1 - FLIGHT PROCEDURE

The pilot took off from Antwerp (Belgium) around 2:40 p.m. bound for Saanen (Switzerland) where he had to drop off his three passengers. The flight was carried out under IFR then VFR flight plan, at a cruising altitude of 26,000 ft.

After approximately 1 hour and 15 minutes of flight, still in IFR, the Geneva controller authorized the pilot to descend to FL 210 and to proceed towards Saanen for the approach. Shortly thereafter, radar data showed that the aircraft was deviating from the planned path. Following a question from the controller, the pilot reported an autopilot problem. The controller then asked him to follow the 165 ° course, which the pilot reads, then asked him "if it's good for safety". The pilot replied that he had a "big problem". Radar data shows steep turns downhill. During these upgrades, the pilot indicates that he is “totally in BMI” in response to a request from the controller. During this communication, the aircraft's overspeed alarm can be perceived. The aircraft was then descending at 15,500 ft / min. About ten seconds later, it climbed to 15,500 ft / min. The right wing broke about twenty seconds later. The indicated speed is then 274 kts and the altitude of 12,750 ft.

The wreckage was found in a wood in the town of Solemont (25). A piece of the right wing was found about 2.5 km from the main wreckage; debris, all from the right wing, is found on a southwest / northeast axis. The most distant element is found 10 km from the main site.

2 - ADDITIONAL INFORMATION

2.1 Wreckage examinations

The examinations carried out at the accident site and on the wreckage made it possible to establish the following facts:

The airplane struck the ground with an indicated speed of 305 kts (marked anemometer) and a pitch attitude of around 80 °;

Part of the right wing of the airplane broke in flight and separated from the rest of the airframe;

The flight controls were continuous at the time of the flight rupture;

The front spar of the right wing was broken by overload and showed no previous damage;

The state of the autopilot clutches on the three axes indicates that the autopilot was probably disconnected at the time of the collision with the ground;

The violence of the collision left the occupants no chance of survival.

In addition, a spectral analysis of communications with the controller indicated that the engine was operating at nominal speed.

2.2 Pilot information

The pilot had held a commercial pilot license since 2005. He had been flying on a PC-12 since May 2004 and had obtained his instrument flight qualification in 2005. He also held instructor qualifications (airplane and mountain) and examiner (airplane).

The pilot's experience was distributed as follows:

5,971 flight hours;

Including 5,691 flight hours as captain;

1,785 flight hours on PC-12;

1,226 flight hours in IFR.

A relative, also a pilot, indicated that the pilot was comfortable with the use of the automated systems as in manual piloting and described his piloting as “flexible on the controls”. He was well versed in the operation of the weather radar and always bypassed storm cells widely.

The investigation did not determine the pilot's IMC flight experience. It was declared fit on its last type-extension and instrument flight. Only one adjournment was made regarding the extension of the instrument rating in 2007. The failure was linked to a lack of approach training.

2.3 Meteorological information

When the pilot is authorized to descend by the Geneva controller, the aircraft operates in a stormy area.

The TEMSI EUROC card valid at 3 p.m. provides the following information in the region of the accident:

A cloud layer extending from 3,000 ft to FL 400;

Cumulonimbus embedded in the mass, the top of which reaches FL 400;

Showers of rain and hail;

Moderate icing between FL 130 and 230;

A 0 ° isotherm at FL 130.

The TEMSI France map also indicates that the pilot crossed rainy areas during the climb after takeoff from Belgium.

Forecast and observation messages from aerodromes near the route followed report thunderstorms, precipitation and cumulonimbus clouds.

The analysis made by Météo France after the accident mentions the existence of strong icing zones along the Jura, linked to the presence of convective cells. It also indicates "a very humid or even saturated atmosphere". The heavy icing area covers the accident area.

Note:

The distribution of debris from the right wing was consistent with the wind direction at the time of the accident.

