Final Report

ACCIDENT/2022/1027

STATE COMMISSION ON AIRCRAFT ACCIDENT INVESTIGATION

UL. CHAŁUBIŃSKIEGO 4/6, 00-928 WARSZAWA | EVENT NOTIFICATION + 48 500 233 233

FINAL REPORT

from investigation of the aviation occurrence of the aircraft below 2250 kg MTOM

ACCIDENT

OCCURRENCE NO. – 2022/1027

AIRCRAFT – Fly Penquin 2.0 (FOX), SP-STYL

DATE AND PLACE OF OCCURRENCE – 12 March 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

Occurrence reference number	**2022/1027**			
Type of occurrence	ACCIDENT			
Date of occurrence	12 March 2022			
Place of occurrence	Bielsko-Biała (EPBA)			
Type and model of aircraft	Flying Device Kat. K4, UL-A. Aircraft, Fly Penquin 2.0 (Fox)			
Aircraft registration marks	SP-STYL			
Aircraft/User Operator	Private			
Pilot in Command	LAPL(A)			
Number of victims/injuries	Fatal	Serious	Minor	None
	0	2	0	0
Domestic and international authorities informed about the occurrence	EASA, ULC			
Investigator-in-Charge	Michał Ombach			
Investigating Authority	State Commission on Aircraft Accidents Investigation (PKBWL)			
Accredited Representatives and their advisers	None			
Document containing results	Final Report			
Safety recommendations	None			
Addressees of the recommendations	Not applicable			
Date of completion of the investigation	2 September 2022			

1. Type of occurrence

Accident.

2. Investigating Authority

SCAAI (PKBWL).

3. Date and time of the occurrence

12 March 2022, 15:48[1] (14:48 UTC).

4. Place of the take-off and intended landing

Bielsko-Biała airfield, EPBA (Fig.1).

[1] All times in Final Report are in LMT, LMT=UTC+1 h

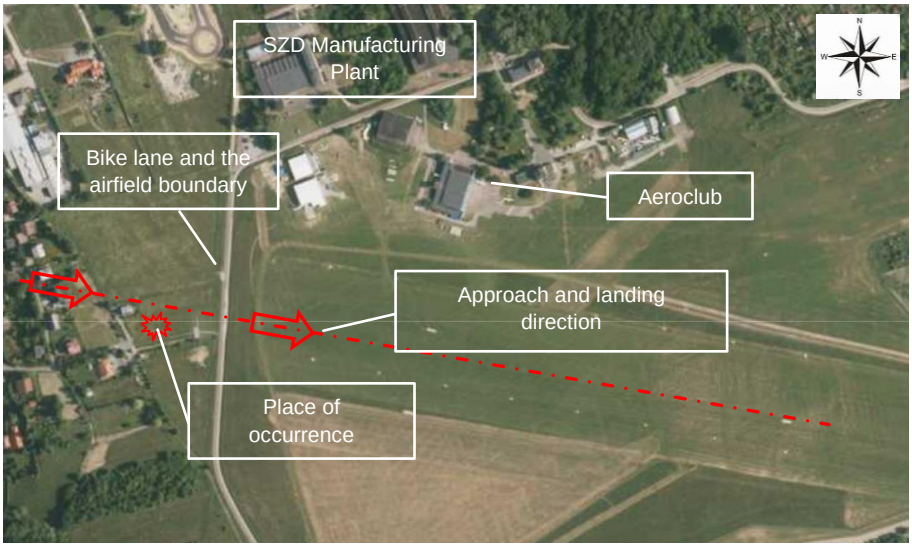

Fig. 1. EPBA (Bielsko-Aleksandrowice) aerodrome. Place of occurrence [source: Geoportal]

5. Place of occurrence information

A foreground of the EPBA aerodrome, west side, approx. 90 m from the aerodrome fence (Fig. 1 & Fig. 2).

Fig. 2. Crash scene. In the background the airfield fence to be seen [source: PKBWL]

6. Operation type

Private flight.

7. Flight phase

Approach to landing.

8. Flight conditions

Daylight, VMC.

