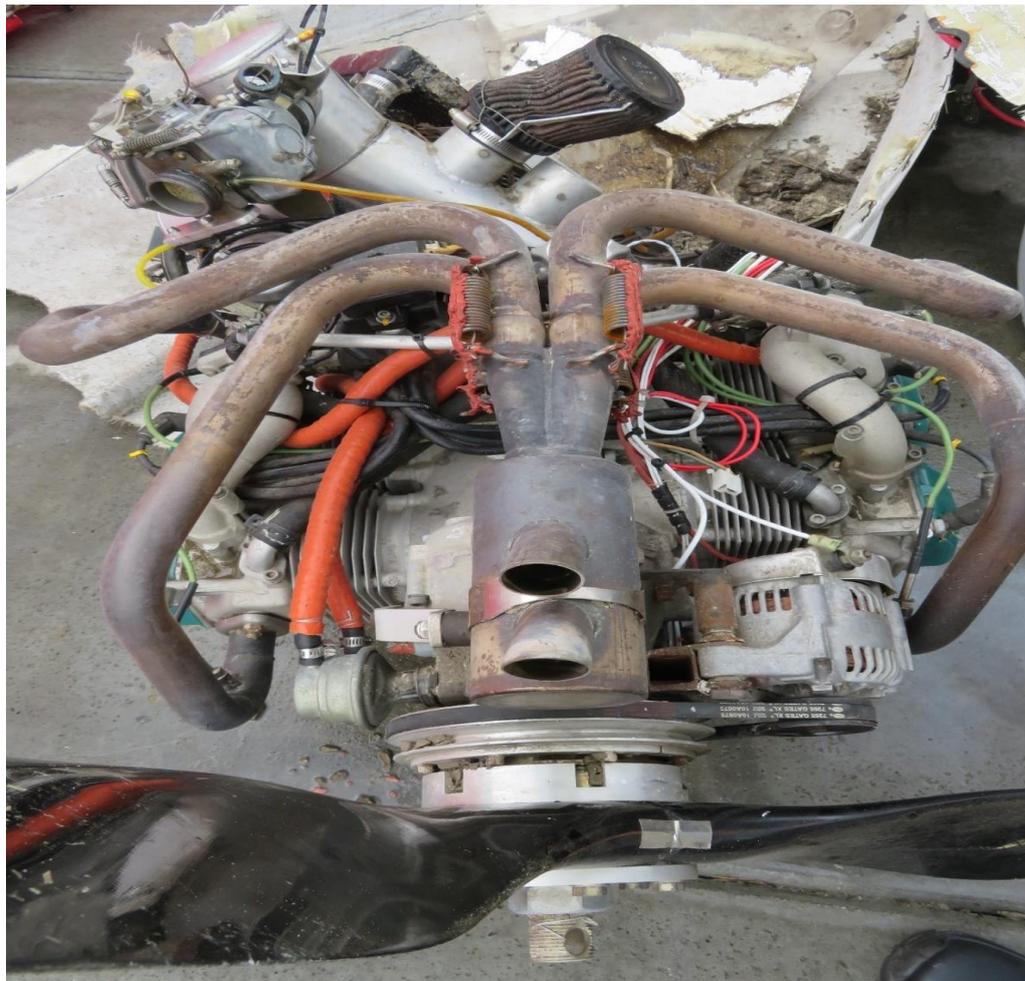


Fig. 11. General technical condition of the engine after collision with water [source: PKBWL].

1.16.5. Witnesses' statements

Three witnesses of the accident were identified and questioned by the Police on 29 March 2022. The PKBWL investigation team analysed the statements and regarded them as too general and insufficient to recreate the course of the flight in the area of Jezioro Kłeckie. Therefore, the investigation team conducted interviews and on-site verification with the participation of witnesses in the places from which they observed the occurrence. Witness 3 attended the on-site session on 30 March 2022. Witnesses 1 and 2 attended the session on 9 June 2022.

During the on-site session, the witnesses presented the course of the flight, including the demonstration of the aircraft's position during the manoeuvres performed with the use of an aircraft model, and answered detailed questions.

On 12 July 2022, the Police provided information about the identification of two more witnesses (witnesses no. 4 and 5).