The aircraft is certified for flight in known icing conditions. It is equipped with weather radar and a defrosting system. The investigation did not determine the operating condition of these systems at the time of the accident.

A relative of the pilot indicated that he used to use digital media to view weather information. The investigation did not determine the elements available to the pilot to prepare and conduct his flight.

2.4 Other events

- Autopilot failure on the HB-FPZ

The pilot reported to Pilatus that during an ILS autopilot approach a few days before the accident, the aircraft suddenly turned to the left. The pilot then disconnected the autopilot and continued the approach without difficulty. The plane was to be taken to Pilatus on the Monday following the accident for examination. The pilot had not reported any other autopilot problems.

- Roll control difficulties on a PC-12 in Canada

Pilatus was notified of an incident that occurred in February 2012 in Canada. Shortly after takeoff, the pilot flew approximately fifteen minutes in heavy rain, before being authorized to climb and cruise on FL 260. The pilot then noted slight oscillations in roll and

attitude. Thinking of an autopilot problem, he disconnected it. By taking over the controls, he found that the roll control required significant efforts, as if the autopilot had remained connected. Pitch control was normal. The use of all the means of disconnection of the automatic pilot, including the circuit breaker, had no effect on the rigidity noted on the roll control.

During the descent, the roll control returned to normal when passing 5000 ft, while the outside temperature was -1 °. The flight was continued without incident.

On the ground, moisture was found at the level of a guide of the aileron control rod. The stiffness of the roll control was then attributed to the icing of the water present there when the aircraft flew in colder air.

Tests carried out on the ground by Pilatus have shown that when water infiltrates this area and freezes, the efforts required to actuate the fins are increased by approximately 31 N. In flight at an indicated speed of 180 kts, these efforts are 97 N, which remains below the 222 N limit imposed by the certification for a temporary effort.

2.5 Flight manual

The aircraft flight manual indicates, in section 2 Limitations, section Strong Icing Conditions, that, when the flight is made in known icing conditions, attention must be paid to tactile indications such as a hardening of the controls in order to verify that these efforts are not masked by the use of the autopilot. It is recommended to disconnect the latter at regular intervals in order to detect abnormal hardening.

The manual indicates that in the event of an autopilot malfunction, its disconnection can cause significant effort. These can be compensated by manually acting on the compensators.

The manual also specifies that the use of the autopilot is prohibited following abnormal operation or failure of the latter and as long as a corrective maintenance operation has not been performed.

It was not possible to determine whether the pilot was aware and aware of this information.

2.6 Data available

The aircraft was not equipped with flight recorders; the regulations do not require it.

It was equipped with an EGPWS and CAWS (Central Advisory and Warning System) which can record alarms and certain flight parameters. Their total destruction during the accident did not allow data to be extracted.

The aircraft was also equipped with an extended Mode S transponder. Basic mode S transmits the aircraft identification, altitude and transponder code. Extended S mode transmits in addition to the flight parameters measured by the aircraft's instruments (indicated speed, roll, vertical speed, magnetic heading in particular).

At the date of the accident, these extended data were not processed in real time by French radars. The radars are capable of performing extended surveillance receiving the heading, speed, course, roll and selected altitude parameters of the aircraft. However, this ability is only activated on a speed camera for testing and study purposes. The limitation of the current bandwidth of the DSNA communication network does not allow a general activation of these capacities. The latter is scheduled for the end of 2015. On this date, the data from the extended surveillance will then be centralized and recorded.

Swiss radars recorded the extended data of the aircraft during its last thirty minutes of flight. These show slow oscillations (periods between 45 and 80 seconds) and of increasing amplitude of the roll and the vertical speed. These oscillations seem to begin before the recording of mode S and before the pilot do not communicate his difficulties to the Geneva controller. The period and amplitude of these variations suggest that they are not related to turbulence and that the autopilot was not connected.

2.7 Flight in icing conditions

Transport Canada published an information circular (1) to air operators in May 2010. The document aims to help operators to define their training programs and to "make pilots more aware of the real dangers associated with flying in icing conditions".