9. Meteorological information

Weather conditions had no impact on the occurrence.

On the day of the occurrence the airfield area was under the influence of high pressure center over eastern Poland with a light breeze coming in from N-E direction (ca. 3 m/sec.). Sky was cloudless. Ambient temperature was +3°C. The Fig. 2 & 3 present the weather about 1 h after the occurrence.

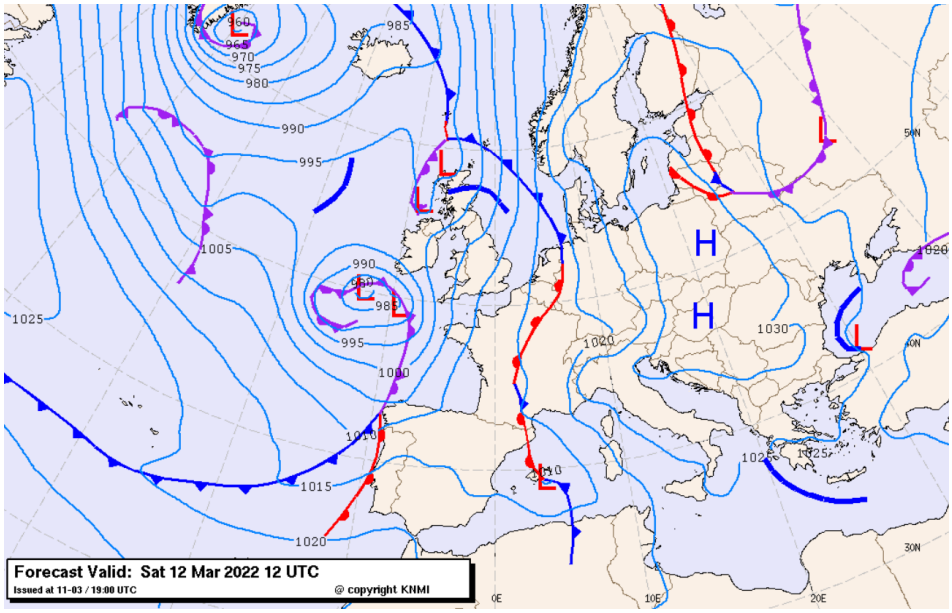

Fig. 3. Ballot systems over the Europe and it's influence on the weather in Poland on the day of the occurrence
[source: KNMI meteo]

10. Flight organizer

Private.

11. Personnel information (crew data)

Pilot - male, aged 52, hereafter referred to as "pilot K" (on the right aircraft seat), holder of a valid LAPL(A), medical certificate class II/LAPL with no limitation.

Pilot „K" declared his total flight time about 80 FH (flight hours) on powered aircraft and about 70 FH on gliders. The last flight before the occurrence he made with motorglider, in late autumn 2021. He did not have experience with Fly Penquin aircraft, except familiarization flight approx. 3÷4 years prior to the accident.

Pilot - male 53, hereafter referred to as „pilot M" (on the left aircraft seat), holder of a valid *Pilotni Prukaz*, medical certificate class II/LAPL with no limitation.

Pilot „M" declared his total flight on UL aircraft about 120 FH an approx. 410 FH on gliders. The last flight he made probably during the autumn 2021. His logbook entries were chaotic, poorly readable and outdated. The pilot had no experience on Fly Penquin type. As a conclusion, none of the pilots was in current training.

12. Injuries to persons

Both pilot suffered serious injuries as a result of the accident.

13. Damage to aircraft

The aircraft was destroyed (Fig. 4). Only the left wing and the part of the fuselage behind the cockpit preserved their structural integrity. The 3-blade propeller, the engine with its mount, the firewall and, partially, the instrument panel with its equipment as well as some controls in the cockpit were destroyed. The kinematic continuity of all controls was not broken, however some plastic deformations on controls supports and the right aileron and flap drives did not allow for their free movement.

