The sole objective of safety investigations is the prevention of future accidents and incidents.

The Commission does not apportion blame or liability. The investigation is independent and separate from any judicial and administrative proceedings.

Any use of this Final Report for purpose other than the prevention of aviation accidents and incidents may lead to wrong conclusions and interpretations.

FINAL RAPORT

of the State Commission on Aircraft Accidents

of 27 November 2024

from the investigation of aviation accident

2024-0009

OCCURRENCE NUMBER

Reims Aviation Cessna, Cessna F150F, D-EKIQ

Warsaw, 1 March 2024

ICE: Icing

This Final Report was issued by the State Commission on Aircraft Accidents Investigation on the basis of information available on the date of its issue.

This Final Report presents the circumstances of the aviation occurrence concerned, as well as its causes, contributing factors and safety recommendations, if issued.

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1. History of the flight

On 29 February 2024, a pilot (an Italian citizen), holder of PPL(A), booked a Cessna F150 F airplane with the registration mark D-EKIQ at the Evair Aviation Training Centre (Warsaw Babice) for a sightseeing flight with a female passenger on 1 March 2024. The flight was scheduled for 16:00 hrs[1] on the EPBC – Góra Kalwaria – EPBC route.

On 1 March 2024, after arriving at the aerodrome, the pilot was provided by an employee of the organisation with the necessary information on the flight route and technical condition of the airplane. Next, the pilot performed a pre-flight inspection of the airplane and topped up with fuel supplied by the organisation (40 l of unleaded 98). At around 16:16 hrs, the pilot made three unsuccessful attempts to start the engine. It was only at the fourth attempt that the engine was started by an employee of the organisation (an instructor). Having received clearance, the pilot taxied to the threshold of RWY[2] 10, where he performed an engine runup. During take-off, the pilot did not find any irregularities and continued the flight until he reached the altitude of 1,800 ft[3] and airspeed of 80 kt[4].

The pilot stated that during the flight he had turned on carburettor heating for 1-2 minutes four times. Each time, the engine speed would drop, but within acceptable limits. After the heating was turned on for the fourth time, the engine speed dropped to 2,200-2,300 rpm.

The pilot increased the engine speed to 2,500 rpm, but it started dropping again. The pilot judged that the engine speed drop was not due to carburettor icing and he did not turn on the heating any more until the end of the flight. In that situation, the pilot turned back to the Babice aerodrome at the town of Józefów. However, the engine speed continued to drop and the pilot decided to perform an emergency landing, of which he notified FIS Warsaw.

For the landing site he chose a undeveloped area in the district of Wawer. The pilot stated that during descent the engine speed was 1,200-1,300 rpm, and that he positioned the airplane upwind, deployed flaps, and closed the fuel valve and switched off electrical power supply prior to touchdown. After touchdown, the airplane stopped and overturned after covering a distance of around 15 m. Radar imaging of the airplane's flight path is shown in Fig. 1. It was only after touchdown that the pilot realised that he had landed on a very waterlogged area overgrown with reeds (Fig. 2). The pilot and the passanger left the airplane unaided. They were transported to hospital, where the female passenger was diagnosed to have sustained minor injuries that did not require hospitalisation. Both persons were breathalysed, with negative results.

[1] Times in this Report are provided in LMT = UTC+1 h.
[2] Runway.
[3] Foot/feet.
[4] Knot/knots.