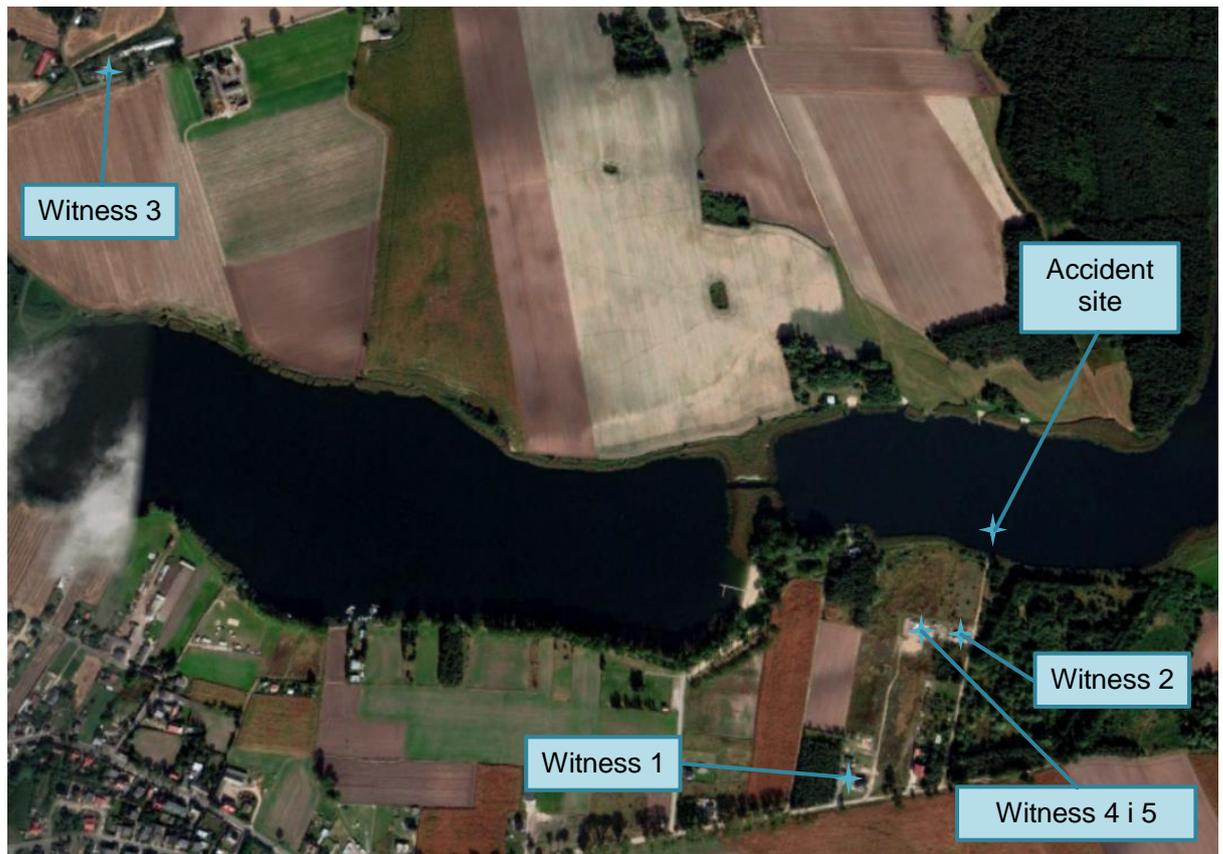


Fig. 12. Location of witnesses during observation of the occurrence [source: PKBWL]

The witnesses described the flight as follows:

Witness no 1.

The witness noticed a plane flying from the south. The plane flew at a height of about 50 m, passed the house (Fig. 13) and then straight ahead to the lake area, where it made a right turn.

Using a model, the witness showed the position of the airplane during a turn made with a bank angle in the range of 50 - 60°. With such a bank angle the aircraft started descending quite quickly, but after about 3 seconds it flew behind obstacles preventing its further observation.

The witness estimated that the airplane probably fell into the lake and immediately went to the lake shore by car. The witness (interested in the course of the flight) did not remember any details of the engine sound, which was very loud due to specific exhaust system. Nor did he hear any sounds that would indicate the plane had collided with the lake.



Fig. 13. The flight path in the area of Jezioro Kłeckie, reconstructed on the basis of the statement given by Witness no. 1 [source: PKBWL]

Witness no 2.

The witness stood in front of the house where the surface of the lake is visible (Fig. 14). The witness did not see the arriving plane, but clearly heard it from somewhere behind the building (on the south side). After a dozen of seconds, he heard a different and louder sound of the engine coming from the eastern part of the lake. The witness stated that probably several seconds after hearing the plane flying over the lake, he noticed it arriving from the east. The plane was in a level flight at a height of about 30 m. After a few seconds, the plane began to turn left with increasing bank angle.

The witness showed the attitude of the airplane during the turn until it collided with water, using an airplane model. In the initial phase of the turn, it flew with a bank angle of about 30°, increased to about 70-80°, and a moment later the plane sharply rolled to the left (over 90°) and at the same time it started to descend very quickly and fell into the lake with an angle of about 80°. The witness showed the bank angle above 90° and said that he initially thought that the pilot wanted to perform some acrobatic figure, but seeing what happened, he quickly realized that this sudden roll could have been the result of a very "strong" wind. The witness showed the direction of the wind, which coincided with the meteorological data obtained. The presence of a strong and noticeably cold wind was also confirmed by the participants of the rescue operation.