Fig. 4. Damage sustained by aircraft [source: SCAAI]

14. History of the flight and analysis

14.1. History of the flight

On 12 March 2021 around midday, the two co-owners: pilot „K” and „M” were preparing their newly bought aircraft to the flying season. Since autumn 2021 the aircraft was stored in the hangar of local aeroclub. Taking advantage of the sunny weather, „K” and „M” were doing some works on aircraft systems. After refueling the aircraft with automotive gasoline, they both took seats in the cockpit: „K” on the left and „M” on the right and then they started up the engine. The systems were working correctly, therefore, the pilots decided for some ground accelerations on the grass runway to check – as per their statements – “wheel breaking action”. Satisfied with the results, after three runs they taxied to the apron in front of the hangar and switched their places:

“M” on the left seat (PIC seat) and „K” on the right one. As per the statement of pilot „K”, they were going to repeat the acceleration, but had no intention to fly.

They were reporting their intents via radio on the frequency of EPBA airfield.

The pilots taxied again to the threshold of RWY09: that time the pilot controlling the aircraft was „M”, the one on the left. As per „K” statement, the first run finished with „unexpected lift-off of the aircraft and its fast climb”. Pilot „K” stated also that none of them was planning to take-off. Having in mind a relatively short RWY 09 on EPBA (about 500 m), and with an intention to reduce the risk of landing „too close to the fence”, the pilots decided to continue climb and make a full aerodrome traffic circuit.

The flight was uneventful. Pilot „M” kept the speed approx. 120 kph., based on the readings of the airspeed indicator (ASI), and engine rpm about 5000. They made 2 or 3 left circles over the airfield and then made a left circuit to RWY09 flying west. The pilot made the third and then the fourth turns of aerodrome traffic circuit far enough to “prepare for landing” (as pilot stated). On final, the pilot „M” on the left communicated to his colleague his “inability to land”. So, the pilot „K”, on the right, took controls. The aircraft was approaching on long final: according to a reliable whiteness on the ground – on low altitude and slowly.

This has been partially confirmed by the pilot „K” who stated „we had a very flat glideslope”. This pilot also explained that he was trying to control the speed based on ASI and kept it in a range of 100 ÷ 110 kph. In a critical moment the speed decreased to 90 ÷ 100 kph. Being at the distance of approx. 120 m from the west aerodrome boundary and about 20÷30 m AGL, the aircraft gentle and then rapidly tilted to the right. Both pilots reacted immediately and set the full engine power. The aircraft lost its direction 90 deg. to the right and collided with the ground, turning additionally 135 deg. The engine stopped.

The pilot „K” suffered his head, left hand an both legs injuries, then unaided got out of the wreckage, walked around the aircraft nose and was trying to get his unconscious colleague out of the cockpit. Witnesses pulled out the pilot „K” further from the aircraft, managed to pull out „M” from the cockpit and administered them the first aid. In the same time the rescue services were notified: the firefighters came as first, then the ambulance and the Police. Both pilots were taken to hospital.

The fire did not occur.

14.2. Analysis

The investigator in-charge examined the place of the occurrence, the wreckage and interviewed witnesses. The CCTV recording, which covered the approach and crash was secured. The aircraft, partially disassembled, was then transported to the aerodrome apron for further investigation.

The reconstruction and analysis of occurrence were made based on interviewing the pilot „K” and other witnesses as well as study of the secured recording.

After a few weeks in hospital, the pilot „M" stated, that he cannot remember any details or circumstances of the occurrence.

The plane was not equipped with flight recorders.

Design description

The Fly Penquin 2.0 aircraft is a Slovakian, home-made STOL[2] design, classified as a "flying device". The fuselage is constructed with tube-welded truss. A flat-profile tail includes the separated control surfaces, also based on truss. Non-spar wings have been built with two aluminium alloy tubes, located on the leading and trailing edges and connected along their spans with ribs. The wings fittings have been combined with the corresponding fittings on the fuselage - two fittings per one wing. The doubled struts support the wings. The ailerons and flaps were made in classical pattern. The aircraft has been equipped with tricycle landing gear and controllable tail wheel. Powerplant: 80 HP Rotax 912 UL carburetor engine is powering the 3-blade Peszke propeller.