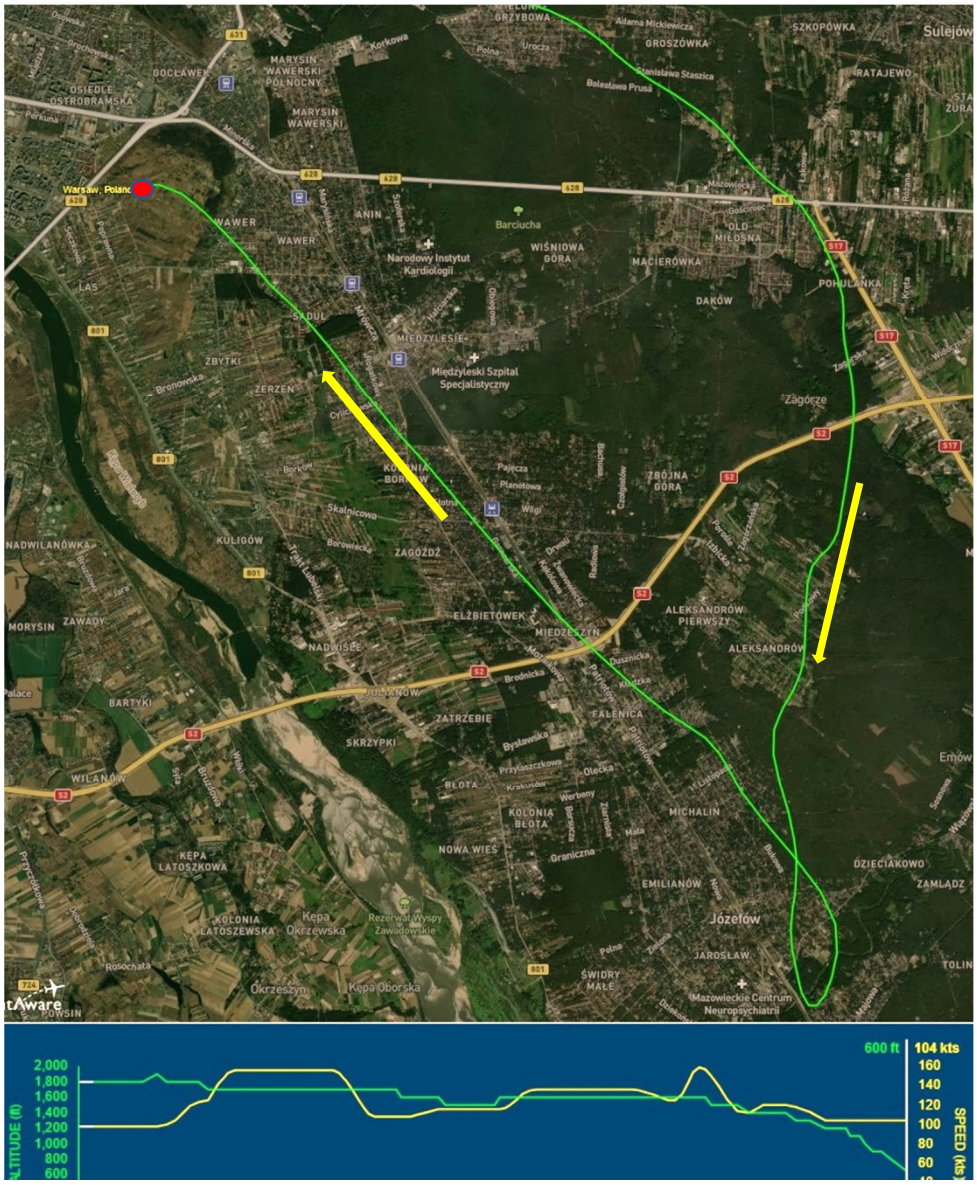

Fig. 1. The flight path of the Cessna F150F – the yellow arrows show the flight direction, and the red circle shows the accident site [source: PANSA, www.flightaware.com]

Fig. 2. The position of the airplane after overturn, with the touchdown point marked by a yellow arrow

2. Relevant information

2.1. Pilot information

The pilot held a PPL(A) with a valid SEP(L) rating[5] and an aero-medical certificate.

Aircraft flight time:

a) total flight time: 254 h;
b) type flight time:
   - Cessna 150/152: 21 h;
   - Cessna 172: 78 h;
   - PA-28-140/161/180: 53 h.
c) flight time before the occurrence:
   - within last 7 days: 1 h 2 min on Cessna 150;
   - within last 90 days: 7 h on Cessna 150.

Rest during last 48 h – the pilot was provided with an opportunity to rest in hotel conditions. Pilot's familiarity with the aerodrome and experience on the flight route – the pilot had performed 6 departures from the EPBC on the Cessna 150 since 27 October 2023.

2.2. Pilot actions

According to the pilot's statement, the airplane was serviceable and all engine performance parameters were normal during take-off and climb to 1,800 ft and airspeed of 80 kt.

