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Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile

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SAFETY INVESTIGATION REPORT

Accident to the CESSNA TR182 (RG) registered D-ELXC on Friday 19 July 2024 close to Vichy - Charmeil aerodrome

Time	Around 17:50[1]
Operator	Auvergne Chute Libre
Type of flight	Skydiving local flight
Persons on board	Pilot
Consequences and damage	Aeroplane damaged
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation. As accurate as the translation may be, the original text in French is the work of reference.	

Collision with vegetation during an off-field emergency landing

1 HISTORY OF THE FLIGHT

Note: the following information is principally based on statements, radar data and the data from the aeroplane's EDM[2].

The pilot took off from runway 01 of Vichy - Charmeil aerodrome with two pairs of tandem[3] skydivers for a jump at FL 100[4]. On returning to the aerodrome, the pilot boarded two new pairs of skydivers with the engine running. He took off again and climbed to FL 100 for the second jump[5]. At the end of the jump, he joined the beginning of the downwind leg of the left-hand circuit for runway 01.

During the descent, as he reached the end of the downwind leg, the pilot adjusted the power control and noticed that the engine was no longer delivering power. He checked the position of the magneto selector and the mixture control but found no anomalies. He began a left-hand turn to join the runway but realized he was too low to reach it. He extended the landing gear and the flaps to the first position before searching for a suitable field to land in. He judged he was too high for the first field he identified and chose another one nearby. He fully extended the flaps and adjusted his flight path. He realized he was going to fly at a very low height over an inhabited house and carried out a left-hand sidestep. The tip of the left-hand wing then struck a tree at the beginning of the field and was torn off. The aeroplane touched down in a nose-down attitude, and the pilot

[1] Except where otherwise indicated, the times in this report are in local time.
[2] Engine Data Monitoring computer.
[3] A skydiver with a "tandem pilot" rating and a passenger.
[4] The glossary of abbreviations and acronyms frequently used by the BEA can be found on its web site.
[5] Fourth flight and sixth skydiving jump flight of the day.

braked sharply. The aeroplane pivoted 180°, the tip of the right-hand wing struck a second tree, and the aeroplane came to a stop. The pilot put the aeroplane into a safe configuration and then evacuated it.

2 ADDITIONAL INFORMATION

2.1 Examination of site and aeroplane

The aeroplane was situated in a field at 1,300 m from and to the west of the threshold of runway 01 of the aerodrome at an altitude of 870 ft. Marks from the main landing gear run were visible and showed a slight leftward deviation before the aeroplane pivoted 180°. The aeroplane travelled approximately 40 m between the collision with the tree at the beginning of the field and its final position.

Figure 1: overview (map source: Google Earth)

The tip of the left-hand wing was torn off and found in the tree at the beginning of the field. Distortions were visible at the left-hand wing root and on the upper surface of the wing.

The front of the right-hand wing tip was dented, corresponding to the point of contact with the tree when the aeroplane pivoted.

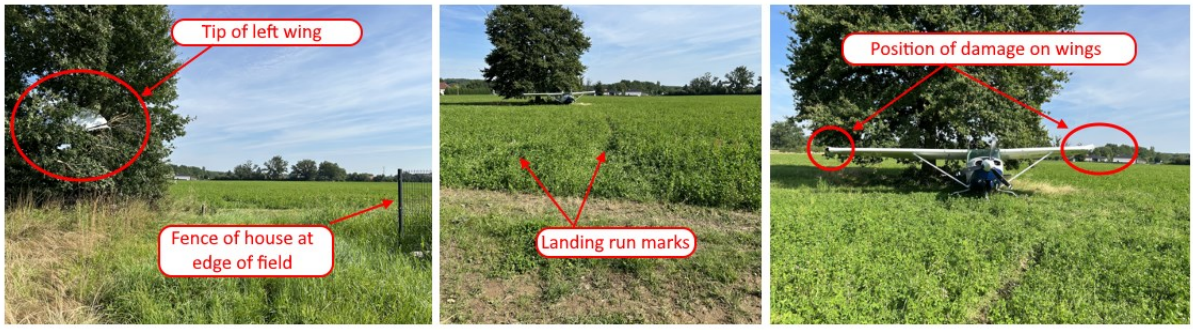

Figure 2: damage and marks (source: BEA)

The three metal blades of the propeller were bent backward, indicating that the engine was not delivering power at the time of landing.