The controls in the cockpit are dual, classically arranged: two control sticks and two pairs of rudder pedals. The landing flaps can be set in three positions with their handle located between the crew heads. Standard analogue avionics have been installed. One of the pilots involved into the accident was using a portable transceiver (radio) combined with a single headset.

Inspection of the wreckage

A fuel sample and then the 23 litres of automotive gasoline were drained from the fuel tank, located behind the right seat. The sample was cloudy but did not include the water particles. Most probably, the engine was operated out of its life limit established by the manufacturer (out of TBO[3]). The inflight failure of the powerplant as well as the power drop or icing of carburetor nozzles have been excluded as a cause of the occurrence.

Due to the collision with the ground the cockpit in the area of instrument panel, rudder pedals, the floor and the reinforcing tubes on the roof were partially deformed. The seats and their back-rests were not affected. The aircraft was equipped with regular automotive seat belts. Both pilots heads collided with the instrument panel and reinforcing elements on the centre wing. Among others, the pneumatic, mechanical, electrical and fuel systems, the windows and the left door were broken or cracked. The Hobbs meter was found out of the cockpit.

Due to the fact that reliable witnesses and the pilot „K" stated that the take-off and the approach to landing were performed at a low speed, a special attention was paid to the pressure systems of flight instruments. Pilot „K" underlined that he and his colleague controlled the airspeed based on the ASI indications only.

[2] **STOL –** an acronym of *Short Take-Off and Landing*
[3] TBO – *Time Between Overhaul*, established by a manufacturer. Based on the last Confirmation of Release to Service (CRS) for the engine, there is an entry about TTSN (Total Time Since New) to be impossible to establish.

No leakage from the total pressure tubes was discovered. The total pressure port was located on the left wing strut. The location of the static pressure port was not found: it was not placed in any of typical locations – the static tube was routed under the floor of the left seat in the cockpit and then disappeared somewhere in the compartment behind the seats.

The static pressure tubes were broken in several places and the plastic connectors were also found cracked. It was found that the polypropylene transparent tube connected to the static port („S) of the ASI, was bent of about up to 90 deg. (see Fig. 5), just at the ASI port. The character of this failure (among others, lack of resilience of the affected area and its whitening) shows that the bent had occurred before the accident, probably during instrument panel installation in the cockpit. Pilot „K" assured that neither he nor his colleague checked nor rebuild the static system. The instrument panel has not been reinstalled since aircraft purchase. The bent of the static pressure tube could have had an adverse influence on the quality of the ASI indications. The aircraft with such a malfunction was operated by the previous owner.