Moreover, the witness reported that shortly after the plane rolled sharply, he heard a loud "howl" of the engine continued until the front part of the plane was submerged.

The witness notified the emergency services about the accident and went to the lake. According to him, at a distance of about 40 meters from the shore, he noticed a partially sunken plane in water with one float visible. Due to strong wind, the plane was pushed towards the other shore, and after a few minutes it sank.



Fig. 14. Airplane flight path in the area of Jezioro Kłeckie, reconstructed on the basis of the witness' statement [source: PKBWL]

Witness no 3.

The witness observed the airplane from a distance of about 1200 m, but he had the best view of the lake area where the accident occurred (without the lake's surface being visible). The witness began the observation when the airplane was flying east over the lake (he did not see the right turn). According to the witness, the airplane made two turns to the left and indicated stability problems (he compared the observed flight to that of a paper airplane). During the last turn, the aircraft began to descend sharply and flew down almost vertically (the witness did not see the collision with the water). He calculated the flight height (about 50 m) by comparing it with the height of the trees (Fig. 15a).

Like witness 2, he heard the engine's "howl" in the last phase of the flight.



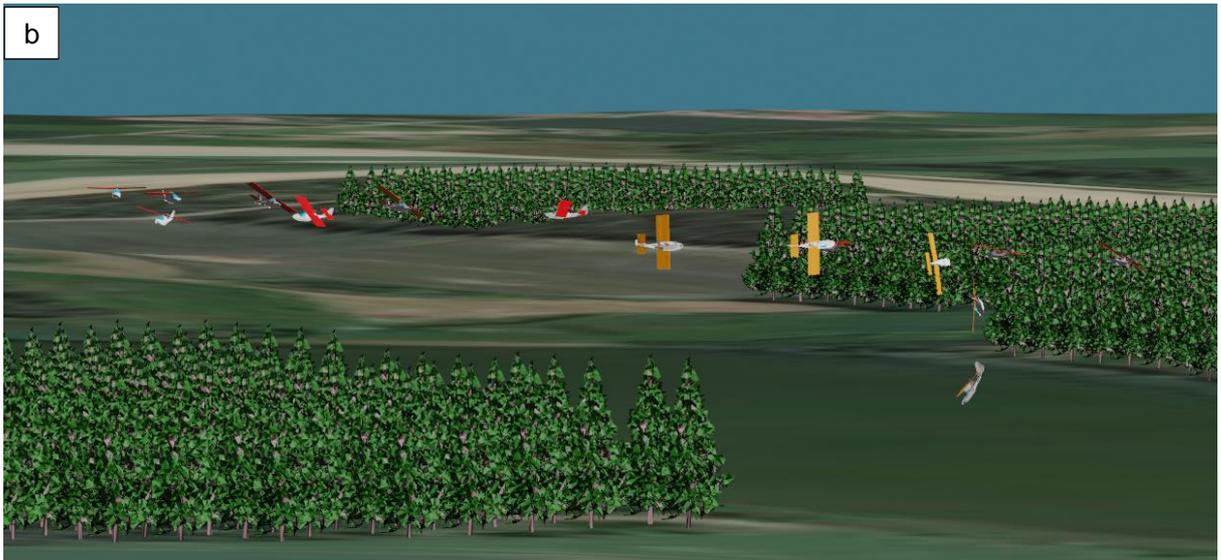


Fig. 15. Flight path in the area of Jezioro Kleckie, reconstructed on the basis of the testimony of witness no. 3, a – view from the level of the witness no. 3 eyes, b – view from the height of 50 m AGL [source: PKBWL]

Witnesses no 4. and 5.

On 12 July 2022, the Police informed about two other witnesses who worked on the roof of the building located 20 meters to the left of the building of witness no. 2. The witnesses heard the airplane arriving from the south, but did not see it, because they were operating in difficult conditions, not allowing them to turn in that direction.

After a while the witnesses climbed higher (5-6 m above the ground) and they noticed an airplane flying eastwards at a very low height (about 20 m) over the lake, which after about 3 seconds disappeared behind the trees.

Witnesses heard the engine running all the time, the sound was getting far for a few seconds, then began getting closer for a few seconds. At one point they heard the "engine howl" and after a while a loud splash. Due to the worse visibility of the lake's surface from their place (compared to witness no. 2), they noticed the airplane right after the impact, when it was already partially submerged in the water.

The witnesses confirmed the place of the airplane collision with water indicated by witness number 2.

The flight path in the area of Jezioro Kleckie, recreated on the basis of the statements of five witnesses, is shown in Fig. 16.