The aeroplane's tail was slightly damaged and folds were visible on the moving part of the elevator.

The positions of the contacts, fuel selector, and power and mixture controls were changed after the aeroplane came to a halt and are therefore not representative of their positions at the time of landing.

Both wing tanks were empty; however, according to the statement made by the firefighters who arrived a few minutes after the accident, fuel was leaking from the left-hand wing, for an estimated quantity of around fifty litres.

Note: this amount of fuel is close to that which was available in the left-hand tank after refuelling (total amount on board 110 l according to the pilot's flight log) prior to the two skydiving flights.

2.2 Pilot information

2.2.1 Experience

The 23-year-old pilot held an aeroplane commercial pilot licence (CPL(A)) issued in September 2023. He held the following ratings:

- single engine (SEP) issued in October 2021 and revalidated in June 2023;
- multi-engine (MEP) issued in November 2023;
- instrument (IR) issued in January 2024.

He had totalled 256 flight hours, including 136 hours as pilot-in-command. The morning of the day of the accident, he had flown for one hour[6] with an instructor[7] in order to familiarize himself with the Cessna 182 and obtain the approval to carry out skydiving flights[8].

2.2.2 Statement

The pilot stated that it was the first time that he had carried out skydiving flights. He added that he had just been hired by Auvergne Chute Libre and had received the company's OM (Operations Manual) on 16 July, three days before the accident flight. He confirmed that he had indeed carried out a one-hour flight[9] with an instructor that morning to obtain the solo-pilot approval for the aeroplane and the approval to perform skydiving flights. The flights preceding the accident were uneventful. He indicated that between each series of flights, he added fuel[10] after checking the fuel levels in the tanks and distributed the amount between the two tanks according to his gauge readings. He specified that he used the standard consumption of 25 l per flight to calculate the amount of fuel to add for the next flight.

The pilot stated that at the beginning of each flight, he set the fuel selector to "both" and did not check it again until the end of the flight. He specified that he did not rely on the fuel gauge readings on board the aeroplane, as, in his opinion, they were inaccurate.

For the accident flight, he descended without noticing any anomalies and adopted a flight path to join the start of the downwind leg at an altitude of 1,800 ft. He explained that at the beginning of the downwind leg, while applying power to stabilize level flight, he noticed a sudden drop in manifold pressure. He checked the position of the mixture control and magneto selector and found

[6] The flight time to obtain the skydiving flight approval did not comply with the company's OM.
[7] Company's nominated person for crew training (NPCT).
[8] The company's OM does not stipulate that these two objectives can be grouped together in a single flight.
[9] A two-hour flight is recorded in the pilot's logbook.
[10] The information entered by the pilot on his flight log and the fuel pump reading are consistent.

no anomalies[11]. He specified that he did not check the position of the fuel tank selector. He turned left towards the aerodrome but judged that he was too low to reach the runway threshold and did not have time to try and restart the engine.

He added that he extended the flaps to the first position and searched for a field to land in. He targeted a first field, but as he was too high, he chose the next one, which was just behind it. He fully extended the flaps to have the minimum approach speed before realizing that his final approach path would take him very low over the garden of a house where people were present. He carried out a left-hand sidestep to avoid it. He stated that the tip of the left-hand wing struck a tree, destabilizing the aeroplane whose nose gear then hit the ground hard. He braked hard, and the aeroplane pivoted 180° before coming to a stop in front of a tree. He explained that he initially evacuated the aeroplane before returning to put the fuel tank selector and magneto switch to the "OFF" position.

He stated that during the flight, he did not have time to transmit a distress message by radio or to display the 7700 code on the transponder.

2.3 Aircraft information

2.3.1 General Information

The Cessna TR182, registered D-ELXC, is a high-wing monoplane. It belongs to the Auvergne Chute Libre. The aeroplane is equipped with a 235 hp Lycoming O-540-L3C5D turbocharged carburettor engine and a three-blade metal propeller. It has a retractable tricycle landing gear. Each wing has a bladder tank with a capacity of 174 l, of which 167 l are usable.

The aeroplane had been modified for skydiving with a gullwing door on the right-hand side. It can carry up to four passengers in addition to the pilot. The seat to the right-hand side of the pilot had been removed, as well as the control wheel; a guard had been added to the end of the control wheel shaft. A rigid protective backrest had been added for a skydiver to lean against, and which also ensured sufficient space with respect to the line of operation of the flight controls and their full stroke.