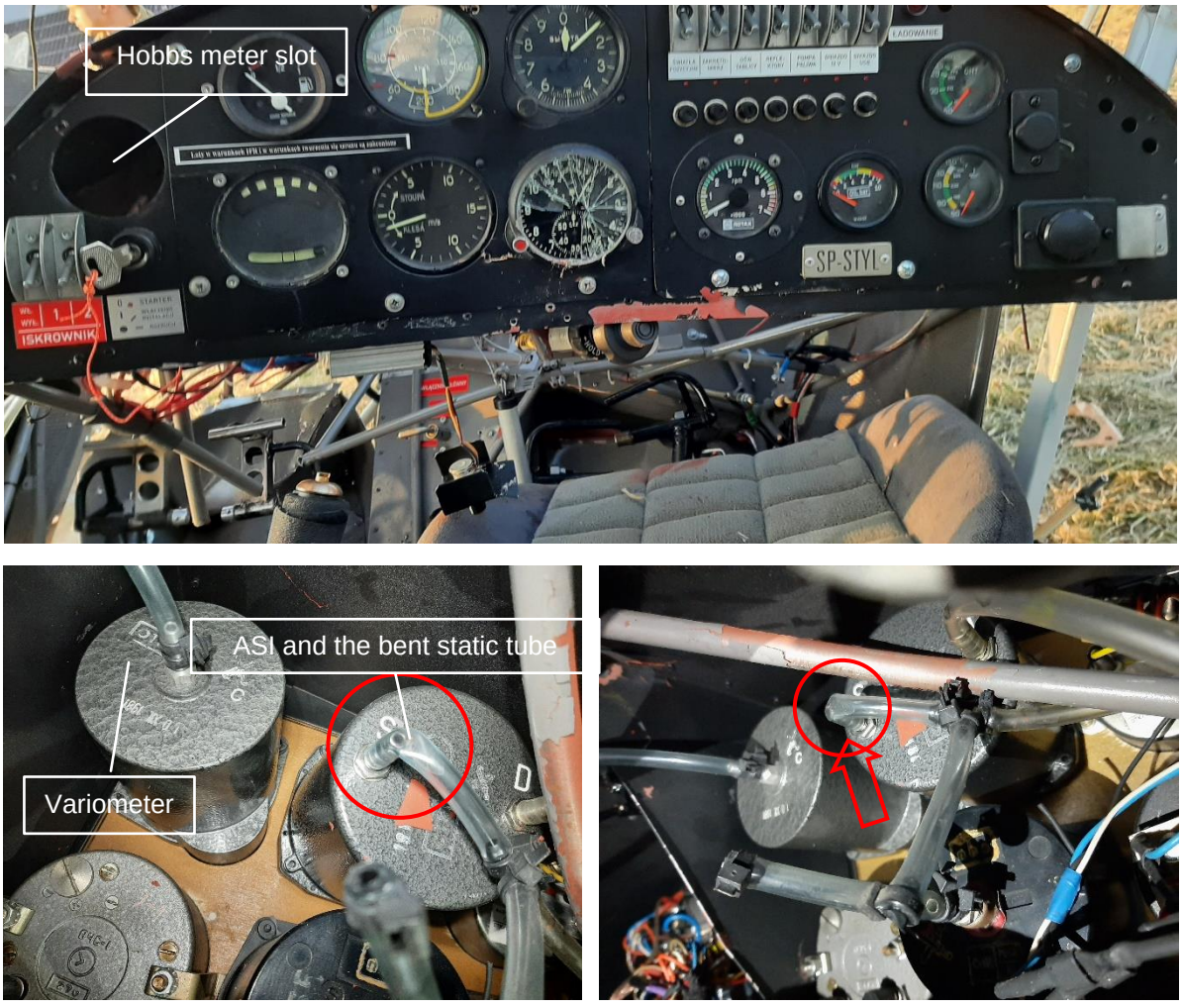

Fig. 5. Avionics of SP-STYL a/c and static pressure tube connected to ASI [source: SCAAI]

This was impossible to confirm whether the instrument static pressure system was leakproof inflight. It is irrelevant to the instruments like altimeter or not compensated

variometer, however in case of a speed indicator, the patency and leakproof are the key issues.

The ASI compares the total pressure with the static one, and the mechanical system inside the instrument case acts on the metal diaphragm moving a pointer relative to the ASI scale. The ASI measures the airspeed relative to ambient air and it is a function of dynamic pressure. Bending of any pressure tube disturbs the instrument response and – in consequence – provide improper speed readings.

It should be noted, the ASI has not been calibrated for this type of the aircraft. The errors for the ports on the airframe have not been defined and the port positioning were most probably random.

The ASI readings were higher than the real airspeed and an estimated error could have been even 20÷30 kph.

It was found that the ASI markings did not correspond even roughly to the template presented in the Flight Manual with regard to the real operation range (Fig. 6).

Fly Penquin 2.0 (Fox 912) FLIGHT AND MAINTENANCE MANUAL		
Designation	**kph IAS**	**Description**
White arc	55÷80	Flaps operating range
Green arc	80÷150	Normal operating range
Yellow arc	150÷160	Maneouvres to be made carefully and in a smooth air
Red line	160	Never exceed airspeed

Fig. 6. Airspeed indicator (ASI) installed on SP-STYL aircraft (green arc up to V = 160 kph., yellow arc up to V=230 kph, red line at V_{NE}≅250 kph.) and the table of ASI marking as per Flight Manual [source: SCAAI]

<u>The actual take-off mass of the aircraft</u>

The Flight Manual for Fly Penquin aircraft, provided by the pilot „K", specifies the maximum take-off mass (MTOM) of 450 kg.

