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INVESTIGATION REPORT

Accident to the Cessna - 172RG registered F-GEJD
on 13 June 2019
at Saillagouse (Pyrénées-Orientales)

Time	Around 15:30[1]
Operator	France
Type of flight	Cross country
Persons on board	Pilot and one passenger
Consequences and damage	Pilot and passenger fatally injured, aircraft destroyed

This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in April 2020. As accurate as the translation may be, the original text in French is the work of reference.

[1] Unless otherwise stated, all times given in this report are in local time.

Loss of control when turning during initial climb while flying in the critical area of the back side of the power curve, collision with ground, fire

1 - HISTORY OF THE FLIGHT

Note: The following information is mainly based on the statements of the helicopter pilots from the Centre de vol en montagne (CVM)[2] who were flying at the time of the accident.

[2] This satellite base of the Army Air Corps Training School (EALAT) is primarily intended to train Army Air Corps (ALAT) helicopter pilots.

The pilot, who was accompanied by a passenger, took off from Muret - Lherm aerodrome (Haute-Garonne) at about 14:30 and headed for the restricted-use Sainte-Léocadie aerodrome (Pyrénées-Orientales).

According to the statements, the pilot checked in on the radio frequency with a view to making an overhead evaluation of the installations at 6,000 ft. He then announced that he was on a right-hand base leg for a touch-and-go landing on runway 07. The aircraft touched down on the ground at the runway threshold (see point ❶ Figure 1), then the pilot applied engine power abeam the aero club (see point ❷ Figure 1). The aircraft rotated just before the helicopter landing pad (see point ❸ Figure 1). The aircraft skimmed the trees at the end of runway 07 and lost altitude in the Saillagouse basin with a nose-up attitude. The pilot reported that he had power problems over the radio frequency. The aircraft turned left, still with a nose-up attitude. The pilot lost control of the aircraft during the turn. The aircraft hit the ground and immediately caught fire.

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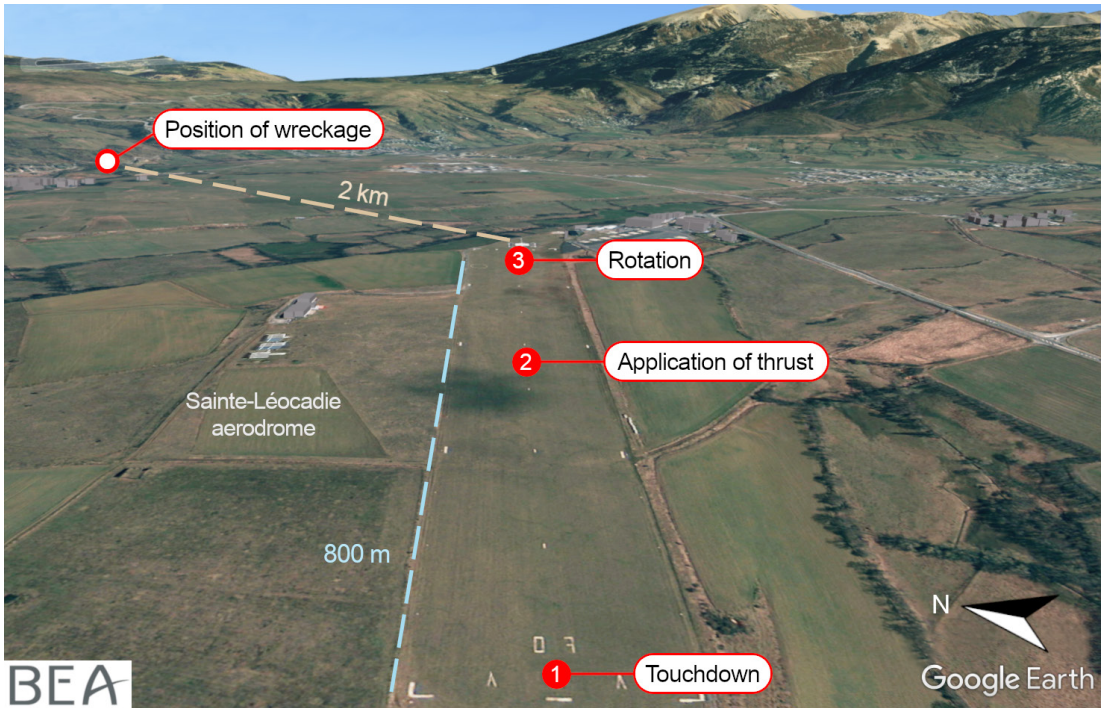