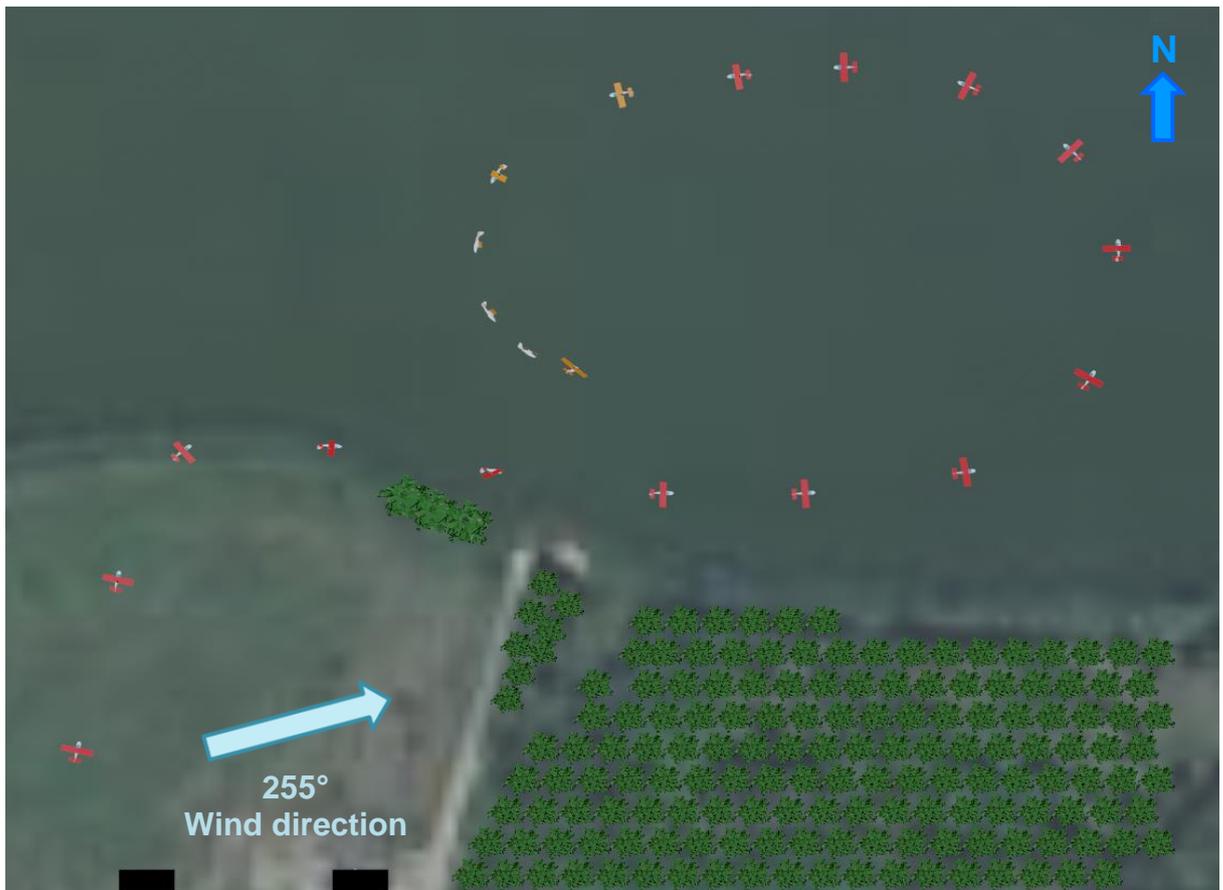


Fig. 16. Flight path in the area of Jezioro Kłeckie, recreated on the basis of witnesses' statements
[source: PKBWL]

1.17. Organizational and management information

According to information received from FAA via NTSB, the owner of the Aventura II aircraft, N27ZX registration marks was an American citizen.

According to the witness' statement (the German citizen), the owner of this aircraft from autumn 2021 was the accident pilot, but no documents confirming this fact were presented to PKBWL.

1.18. Additional information

The investigation team checked the WT-9 Dynamic aircraft belonging to the accident pilot and found that all the necessary WT-9 documents were in the cockpit and were updated on an ongoing basis.

The comments submitted by the BFU were accepted and taken into account in the Final Report.

1.19. Useful or effective investigation techniques

Standard investigation techniques were applied.

2. ANALYSIS

2.1. Flight operations

2.1.1. Pilot's qualifications

The pilot had the necessary qualifications and license to fly the Aventura II aircraft. On 2 August 2020, at ATO Żerniki near Poznań he obtained the rating to fly on water bodies. From autumn 2021 until the accident, the pilot flew on the Aventura II plane for about 60 hours. According to a witness' statement, the pilot performed the first two flights on this aircraft with its previous owner. The pilot informed the witness on a regular basis that he had no problems with flying an amphibious aircraft, but pointed out the necessity to maintain the flight speed within the range of 100 - 110 km / h, as he noticed that the airplane showed signs of reduced stability below this speed.