The pilot stated that during the flight he had turned on carburettor heating four times for 1-2 minutes each at 10-15 intervals. An analysis of the flight records shows that it was impossible to carry out these actions because the duration of the flight from reaching the altitude of 1,800 ft to the decision to return to the Babice aerodrome was approximately 10 minutes. However, on 5 March 2024 the pilot said in the presence of the flying personnel from the training centre that he had turned on the heating only once or twice during the flight, pulling the carburettor heating lever only half-way because he had been afraid that the engine speed would drop. The pilot decided to turn back after he had turned on carburettor heating for "the last" time, when the engine speed had dropped to 2,200-2,300 rpm, and he even increased the engine speed to 2,500 rpm, but despite that he considered it to be a dangerous condition.

According to the FM[6], that engine speed should have ensured a cruising speed within the range of 83-97 kt and a safe landing.

The pilot considered at that moment that the engine speed drops could be caused by a malfunction of the throttle control mechanism and he ruled out carburettor icing, which is why he did not turn on carburettor heating any more until the end of the flight. It was found during the inspection of the cabin at the site of the occurrence that the carburettor heating lever had been in the closed position and the throttle lever had been in the opened position (Fig. 3).

[5]Single engine piston (land).
[6]Flight Manual.

Fig. 3 A view of the pulled out throttle control lever.

According to the pilot, during the return flight do Babice, he could successfully increase the engine power whenever he attempted that, but the engine speed would still gradually drop. It is a characteristic feature of the Cessna 150, which is equipped with a fixed pitch propeller, is that the engine speed drops in the event of carburettor icing. Any attempts to rectify the gradual engine speed drop by opening the throttle only slightly would only mask the signs of icing.

The facts presented above indicate a case of possible carburettor icing. The fact that it was still possible to increase the engine power despite the engine speed drop shows that the icing was at the stage where it could have been eliminated by following the provisions of the FM, i.e. the pilot should have immediately turn on carburettor heating to the full until the engine speed was back at previous values, which would mean that ice had been removed from the carburettor. Turning the heating on only partially can be ineffective. If the heating is turned on when icing is already present, then a 13-15% drop in the engine power may occur at first.

The groundless concerns that activation of the heating would be followed by a further, unacceptable engine speed drop led to abandoning actions aimed at preventing further icing, including during the descent to land. It was probably a result of incomplete knowledge of the carburettor icing phenomenon and its effects, and lack of knowledge of the procedure to be followed in case of icing.

The pilot had performed flights on this airplane in the previous months, with the last flight prior to the occurrence flown on 27 February 2024.

To compare the flight on the day of the occurrence on 1 March 2024 and that on 27 February 2024, the route records of those flights were plotted on a single chart (Fig. 4).