[11] The fuel mixture was set to "full rich" and the magnetos to "1+2".

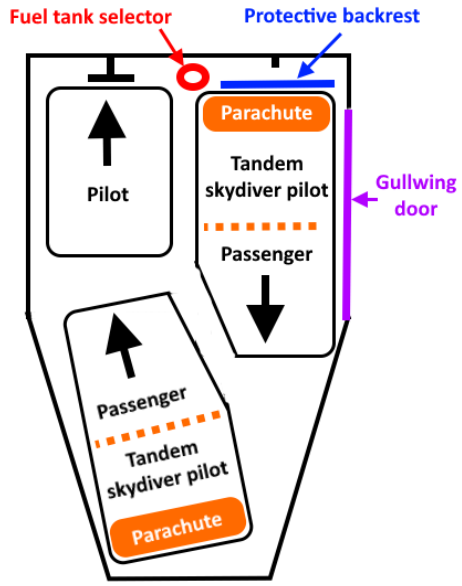

Figure 3: position of tandem skydivers in the aeroplane (source: BEA)

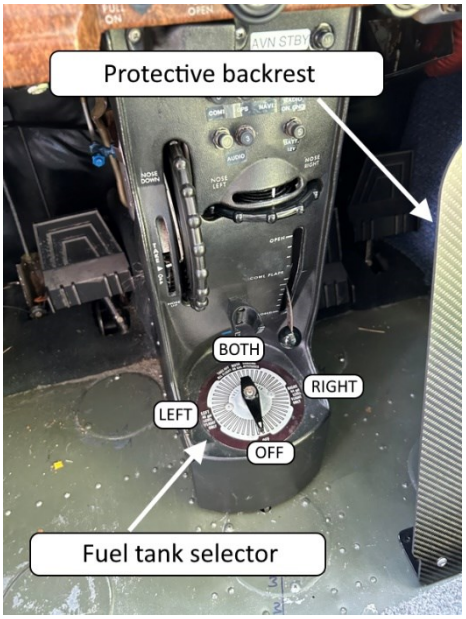

Figure 4: layout inside the airframe (source: BEA)

2.3.2 Special instructions in flight manual

The aeroplane checklist specifies that the pilot must check that the fuel selector is set to "Both" before take-off, before starting the descent and before landing.

The aeroplane's flight manual states that when the fuel tank is less than a quarter full, prolonged sideslipping can lead to the fuel system unpriming.

When the fuel selector is set to "Both," the amount of fuel drawn from each tank can vary significantly if the wings are not level (e.g. during turns). In addition, with the selector set to "Both," fuel can flow from one tank to the other via the selector which helps balance the aeroplane during flight.

2.3.3 Special instructions in OM

The company's OM indicates that:

- during refuelling, the fuel selector should be set to "Left" or "Right" to avoid fuel transfer from one tank to the other;
- the pilot must not carry out a sideslip manoeuvre when there is less than a quarter of the tank's capacity in the wing to prevent engine fuel starvation;
- the tank levels before and after refuelling must be checked with a dipstick in order to verify the consistency of the information and comply with the total fuel load values;
- for a drop at 3,000 m (FL 110), the standard consumption for a rotation is given as 25 l (5 l for taxiing and 20 l for flight). The total fuel load (route, diversion, final, and additional as determined by the company) is 36 l.

2.4 Operator information

Auvergne Chute Libre, founded in 2020, registered as an SPO[12] operator with the DSAC-CE in July 2021. Its primary activity is tandem skydiving. It has an OM defining its organization, activities, and associated procedures in accordance with European AIR OPS[13] regulations, Part ORO/SPO. Its main activity is located at Vichy-Charmeil aerodrome.

The company operates single engine piston aeroplanes with a single pilot, during daylight hours under VFR.

Pilots must, at a minimum, hold a commercial pilot licence (CPL(A)), a SEP class rating, a valid class 1 medical certificate, and a minimum of 150 flight hours, including 100 as pilot-in-command. They must also have completed the operator conversion course (OCC), particularly newly recruited pilots.

The content of the OCC is defined in Part D of the OM (Training paragraph 2.2) and includes several training modules (theoretical and flight-based), including:

- single-pilot crew resource management (CRM);
- approval for the skydiving activity;
- familiarization with the type of aircraft used by the company.