The pilot had a total flight time of 4,000 FH on various types of aircraft. (according to available documentation) and flew regularly to many countries across the continent. The pilot also regularly performed flights on WT-9 Dynamic.

The information collected by the investigation team shows that the accident pilot was experienced and knew the procedures related to flying AVENTURA II aircraft and did not report any problems from the beginning of flying this type of aircraft.

2.1.2. Meteorological conditions

The meteorological data show that on 29 March 2022, around 15:30 hrs, the following meteorological conditions prevailed at the accident site:

- ambient temperature - 7°C;
- dew point temperature - 0.5°C;
- relative air humidity - 63%

Taking into account the above, the investigating team analyzed data related to the possibility of icing of the engine carburetors.

For this purpose, the meteorological data from the accident area were plotted on a graph showing the possibility of icing in aviation piston engines (Fig. 17 - red lines).

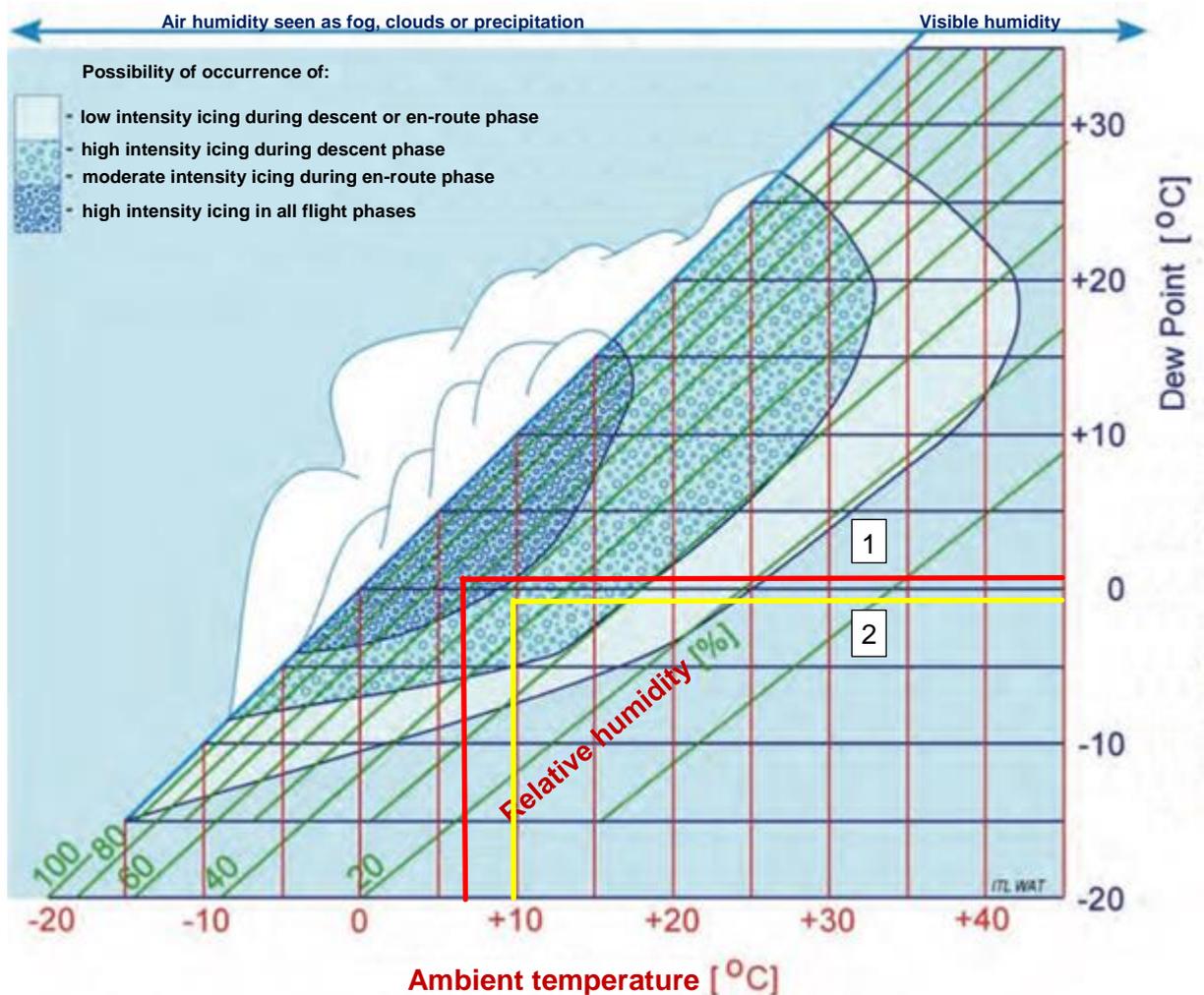


Fig. 17. Graph for determination of a possibility of carburetors icing [source: Internet]

The graph clearly shows that during the accident time there was a possibility of high-intensity carburetor icing in each phase of the flight (item 1).