Source : BEA

Figure 1: environment and history of the flight according to the statements

2 - ADDITIONAL INFORMATION

2.1 Site and wreckage information

The aerodrome is located in a mountainous area. There is a small valley running in a south-east/north-west direction to the east of runway 07 (see Figure 1). The wreckage was located on a hillside about two kilometres north-east of Sainte-Léocadie aerodrome at an altitude of 1,295 m. The wreckage was all in one place and had been heavily damaged by the fire.

The examination of the wreckage found the following:

- the flight controls were continuous;
- the flaps were in the retracted position;
- the landing gear was probably retracted;
- the engine was severely damaged by the fire; a workshop examination of the engine found that:
  - the mechanical assemblies were in good working order and rotated freely;
  - the rear accessory case and the carburettor had melted;
  - the position and continuity of the engine controls could not be confirmed.

Based on the damage observed and the examinations carried out, it was not possible to determine how much power was being transmitted by the powerplant at the time of the impact.

2.2 Aerodrome information

Sainte-Léocadie aerodrome (LFYS) is a restricted use aerodrome, which uses a dedicated A/A frequency. It is located in the Pyrenees at an altitude of 4,331 ft (1,320 m). Air traffic is mixed with the presence of helicopters from the CVM school.

The aerodrome has a grass runway[3] 07/25, which is 800 m long and 90 m wide, with a positive slope of about 3.4%, QFU 070. The VAC chart applicable at the time of the accident includes the following items:

- Prefer LDG RWY 07 because of runway slope. No "*Touch-and-go*" RWY 07.

The aerodrome is reserved for pilots based there as well as for pilots:

- with either the mountain rating;
- or with100 flight hours and meeting at least one of the following conditions:
  - have used the field as pilot-in-command in the last 12 months;
  - have carried out a check-out of the site within the last three months in the company of a mountain instructor and obtained their authorization at the end of this check-out.

[3] The height of the grass on the runway on the day of the accident was less than 20 cm.

2.3 Meteorological information

The pilots from the CVM flying at the time of the accident indicated that the wind from the CVM weather station[4] was 180°, 10 kt, gusting to 20 kt.

The meteorological information provided by Météo-France for the day of the accident is as follows:

- East to south-easterly wind at the beginning of the flight with an average speed of 12 knots, veering south midway through the flight with gusts occasionally reaching 25 knots on arrival.
- The airflow from the south over the Pyrenees caused a Foehn effect. Visibility and ceiling conditions were favourable, but mountain wave systems generated moderate turbulence with the presence of stationary rotors in the south-west and north-east radials of the aerodrome. Turbulence was moderate to strong below altitudes of 3,000 m.
- Conditions were not conducive to carburettor icing at Sainte-Léocadie aerodrome.
- The QNH was 1013 hPa.
- The Formigueres weather station, which is located about 20 km from Sainte-Léocadie aerodrome at an altitude of 1,495 m, recorded a temperature of about 18°C at 15:00.
- The Targassonne weather station, which is located about 7 km from Sainte-Léocadie aerodrome at an altitude of 1,600 m, recorded a temperature of about 15 °C at 15:00.

Pilots flying regularly to and from the aerodrome and in the mountains indicate that flying in southerly winds over the Pyrenees is often uncomfortable and flight paths can be difficult to stabilise.