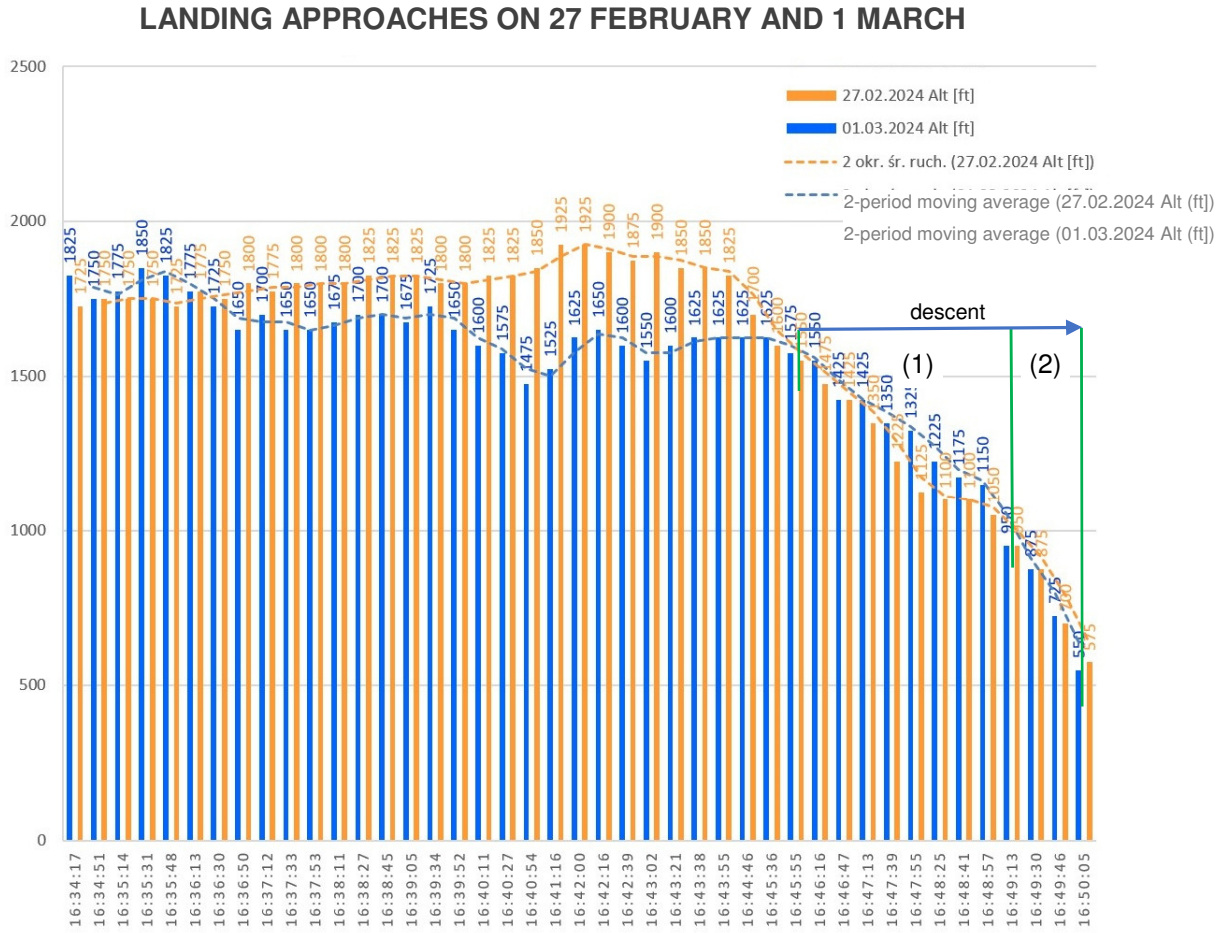

Fig. 4. A chart of the Cessna's flight altitudes during approaches on 27 February and 1 March and 2024.

The chart shows that the flights initially proceeded at different altitudes without any significant differences in flight characteristics. The flight altitude on 1 March 2024 could be due to a rather strong cloud coverage during that flight.

The landing approach paths of both flights were analysed in detail. The analysis of the airplane's landing approach paths shows that:

- the flight path during descent was at similar altitudes in both flights;
- in the first phase in Fig. 4 (1), the descent during the flight on 1 March 2024 proceeded at an altitude higher by approximately 100 ft;
- in the second phase in Fig.4 (2), the descent proceeded at a slightly different altitude, with the difference below 25 ft.

The similar characteristics of the two flights, notably almost identical flight paths during descent, confirm that it was possible to continue the flight to the aerodrome.

The pilot probably increased the throttle opening after each engine speed drop (by 100-150 rpm, according to his statement), which caused the speed to increase and enabled him to continue the flight.

The pilot performed two similar flights, but during the one on 1 March 2024 he noticed a gradual engine speed drop, characteristic of that airplane in a carburettor icing situation, but he misinterpreted the cause for a throttle malfunction.

The pilot decided to turn back to the aerodrome when the engine speed was still sufficient to continue the flight. Furthermore, the chart and airspeed calculations indicate that the flight parameters after turning back permitted flying at a slightly higher airspeed than before turning back.

2.3. Meteorological conditions

According to METAR7 for EPWA as of 1 March 2024, 16:30 hrs (15:30 hrs UTC), the meteorological conditions were as follows:

METAR EPWA 011530Z AUTO 12O15KT 9999 09/05 Q1013=

which means:

- date: 1 March 2024;
- time: 15:30 hrs UTC;
- wind direction: 120°;
- wind speed: 15 kt;
- visibility 10 km and more;
- cloud cover: BKN016, 5-7/8 of the sky covered by clouds (62,5 – 87,5%), cloud ceiling 1,600 ft;
- ambient temperature: 9 °C;
- dew point temperature: 5 °C;
- pressure: QNH 1013 hPa.

The pilot probably read the METAR as of 15:00 hrs UTC which did not have any information on the cloud cover and described the visibility as CAVOK.