The plotted meteorological data from EPPO (yellow lines) located 40 km south-west of the site (at 15:30 hrs) showed the possibility of high-intensity carburetor icing during a descent and of moderate intensity during en-route flight.

In addition, meteorological data from 10:00 to 15:30 hrs from all weather stations close to the route were analysed and it was established that there was a possibility of carburetor icing of varying intensity during the flight along the entire route. The lack of information about the place and time of landings and take-offs on lakes did not allow to determine the probability of icing in particular places of the actual flight route.

The effect of icing of the engine carburetors could be a gradual reduction of its power. Depending on the intensity of icing, the process of reducing the engine power could have happened very quickly or over a longer period of time.

It can be assumed that the pilot might not notice changes in flight parameters or not associate them with carburetors icing and continued the flight with the electric carburetor heating system turned off (the engine was equipped with such a system).

In the area of Jezioro Kłeckie, the wind blew at an average speed of 5 m/s and a maximum speed of 8 m/s (15.6 kt) which was close to the maximum allowable wind speed for the accident aircraft, which was 17 kt.

The relatively low weight, combined with a large wing area, makes it vulnerable to the effects of wind.

High wind speed at the scene was confirmed by witnesses and participants to the rescue operation. During the left turn, the plane was in a zone of turbulence caused by the wind and the proximity of trees, which disrupted the flow of air streams of the area shown in Fig. 18. Entering the turbulence area could have contributed to an increase in the roll angle and a decrease in the turn radius of the aircraft.

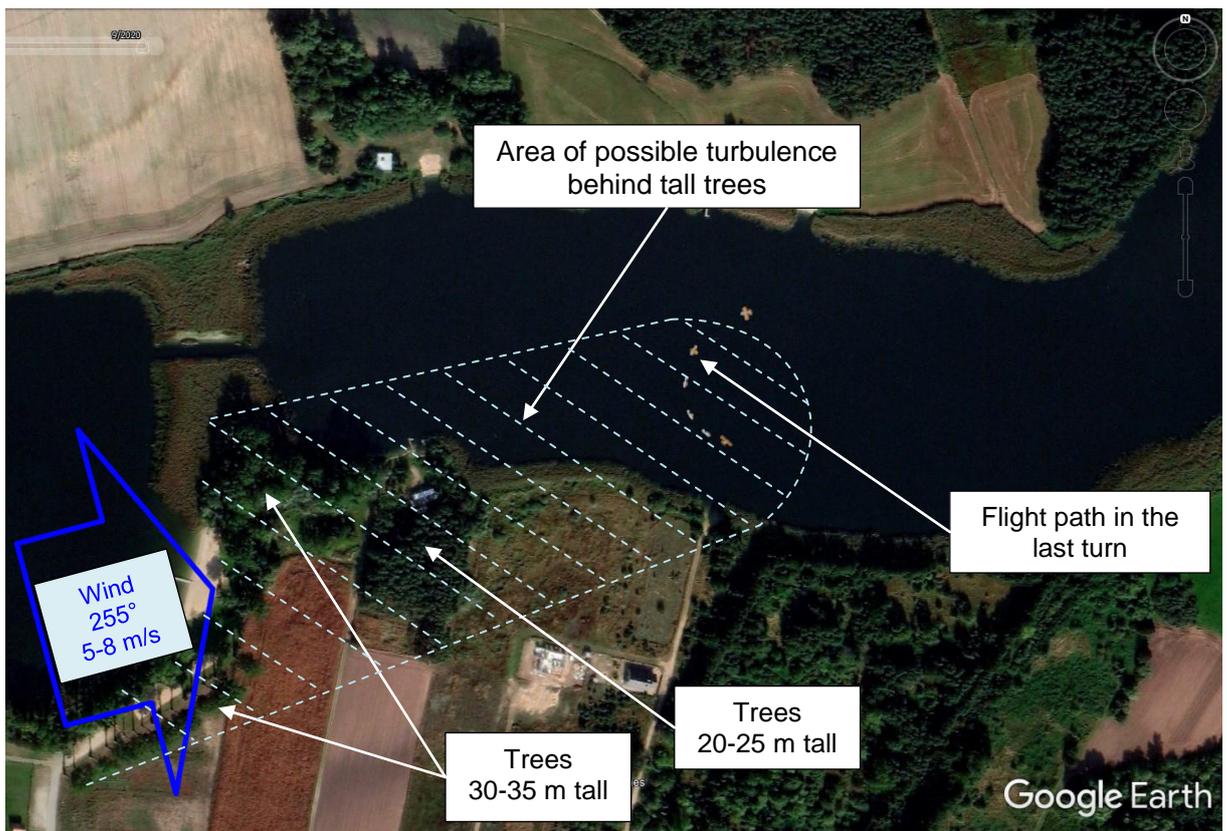


Fig. 18. Area of possible turbulence behind tall trees [source: PKBWL, Google Earth September 2020 r.]