Calculation of the actual take-off mass:

- empty mass („Q")[4], including 10 l of unusable fuel: **308 kg**;
- crew mass ("Z"): 75 kg (pilot „M") + 73 kg (pilot „K")[5] = **148 kg**, at max. permitted crew mass as per FM = 152[6] kg;
- fuel mass in the fuel tank („P"): 23 l (litres) x 0,75 kg/l ≅ **17 kg**

[4] Acc. to the weight & balance report provided
[5] Mass of the pilots as per their declarations
[6] The FM provides two different data about max. crew masses – in Chapter 2.10 - 156 kg and in Chapter 6.3 - 152 kg

- the difference P-Q 23 l – 10 l = 13 l x 0,75 kg/l = **9,75 kg**

Note: the exchange rate of the volume towards mass for automotive gasoline Pb 95 is: 1 liter = 0,75 kg.

The take-off mass Q_s:

308 + 148 + 17 - 9,75 = **463,25 kg**

and **was exceeded** for the affected aircraft by **13 kg** at least[7]

Based on the table in item 6.2 of FM and the pilots declarations of their masses, it can be assumed that the recommended by FM (item 2.7) centre of gravity location was not affected.

Approach to landing analysis

The pilot who was maintaining the approach speed of 90÷100 kph. according to ASI, actually flew much slower and close to the minimum aircraft speed, on the edge of a stall with flaps extended, i.e. v_{S0}. After the accident the flap handle was found on "take-off/landing" setting.

The stall speed of Fly Penquing aircraft with flaps extended v_{S0} (according to the Flight Manual provided by the pilot „K") at maximum take-off mass of 450 kg is 55 kph. With regard to the fact that the maximum take-off mass was exceeded, the real stall speed was higher than as per the FM and could reach approx. 60÷65 kph.

Flat approach and a low angle relative to the aerodrome surface impeded touch-down planning. Even a small up or down movement of the aircraft nose (changing its glide path) was connected with significant change of reference point for landing. The regular approach (from higher altitude and closer to the airfield) would allow for precise touch-down and safe approach speed.

The low approach angle did not ensure the required aerodrome observation – the pilot could not easily observe a potential ground traffic in the landing area and thus had to move his head up, looking over the engine cowling. The regular approach angle provides an excellent conditions for observation landing area because the engine cowling is under the horizon in that case.

Flat approach at low engine power and extended flaps usually requires to keep the nose up by applying elevator, what may lead to airspeed drop and flying close to the stall speed. The cowlings located high make horizon difficult to see what disturbs keeping the proper approach angle.

The EPBA aerodrome is located on the plateau, several dozen meters above the Wapienica valley. The aircraft was approaching from the west, over the rising terrain. This was possible that during a flat approach with constant engine power, the pilot intuitively and unwittingly was changing the trajectory, to be parallel to the rising terrain.

[7] The SCAAI is in doubts with regard to the declared pilots masses

In consequence, the airspeed was dropping systematically (Fig. 7). Additionally, the extended flaps were reducing the airspeed.