An analysis of the meteorological conditions shows, however, that the cloud cover was growing from the southerly direction during the flight, remaining at 5-7/8 of the sky covered between 15:30 hrs UTC and 16:00 hrs UTC, with a tendency for the cloud ceiling to descend further.

The increased cloud cover in the area of the scheduled flight of Cessna 150 D-EKIQ was confirmed by a pilot (instructor) from the EVAIR training centre, who had been returning from the area of the town Góra Kalwaria in another Cessna 150 and landed at EPBC at around 16:10 hrs.

The above data was analysed for a possible icing of the engine's float-type carburettor. The meteorological data from the area of the occurrence was plotted on a chart to allow determining the possibility of icing in piston aircraft engines (Fig. 5 – yellow lines).

[7] Meteorological Aerodrome Report - a message containing routine aerodrome weather observations.

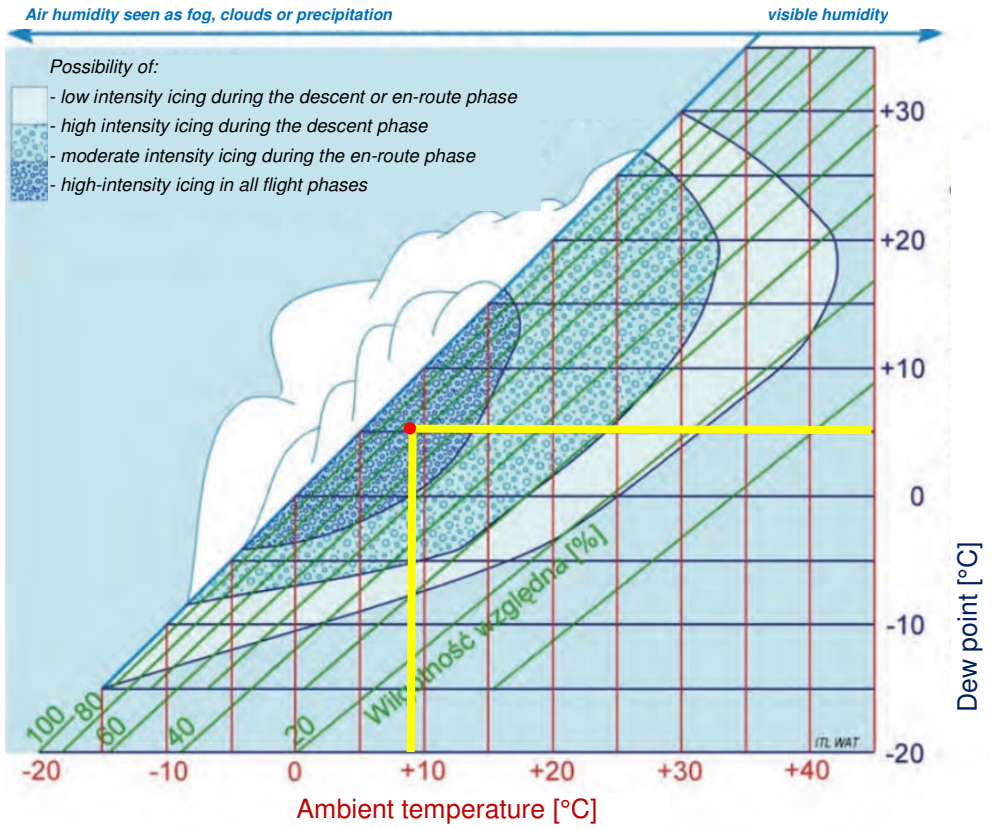

Fig. 5. A graph for determining the possibility of carburettor icing [source: the Internet]

The graph shows clearly that at the time of the occurrence carburettor icing was likely at each phase of the flight.

The factors contributing to carburettor icing could include:

- high air humidity: 76.03%;
- car fuel - due to its higher volatility and water content;
- strong susceptibility to icing in the fuel feed system of the Continental O-200A engine;
- partial opening of the carburettor heating lever during the flight;
- decision not to turn on carburettor heating prior to the start of the descent to land;

2.4. Aircraft

The airplane sustained minor damage, mainly to the nose section of the fuselage. All damage to the airplane was caused by the collision with the ground and overturning on a very waterlogged ground that generated a strong resistance. No other visible damage that could have been caused earlier was found. The locations and character of the damage to the airplane are shown in Fig. 6. The very small damage to the airplane shows that the pilot performed a correct landing.