The OCC also stipulates that the pilot must receive the following documents before their arrival:

- the manual for the aeroplane to be used;
- the minimum equipment list (MEL) for the aeroplane in question;
- parts A, B, and C of the OM, which notably concern operating procedures, the aeroplane to be used, and the area where operations are to take place.

2.5 Oversight of the operator by the civil aviation authorities

In accordance with European regulations, the DSAC-CE was responsible for overseeing[14] Auvergne Chute Libre. An initial DSAC-CE inspection was carried out in May 2022, during which non-conformities were identified. Operations were reauthorized on 5 December 2022. An inspection by the DSAC-CE was scheduled for no later than 2026 to comply with the requirements of the oversight cycle.

2.6 Analysis of recordings

2.6.1 Video recordings

For tandem skydives, video clips of a few tens of seconds are recorded at various points during the flight (boarding the aircraft, during the climb, on exiting the aeroplane and under the canopy until landing) to offer the passenger a video of their skydive.

The video clips from the six flights of the day were retrieved and viewed, particularly during the take-off, climb, and exiting the aeroplane phases.

[12] Commercial specialised operation

[13] Commission Regulation No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations (Version in force on the day of the accident).

[14] Four year cycle for SPO operators.

In the video clips, it was seen that:

- the position of the fuel selector is not visible;
- the fuel quantity values on the gauges are significantly lower than the total fuel quantity recorded by the pilot when he manually gauged the fuel level on refuelling;
- the gauge readings vary significantly, especially during take-off, depending on the aeroplane's pitch, bank angle, and sideslip. The values displayed by the gauges do not allow for a detailed analysis of fuel consumption during the various flights, nor for a correlation with the quantities measured with the dipstick or estimated by the pilot;
- the mixture control was consistently set to "full rich" during climbs;
- the (needle) instrument to monitor engine parameters (RPM and Fuel Flow) showed that the indicated fuel flow during climbs was of the order of 14 to 16 US gal/h[15].

2.6.2 Radar recording of last flight

The radar track shows that after the jump at FL 100, the pilot descended by making a series of right-hand turns at an average rate of descent of approximately 1,500 ft/min. He joined the aerodrome circuit (see point 6 of Figure 5) while continuing his descent in the downwind leg at an average rate of descent of 1,000 ft/min. This reduction in the rate of descent probably corresponds to the speed reduction phase in preparation for landing. The descent continued until the end of the downwind leg (point 8), at which point the pilot most likely wanted to readjust power and realized that the engine was no longer delivering power. Up to the last valid (point 9), the average rate of descent was approximately 1,000 ft/min.

[15] The US gallon is an Anglo-Saxon unit of volume. One US gal is approximately 3.78 l.