[4] The station does not record data.

2.4 Pilot and passenger information

Pilot

On the day of the accident on 13 June 2019, the pilot, aged 55, held a private pilot licence - aeroplane, which was issued in September 2018. He had logged just over 200 flight hours, including approximately 100 hours as pilot-in-command. He did not have a mountain rating.

He completed his initial training on DR400-180s and DR400-160s at Muret, then flew on C172s and DA40s. He bought the C172RG registered F-GEJD at the end of January 2019. He was trained on this aircraft by an instructor at Muret within the space of about 20 flight hours between late January and early February 2019. Following this further training, he obtained the retractable landing gear and variable pitch propeller endorsement.

At the end of February 2019, he went to Sainte-Léocadie airfield and landed there three times on a DR400-180 with a mountain instructor based there. The pilot thus obtained authorisation to use the site.

According to the statements, the pilot had not returned to the aerodrome until the day of the accident.

Passenger

The passenger, aged 27, had held a microlight licence since June 2019. He was training to obtain passenger carrying privileges. He flew at Muret.

2.5 Aircraft information

F-GEJD was a Cessna 172RG Cutlass with retractable landing gear, and a variable pitch propeller powered by a 180-hp Lycoming O-360-F1A6 engine.

The aircraft was purchased by the pilot after the previous owner had completed a 50-hour maintenance inspection at the end of January 2019. The aircraft had last undergone a maintenance inspection on 24 May 2019 (100-hour maintenance inspection). The aircraft had logged approximately 20 flight hours between that inspection and the accident flight.

Take-off procedures

The aircraft flight manual indicates the following two take-off procedures:

Normal takeoff

1) Wing flaps - 0°
2) Carburettor heat - cold
3) Power - full throttle and 2,700 rpm
4) Elevator control – lift nose wheel at 55 kt
5) Climb speed – 70-80 kt
6) Brakes - apply momentarily when airborne
7) Landing gear - retract in climb out

Short-field takeoff

1. Wing flaps - 0°
2. Carburettor heat - cold
3. Brakes - apply
4. Power - full throttle and 2,700 rpm
5. Brakes - release
6. Elevator control - maintain slightly «tail-low» attitude.
7. Climb speed - 63 kt until all obstacles are cleared
8. Landing gear - retract after all obstacles are cleared

Take-off performance

The aircraft flight manual does not indicate take-off performance for touch-and-go landings (*like virtually all flight manuals for other aircraft*).

As regards the calculation of take-off distances, it indicates only the aircraft performance in the case of a take-off using the short field technique, taking into account the effects of a grass runway[5], the slope of the runway[6], tailwind[7] and temperature:

- In the conditions estimated to be the most favourable on the day of the accident[8], the take-off distance[9] at Sainte-Léocadie is 743 m with a take-off run of 441 m.
- In the estimated average conditions on the day of the accident[10] the take-off distance is 911 m with a take-off run of 541 m.
- In the estimated worst-case conditions on the day of the accident[11] the take-off distance is 1,259 m with a take-off run of 742 m.

As a reminder, the runway length available for take-off at Sainte-Léocadie is 800 m.

The take-off and take-off run distances for a touch-and-go landing will depend, in particular, on the position of the wheel touchdown point, the associated airspeed and the piloting technique.

At Muret on the day of the accident

Witnesses at the Muret aerodrome on the day of the accident indicated that the pilot wanted to make a return flight to Sainte-Léocadie and that he invited a member of the aero club to accompany him. They prepared the flight together at the aero club. However, the nature and content of this preparation could not be determined.

They also indicated that the pilot and passenger knew each other a little before the flight.