This circular specifies in particular:

"The warning sign of untimely roll for a pilot is to note, after having disconnected the automatic pilot when it is operating in icing conditions that its fins are soft or react abnormally to its stresses".

The circular recommends, as a corrective measure, to “disconnect the autopilot and resume manual piloting of the aircraft. The autopilot can hide important clues or can disconnect itself when the effort exerted exceeds the limits and the pilot is then faced with sudden and unusual plates and efforts”.

"When the autopilot is used in icing conditions, it can mask changes in performance caused by the aerodynamic effects of icing, which would otherwise be detected by the pilot if the aircraft was piloted manually. It is strongly recommended that pilots disengage the autopilot and pilot the aircraft manually when flying in icing conditions. If this is not desirable for safety reasons, such as too much cockpit work or when operating with a single pilot on board,

pilots should closely monitor the autopilot. This can be done by frequently disengaging the autopilot while holding the control wheel firmly.

3 - LESSONS LEARNED AND CONCLUSION

3.1 Pilot diagnosis and loss of control

The aircraft's unusual oscillations and attitudes were present in the first moments of the event, before the pilot reported an autopilot problem to the air traffic controller. In addition, the attitudes successively adopted by the aircraft are incompatible with the operation of the autopilot alone, even when stuck in one position. It was therefore probably disconnected during the oscillations. However, this situation and the recent case of autopilot malfunction may have led the pilot to incorrectly diagnose an autopilot failure, thus explaining the messages transmitted to the Geneva controller.

The available meteorological information indicates probable icing conditions in the accident area. It is not possible to determine the gravity of the phenomenon, which could nevertheless cause the aircraft cell to be iced. The oscillations in altitude and speed shown by the extended S mode data are consistent with contamination of the airframe and / or the airfoil by frost. The incident in Canada has similarities to this accident (weather conditions, oscillations in altitude and speed), but it cannot be established with certainty that the same phenomenon happened again.

It is then possible that the pilot encountered difficulties in controlling the trajectory due to the ice accumulated on the wing and / or around the aileron control. This contamination could lead the pilot to exert inappropriate actions on the controls, in particular through an over-correction of the deviations of attitude of the plane.

Two hypotheses could explain the loss of control of the aircraft when the airframe is contaminated by icing or the aileron control is made hard by ice:

The pilot having difficulties in controlling his trajectory, it is possible that the airplane entered a cumulonimbus or strong turbulences, rendering the airplane uncontrollable;

The pilot was able to over-correct the roll and altitude oscillations, leading to an amplification of the phenomenon instead of its damping.

Periodic flight check of flight controls or failure to use the autopilot as a result of its malfunction, as provided in the flight manual, could have improved the pilot's situational awareness and helped prevent loss control.

3.2 Flight recorders on light aircraft

The use of on-board recorders on turbomachine airplanes with a maximum take-off weight of 5,700 kg or less and the first individual certificate of airworthiness of which was issued after January 1, 2016 is recommended in Annex 6 to the Convention relating to International Civil Aviation on the Technical Operation of Aircraft. In addition, several safety recommendations have been issued by investigative authorities to extend the use of the recorder to other types of aircraft.

This subject is currently being studied by EASA through a regulatory task (RMT.0271 Recorders for Small Aircraft) started in 2013 and whose completion is scheduled for 2016.

It should also be noted that from serial number 1271, the PC-12 / 47E are equipped with protected CVFDR combined recorders.

As this regulatory task is in progress at EASA, no safety recommendation is made at this stage.

3.3 Causes

The rupture in flight of the right wing was due to an overshoot of the admissible loads by the structure of the airplane during the loss of control by the pilot.

In the absence of flight recorders, the investigation did not determine the causes of this loss of control. It is possible that it was caused by a loss of awareness of the pilot's situation at the controls of an airplane affected by an icing phenomenon. This phenomenon could have affected the aircraft wing or an area located around the roll control.