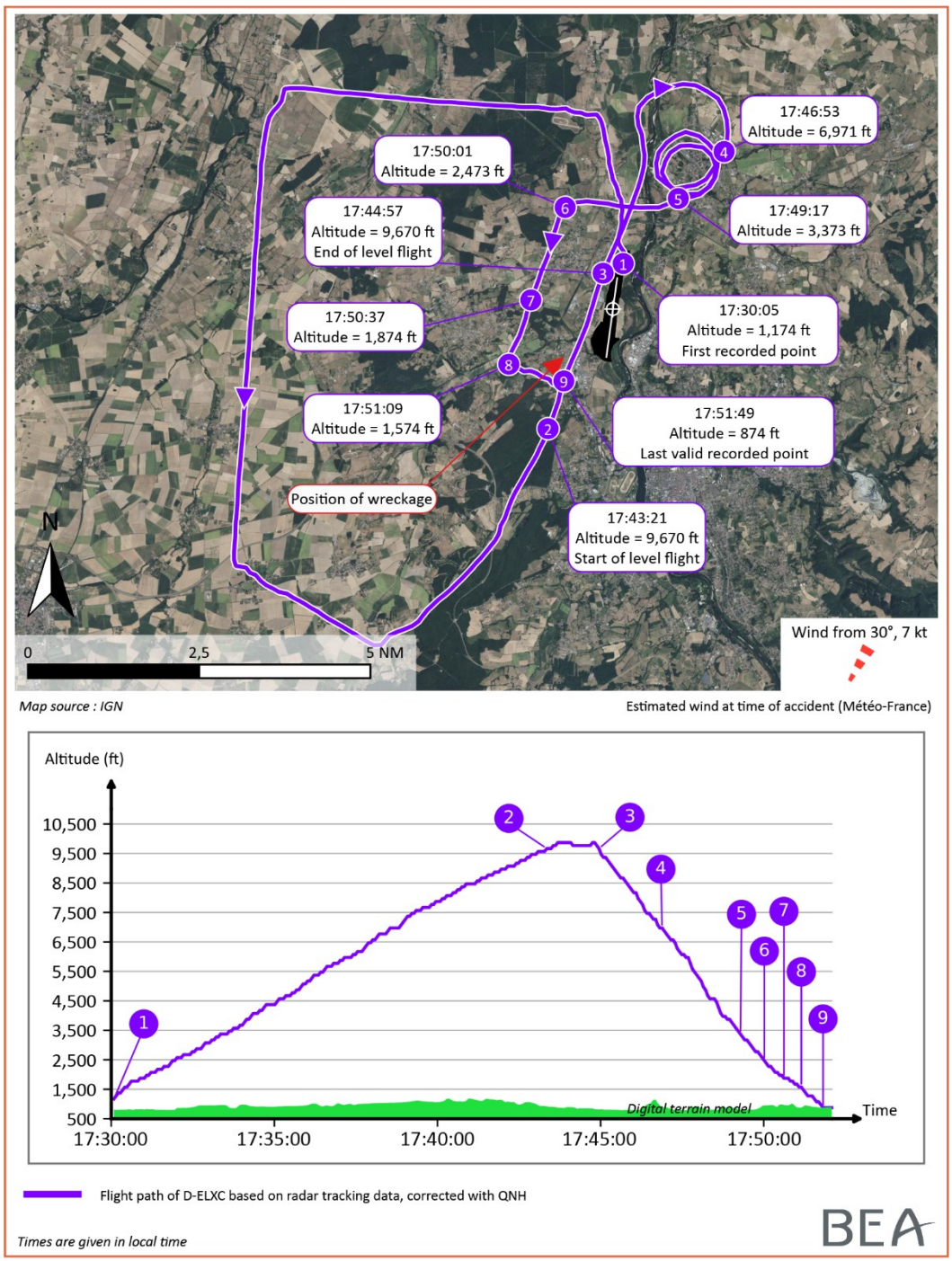

Figure 5: flight path followed during last flight

2.6.3 Aeroplane engine parameter recording

The aeroplane was equipped with an EDM computer that records several engine parameters, including exhaust gas temperatures (EGT), cylinder temperatures, battery voltage and oil temperature.

The parameter chart below shows the last two flights. At the end of the second rotation, the increase in EGT temperatures in a 3 min 2 s interval (see Figure 6, between points A and B) appears to indicate a lean air/fuel mixture until the engine shut down in flight (see point B).

The end of the flight corresponds to the parameter recording stopping (see point C) and occurs approximately 40 s after the engine shut down in flight, which is confirmed by the sharp drop in EGT temperatures (between points B and C).

This abnormal engine operation began approximately four minutes before the end of the flight.