The instructor at Sainte-Léocadie

The instructor, who is also the chief pilot of the club based at Sainte-Léocadie, indicated that he was flying at the time of the accident. On returning from flying in the area with a student and during the airfield evaluation at a height of 1,000 ft, he heard the pilot of F-GEJD report on the A/A frequency that he was on final for runway 07. He then saw the aircraft land and take off again without stopping[12]. The instructor continued his runway pattern and saw the other aircraft in flight, but very low and making a turn in the valley. He issued a MAYDAY when he saw the aircraft collide with the ground and catch fire upon impact. Fire fighters and military personnel then proceeded to the accident site and the instructor landed on runway 07.

[5] Increases take-off distance by 15 %.

[6] Increases take-off distance by 5 % for every % of runway slope.

[7] Increases take-off distance by 10 % for every 2 kt of the tailwind component.

[8] Temperature 15 °C, wind 160° (no tailwind component), 15 kt, altitude 4,331 ft, take-off weight at Sainte-Léocadie of 2,300 lbs after one hour of flight.

[9] From application of thrust to passing 50 ft above ground level.

[10] Temperature 15 °C, wind 180°, 15 kt, altitude 4,331 ft, take-off weight at Sainte-Léocadie of 2,300 lbs after one hour of flight.

[11] Temperature 20 °C, wind 180° with gusts of up to 25 kt, altitude 4,331 ft, take-off weight at Sainte-Léocadie of 2,500 lbs after one hour of flight.

[12] He does not know if the aircraft actually touched down on the runway or if it just flew very low over the runway.

He teaches the following points to his students, as well as to pilots who want to carry out site check-outs:

- he recommends landing on runway 07, even with a tailwind, given the slope of the runway. However, he recommends taking off from runway 25;
- touching down on runway 7 should be avoided, once again because of the slope of the runway, and should be excluded when there is a tailwind;
- given the specificities of the terrain, he recommends being able to take off in less than 400 m from the departure aerodrome in order to have the performance required to fly to Sainte-Léocadie;
- in the case of engine failure during take-off from 07, he recommends flying an appropriate left-hand pattern in the valley in order to have a greater height margin;
- he warns that flights can be complicated in the event of southern wave phenomena, with conditions that can change significantly and rapidly.

He reported that he had performed a site check-out with the pilot of F-GEJD in February on a DR400-180 over the course of three landings. During these flights, he explained the specificities of the aerodrome to the pilot.

Helicopter crews from CVM

Several helicopters from CVM were flying at the time of the accident and some of the crews witnessed the event. The statements of the CVM helicopter crews were incorporated into the various sections of the report, primarily in Section 1, History of the flight.

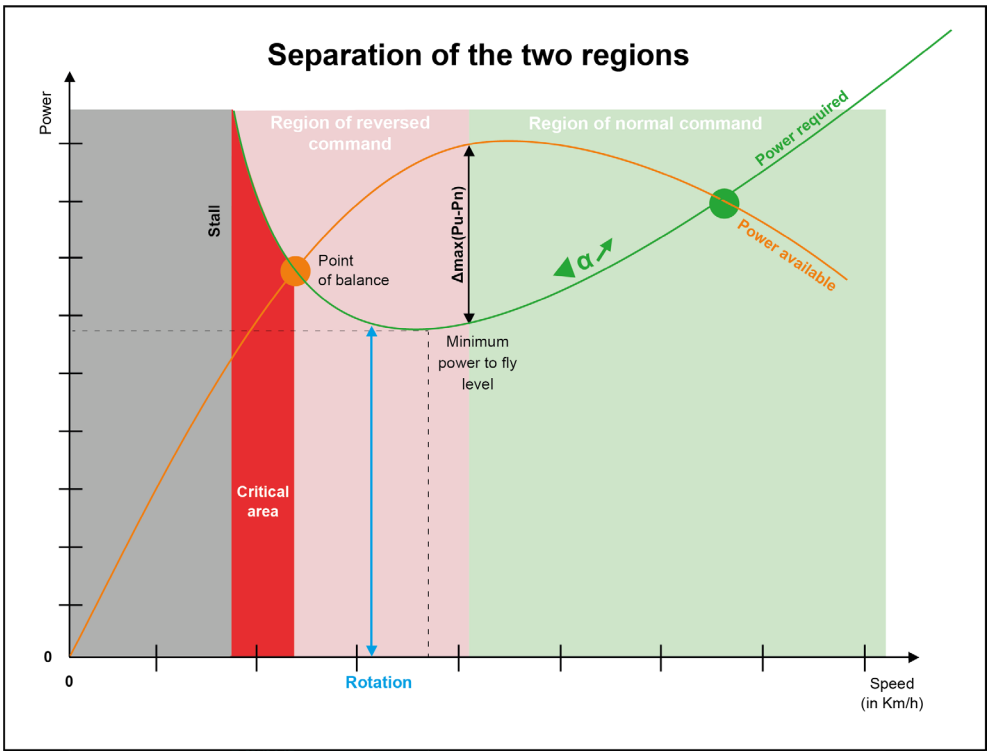
2.7 Critical area of the back side of the power curve