Fig. 6. A view of the damage to the nose section of the fuselage.

The airplane had a valid Certificate of Airworthiness and was subject to timely periodic maintenance. The airplane's mass and centre of gravity were within acceptable limits.

Considering the pilot's remarks about a possible malfunction of the throttle control system and the fact that the good technical condition of the engine could enable identification of any possible malfunctions taking place before the occurrence, SCAAI approved a further examination of the engine.

An expert examination of the Continental O-200A engine was commissioned by the Prosecutor's Office Warszawa-Praga to the Company Franklin Sp. z o.o. in Grudziądz. The engine was dismantled and examined on 21 May 2024 in the presence of a SCAAI representative.

2.5. Findings of the expert examination

2.5.1. Spark plugs

The engine was fitted with UREM40E spark plugs in accordance with the manufacturer's recommendations.

The spark plugs were checked on an SPCT100 test bed and found to be in working order. The colour of the carbon deposit on the spark plugs indicated a normal engine performance, appropriate composition of the fuel mixture and proper performance of the ignition system (Fig. 7).

Fig. 7. The spark plugs before cleaning.

2.5.2. Oil system

The absence of soiling and metal filings in the oil filter insert indicated proper performance of the engine's crank and piston system (Fig. 8).

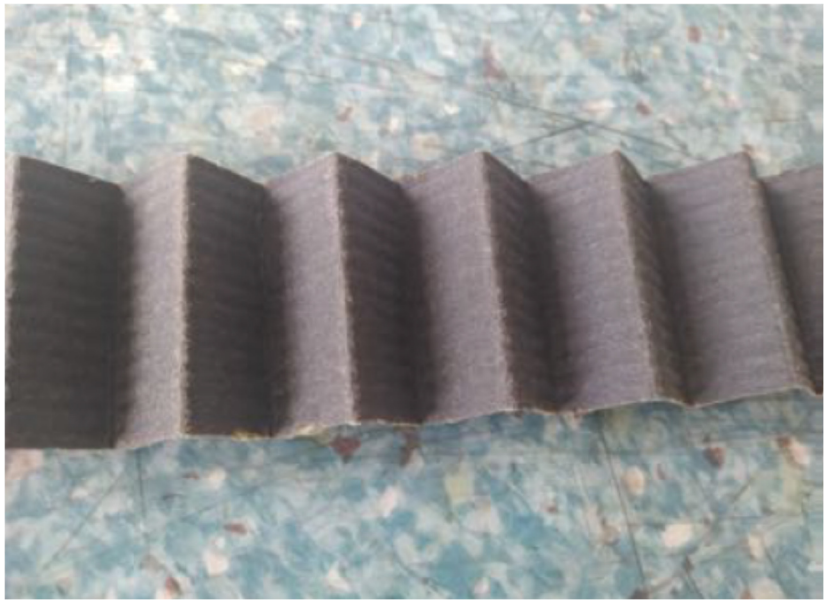

Fig. 8. A view of the oil filter insert

2.5.3. Magnetos

The magnetos were checked on a test bed. The performance of the right magneto was appropriate. On dismantling, components of the left magneto were found to be corroded due to long-term exposure to water. After cleaning, it was confirmed to work properly (Fig. 9).

Fig. 9. Corrosion visible on the magneto's stator.

2.5.4. Carburettor

The throttle lever was found to move within the full range of travel (Fig. 10). The floater chamber was soiled with dirty water due to prolonged exposure of the engine to waterlogged terrain. The fuel level setting in the floater chamber was compliant with the standard.

The examination and check on a test bed confirmed its proper performance at the moment of the occurrence. The absence of soiling and traces of water in the initial fuel filter and fuel lines that feed fuel to the carburettor confirmed that the feeding system worked property at the moment of the occurrence.