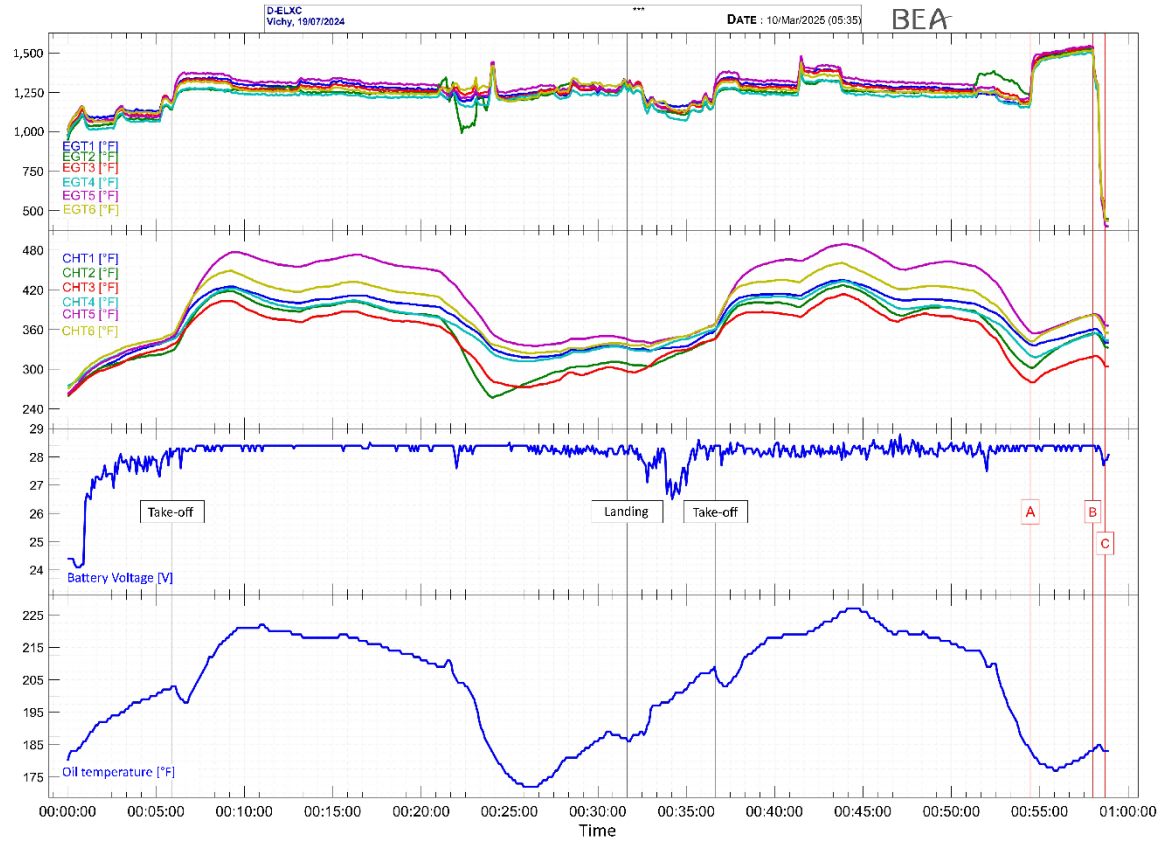

Figure 6: EDM parameter chart (source: BEA)

3 CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation.

Scenario

Before undertaking the two planned skydiving flights, the pilot refuelled the aircraft. He had approximately 55 l of fuel in each of the two tanks. This quantity, given the standard consumption of 25 l per flight, meant that it was possible to carry out two rotations per tank. The pilot then started up the engine, embarked the skydivers and took off. During the descent following the second jump, the engine shut down.

Given:

- the large amount of fuel in the left-hand tank after the accident, according to the rescue services,
- the characteristic lean air/fuel mixture signature observed in the data recorded before the engine shut down,
- the flight time consistent with the amount of fuel in only one of the tanks,
- the company procedures and the pilot's habits, which involved refuelling by pre-selecting one of the tanks,

it is probable that the fuel selector was set to the right-hand tank from take-off and remained in that position during both flights. The pilot omitted to verify that the fuel selector was in the "Both" position and completed both flights with the selector set to the right-hand tank, without realizing it, due to the lack of regular checks of the selector's position.

The engine then shut down during the descent due to a lack of fuel after consuming all the fuel in the right-hand tank. At the end of the downwind leg, still descending, when the pilot wanted to readjust engine power, he realized the engine was no longer delivering power. He checked the positions of the magneto and mixture controls, but not the fuel selector. Given the altitude, the pilot decided to make an emergency landing in a field.

During the landing, the pilot carried out a left-hand sidestep to avoid flying over a house at a very low height. The left-hand wing struck a tree, destabilizing the aeroplane, which then touched down hard. During the run on the soft ground, the aeroplane performed a ground loop, and the right-hand wing tip struck the tree in front of which the aeroplane had stopped.

Contributing factors

The following factor may have contributed to the fuel starvation:

- the pilot's failure to regularly check the fuel selector position.

The following factor may have contributed to the late detection of the engine failure:

- carrying out the aerodrome circuit in a continuous descent which delayed the moment at which the pilot sought to increase power to stabilize the altitude and the detection of the engine shutdown, thus reducing the time available for the pilot to diagnose the malfunction, identify anomalies, and take corrective action.

Safety lessons

Engine power loss or failure due to the fuel system unpriming is a recurring theme in general aviation accident statistics.

The BEA, in its 2024 general aviation safety lessons, emphasizes that this issue is often associated with a problem in fuel management or fuel load.

The accident to F-BUSU on 27 May 2023 at Tarbes-Laloubère illustrates the difficulties of detecting the unpriming of a fuel system when the engine is idling. On final approach, the available reaction time can be limited.

The BEA investigations are conducted with the sole objective of improving aviation safety and are not intended to apportion blame or liabilities.