The light aircraft safety portal, in partnership with the French civil aviation safety directorate (DSAC), uses[13] aspects of a 2008 study by the Institute for the Improvement of Aviation Safety (IASA) with respect to flying on the "*back side of the power curve*", also known as the "*region of reversed command*":

The portal indicates that to simplify, a choice was made to reason on the basis of the power required curve and the power output (power available) curve for stabilized level flight (uniform, symmetrical, steady (constant speed) and straight).

The back side of the power curve is the part of the flight envelope situated at angles of attack above the angle of attack where excess power is at its maximum through to stall. It is characterized by an increase in the power required for flight and a decrease in available power as airspeed decreases. Between the power equilibrium point [red spot in Figure 2], when there is one, (intersection between the required power and power output curves) and the stall, the required power exceeds the power output. Level flight cannot be stabilised. This is called flying in the critical area of the back side of the power curve.

[13] https://www.securitedesvols.aero/productions/les-phases-de-vol/l-envol/decollage/le-second-regime-de-vol-et-le-decollage-no



Source: IASA

Figure 2: back side of power curve

In other words, in the critical area of the back side of the power curve and without pilot input to increase airspeed (for example, through a change in nose-down attitude), the aircraft's airspeed will decrease until it stalls. This phenomenon can be perceived by the pilot as a decrease in engine power.

A pilot on take-off may thus find himself in a tricky situation where the aircraft has less power to accelerate to the region of normal command. The instinctive reaction may thus be to increase the attitude in an attempt to avoid obstacles. This action, which increases the angle of attack, exacerbates the phenomenon[(14)].

[(14)] See, for example, the video animation (around 6 min 30) on the web page of the light aircraft safety portal mentioned above.

3 - CONCLUSIONS

The conclusions are established solely on the basis of the information that came to the knowledge of the BEA during the investigation. They are in no way intended to apportion blame or liability.

Scenario

For the first time since his site check-out with an instructor about three months before the accident, the pilot, who did not have a mountain rating, undertook a flight to restricted-use Sainte-Léocadie aerodrome. On arrival, he completed an aerodrome pattern for runway 07 before carrying out a touch-and-go landing.

During the take-off phase, the aircraft most likely entered the critical area of the back side of the power curve. Calculations of take-off distances under the prevailing conditions that day and the various statements given during the investigation substantiate the assumption that the aircraft performance was insufficient to carry out a safe touch-and-go landing on runway 07.

The pilot in all probability interpreted the inadequate take-off performance as an indication of a loss of engine power. The obstacles surrounding the aerodrome probably led him to turn left into the valley. The pilot then lost control of the aircraft during the manoeuvre.

Contributing factors

The following factors may have contributed to the accident:

- insufficient consideration given to the prevailing conditions that day in respect of the aircraft's take-off performance from runway 07 as part of a touch-and-go;
- the pilot's lack of practical experience of the aerodrome and its specificities;
- the decision to carry out a touch-and-go landing on runway 07 despite the aerodrome directive prohibiting it.