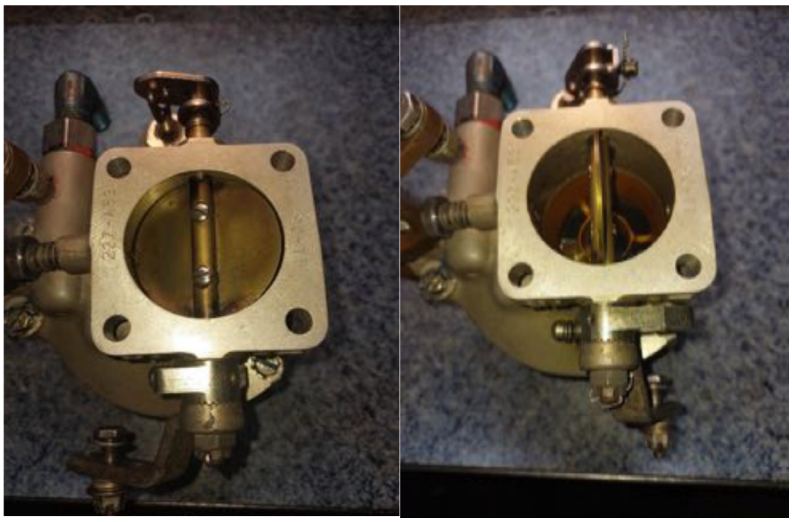

Fig. 10. The throttle in the opened and closed position.

2.5.5. Carburettor heating system

The throttle control system was found to operate properly. The lever moved within the full range of travel and tightly closed the hot air throttle.

Damage was found (deformed air inlet housing) due to the collision with the ground (Fig. 11). It was the only engine element that was damaged.

Fig. 11. A view of the hot air throttle with a deformed air intake housing.

2.5.6. Cylinders, pistons, rings

No traces of seizures, overheating or other damage were found on the cylinders, pistons and rings. The dark deposit found on the pistons was due to normal operation (Fig. 12).

Measurements of the piston/cylinder diameters and clearance confirmed proper operation of the pistons in the cylinders. Normal wear and tear was found.

Fig. 12. A dark carbon deposit visible on a piston.

2.5.7. Inlet and exhaust valves

The condition of the valve face surface confirmed proper performance of the suction and exhaust valves that ensured tightness of the cylinders (Fig. 13).

Fig. 13 A view of the exhaust and suction valve faces.

2.5.8. Con rods, bushings

No signs of seizures or overheating were found on the surface of the con rods and bushings (Fig. 14). The bushings were properly mounted, and the presence of oil on the cooperating surfaces indicated that the lubrication system operated properly. The measured bushing and con rod slacks were within the values set by the manufacturer.

Fig. 14. A view of con rods and bushings

Furthermore, the examination identified cracks in the rubber connectors of the suction system (not all the way through) that did not have any impact on the occurrence. The Certificate of Release to Service (CRS) referred to invalid versions of the Airframe and Engine Manuals

An analysis of the aircraft operating documentation and the measurements and tests performed did not lead to identification of any malfunctions that could have caused the engine to operate improperly during the flight on the occurrence day.

2.6. Supplementary information

Before the publication of the final report, the PKBWL conducted consultations on its draft, requesting comments from interested parties and from the NTSB and EASA:

a) None of the interested parties submitted substantive comments; b) the translated Draft Final Report was submitted to the NTSB and EASA. None of the above institutions submitted comments to the PRK.

3. Conclusions

3.1. Findings

1) The pilot held a valid rating to perform the flight in accordance with applicable regulations.
2) The pilot held a valid aero-medical certificate.
3) The airplane's mass and centre of gravity were within acceptable limits.
4) No evidence was found of any defects or irregularities in the aircraft functioning that could have contributed to the accident.
5) No malfunctions were identified during the tests that could have caused the engine to operate improperly during the flight on the occurrence day.
6) The minor damage to the aircraft was a result of collision with very waterlogged terrain.
7) The meteorological conditions during the flight were conducive to carburettor icing at any phase of the flight.
8) The pilot made a wrong identification of the cause of the gradual engine speed drop.
9) The pilot did not comply with the carburettor icing procedure provided in the FM.
10) The airplane was filled with unleaded 98 petrol (car fuel).

3.2. Causes and contributing factors

1) Occurrence of meteorological conditions that were conducive to carburettor icing.
2) Lack of a detailed analysis of meteorological conditions before the flight.
3) The pilot inappropriately assessed the cause of the engine speed drop ruling out the possibility of carburettor icing.
4) Inadequate knowledge of and non-compliance with the carburettor icing procedure provided in the FM on the part of the pilot.
5) The pilot's premature decision to perform a precautionary landing when the engine performance enabled him to continue the flight.

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