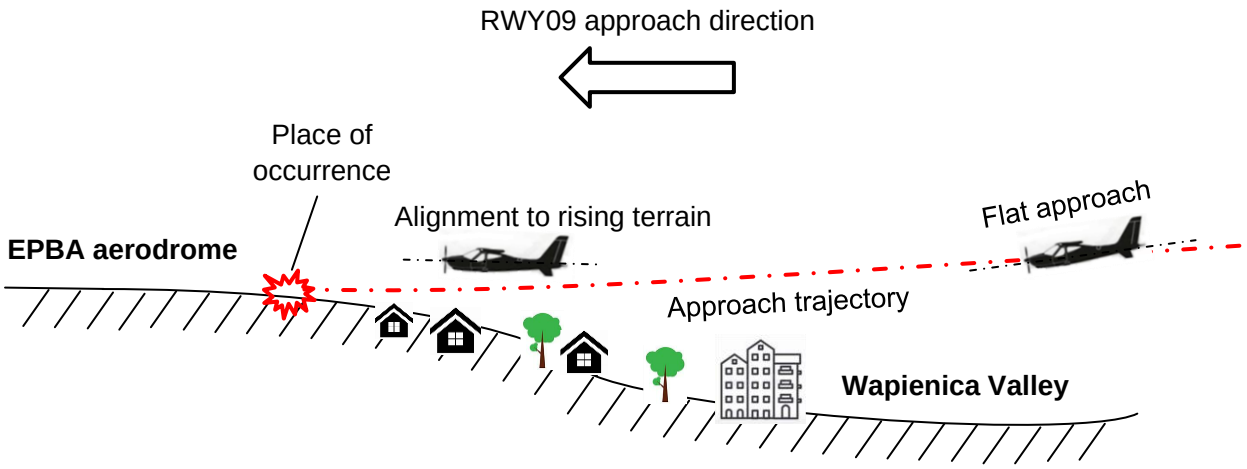

Fig. 7. Approach of SP-STYL to RWY09 of EPBA aerodrome [source: PKBWL]

Moreover, the pilot „K" when asked by the pilot „M" to take over controls just on approach, having no experience on this type of aircraft, was unable to feel properly the aerodynamic forces on controls. At the low approach speed on extended flaps the aerodynamical forces were low – the controls went soft, and to keep the balance (particularly the lateral one), the movements needed to be more extensive. It should be noted that during the take-off and circling above the airfield, the pilot "M" controlled the aircraft. The pilot "K" took over just on approach for landing. None of the pilots had enough experience or training in those circumstances.

An additional mass on board (the second person) had a significant influence on the aircraft response, its performance and handling.

The stall speed as well as inertia of the aircraft increased significantly. The handling was more demanding while flying at a low speed (greater controls deflections required to keep the aircraft stable and early countering of deviations).

The SCAAI draws attention to the fact that it is not a good practice to run the first flights on newly bought aircraft with two persons aboard having no experience on the type, low total flight time as well as lack of current training (before the season). Such flights should be carried out under supervision of experienced flight instructor or eventually solo, but with full planning and analysing of all possible complications in advance.

In the investigated occurrence, the pilots did not decide who would be a PIC, however, it can be assumed that it was the pilot "M" – at least until handing over the aircraft control to the pilot "K". The flight experience and formal qualifications of pilots „K" and „M" were similar. The fact of the aircraft autonomous lift-off against the pilots will can hardly be considered real. However, if it is true, it could be explained by the fact the PIC was not selected prior to the flight.

14.3. Commissions findings

1) The pilots had a valid qualifications to perform the flight;
2) the aircraft was insured (third party liability insurance);
3) the aircraft records were found chaotic and containing many inconsistences, shortcomings and deletions. The Flight Manual was not assigned to the accident aircraft, the same concerns the weight & balance report, there were no placards specifying loading conditions or limitations of the aircraft;
4) the maintenance works effected by the owners did not reveal the failure of the static pressure tube (bending) on the ASI port;
5) the bending on the tube was the contributing factor to stall the aircraft;
6) ASI markings did not correspond with the aircraft limitations;
7) the aircraft maximum take-off mass was exceeded;
8) approach for landing was built improperly.

15. Cause of the occurrence

The cause of the occurrence was the pilot's error. He stalled the aircraft on final approach and entered an unintentional spin, which none of the pilots was able to prevent.

16. Factors contributing to the occurrence

1) lack of experience of both pilots on the type of the accident aircraft;
2) long break in flights, lack of training;
3) exceeded maximum take-off mass;
4) improper, too flat approach to landing;
5) incorrect ASI readings;
6) improper maintenance of the aircraft.

17. Safety recommendations

SCAAI has not proposed any safety recommendations.

18. Proposed systemic changes and/or other comments

SCAAI draws attention of UL aircraft users (including the users of flying devices) to the best practices of maintenance, to effect them according to the established procedures (this is known as the "planned maintenance") as well as to plan the flight operations in advance i.e. prior to take-off.

The PIC should be selected for each flight. His duty is to consider the human, technical and other factors (like weather, traffic, terrain obstacles) which may affect an air operation.

19. Annexes

None

END

Investigator in-charge

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