2.1.3. Flight course

Based on the information provided by a witness, the pilot planned routes of his flights in G class airspace, outside the zones of civil and military aerodromes. After the departure from the EPLS until the landing on Jezioro Lednickie, the pilot made several landings on lakes. According to the information provided during a telephone conversation, the pilot intended to take off from Jezioro Lednickie and return to the EPLS, but according to witnesses, after taking off from Jezioro Lednickie, the pilot flew to the area of Jezioro Działyńskie, and then Jezioro Kłeckie. The pilot reached Jezioro Kłeckie at an altitude of about 50 m in its south-western part.

For unknown reasons, the pilot made a fairly steep right turn with a visible loss of altitude by about 30 m (witness no. 1), but stabilized the flight and made a left turn. The flight in the left turn and the flight to the west were most likely performed at a speed close to the stall speed, as related by witness no. 3, who described the behaviour of the aircraft as indicating problems with stability. This description corresponds to the i manual content describing symptoms indicating an impending stall.

The analysis of the collected information shows that the plane made one steep turn over the lake at a low altitude of no more than 30 m. During the last left turn, in a short time the plane increased the roll angle up to over 90°, and then it descended abruptly and turned left, then collided with the surface of the lake with the left wing and the front part of the fuselage at an angle of about 80° (first phase of the spin).

Therefore, an analysis of the factors that could lead to a stall and spin was carried out. First, the available information about the airplane and its behaviour in different phases and conditions of flight² was collected and compared with the facts established during the investigation.

The analysis of FTS manual shows that:

- 1) Aventura II is an (amphibious) aircraft that differs in aerodynamic properties from traditional aircraft, but in a flight configuration while maintaining a minimum flight speed (62 kt) is not prone to stall. The collected materials show that the pilot had no problems with the plane during level flight.
- 2) In a flight close to stall speed, only elevator and rudder are effective. Ailerons are ineffective in a flight at low speed. Symptoms of a poor coordination of rudder and ailerons deflection were visible during turns, which was mirrored by difficulty in maintaining lateral balance in flight (witness no. 3).
- 3) Each turn should be made with the coordinated use of the rudder and ailerons. It is forbidden to make turns with a bank angle higher than 60°. **At lower speeds in sharp turns, the plane quickly loses altitude.** Turns with a bank angle above 30° should not be performed at speeds below 54 kt.

Witnesses related that the pilot made steep turns with a bank angle exceeding the permissible value of 60°. A significant loss of altitude may indicate that the turn was performed at a speed lower than required. According to the Flight Manual, the altitude loss during recovery from stall is approximately 50 ft.

2.2. Aircraft

During the investigation, no airplane malfunctions, that could have had an impact on the accident were detected.

The setting of the main power switch (off) and the throttle control lever (retracted) detected during the cabin inspection may have been caused by a diver during the rescue operation. The diver recovered the pilot's body operating in zero visibility and with limited access to the cabin of the overturned airplane.

² The main information is contained in the manufacturer's FTS pilot training manual on Aventura II aircraft.

The "howl" heard by the witnesses could have occurred as a result of increase in powerplant RPM. When the airplane stalled and the autorotation started (the first phase of the spin), the airflow on descending wing was separated and turbulent airflow started, which resulted in an increase in roll and a further loss of lift, thus increasing the descent rate. At the same time, the separated airflow began to flow around the propeller (Fig. 19). The factor contributing to such a phenomenon was the fact that the powerplant on the aircraft was mounted on the upper surface of the wing.

The turbulent airflow and the increasingly steep descent caused a reduction in the powerplant load and an increase in its RPM t, which the witnesses heard as the "howl".

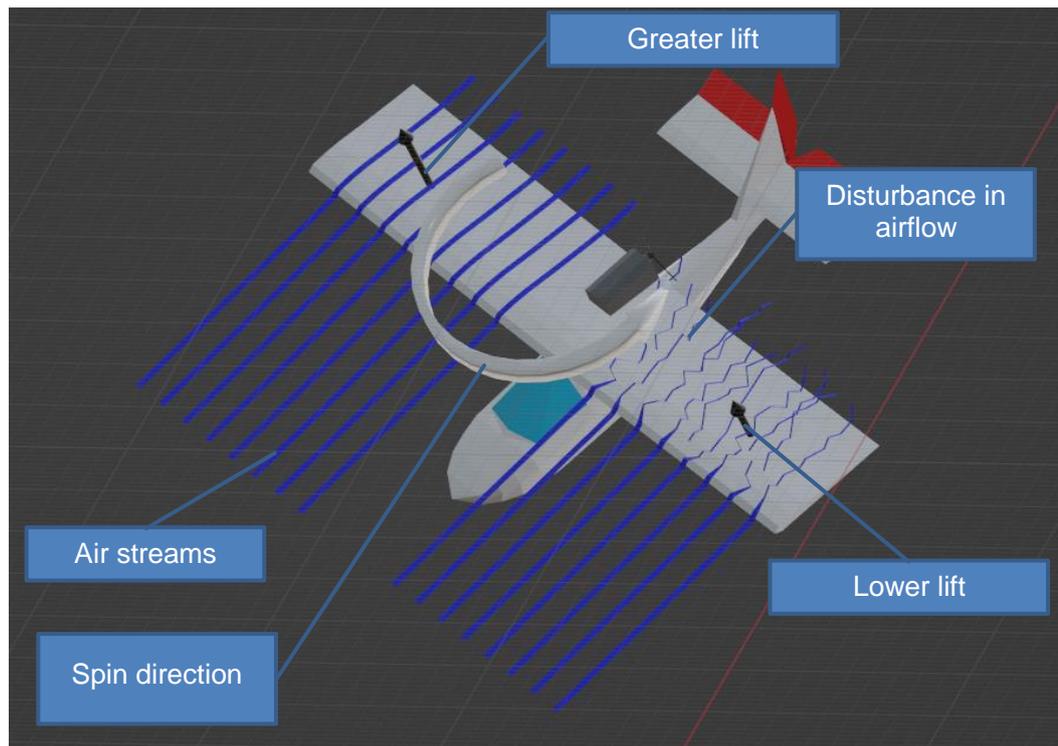


Fig. 19. Turbulent airflow on the descending wing during spin [source: PKBWL].

3. CONCLUSIONS

3.1. Findings

3.1.1. Aircraft

- 1) The aircraft was operated by the owner since autumn 2021.
- 2) The aircraft had an Airworthiness Certificate for an experimental, amateur aircraft.
- 3) PKBWL did not obtain data on flight time and maintenance on the aircraft. No documentation was found during recovery of the wreckage from the lake.
- 4) The mass and center of gravity of the airplane were within permissible range.
- 5) No evidence of any defect or malfunction of the aircraft was found which could have contributed to the accident.
- 6) No part was found to detach from the aircraft prior to impact.

- 7) All control surfaces were identified and all damage to the aircraft was the result of high forces resulting from the impact.
- 8) The fuel remaining in the aircraft tanks was not contaminated.
- 9) The engine was running until the collision with water.
- 10) After recovery of the wreckage from the water, it was found that the switch of electric heating of the carburetors was turned off.

3.1.2. Pilot

- 1) The pilot had valid license and ratings to perform the flight.
- 2) The pilot had valid aero-medical certificate.

3.1.3. Flight operations

- 1) The pilot did not maintain radio communication with FIS.
- 2) The weather conditions in the place and at the time of the occurrence were favourable to icing of the carburetors in every phase of the flight.
- 3) The flight (with breaks) lasted over 5 hours in conditions favourable to icing of the carburetors of various intensity.
- 4) The pilot was probably not aware that the flight was performed in conditions conducive to icing of the carburetors.
- 5) The pilot made a steep left turn at low altitude with an excessive bank angle above 60° and probably too low engine power due to icing of the carburetors. Performing the turn in those conditions resulted in the loss of speed and altitude and, consequently the aircraft stall.
- 6) Windspeed close to the maximum allowable speed specified in AFM could have caused air turbulence behind terrain obstacles, which resulted in an increased roll of the aircraft.
- 7) The pilot could have had difficulties in coordinating the turn with ailerons at a speed close to stall speed.
- 8) In the final phase of the flight, the aircraft did not have sufficient altitude to be recovered from the stall.

3.1.4. Medical aspects

No evidence of incapacitation or physiological factors that could have influenced the performance of the pilot were found.

3.2. Causes of the accident

The most likely cause of the accident was exceeding of the maximum bank angle during turn, in the conditions when engine power was reduced due to carburetors icing, which resulted in aircraft stall and spin.

3.3. Contributing factor

Significant wind speed, which caused turbulence behind terrain obstacles that resulted in an increase of the aircraft bank angle.

4. SAFETY RECOMMENDATIONS

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

5. ANNEXES

None.

THE END

Investigator-in-Charge

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(Signature on original)