CIAIAC

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Report A-028/2017

Accident involving a PILATUS PC6-B2-H2 aircraft, registration EC-EMZ, at the aerodrome of Empuriabrava (Girona, Spain) on 23 November 2017

GOBIERNO DE ESPAÑA

MINISTERIO DE FOMENTO

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Foreword

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission (CIAIAC) regarding the circumstances of the accident object of the investigation, and its probable causes and consequences.

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with articles 5.5 of Regulation (UE) nº 996/2010, of the European Parliament and the Council, of 20 October 2010; Article 15 of Law 21/2003 on Air Safety and articles 1., 4. and 21.2 of Regulation 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future civil aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent from their reoccurrence. The investigation is not pointed to establish blame or liability whatsoever, and it's not prejudging the possible decision taken by the judicial authorities. Therefore, and according to above norms and regulations, the investigation was carried out using procedures not necessarily subject to the guarantees and rights usually used for the evidences in a judicial process.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations.

This report was originally issued in Spanish. This English translation is provided for information purposes only.

Contents

Abbreviations

° ′ ″	Sexagesimal degrees, minutes and seconds
ºC	Degrees centigrade
ACC	Area control center
AEMET	National Weather Agency
AESA	National Aviation Safety Agency
AMT	Aviation maintenance technician
CAMO	Continuing airworthiness management organization
cm	Centimeters
CPL	Commercial pilot license
CRS	Certificate of release to service
CSN	Cycles since new
CSO	Cycles since overhaul
DGAC	Dirección General de Aviación Civil
E	East
EASA	European Aviation Safety Agency
EGT	Exhaust gas temperature
ELT	Emergency locator beacon
FAA	Federal Aviation Administration of the United States
FCU	Fuel control unit
ft	Feet
GPS	Global positioning system
h	Hours
IFR	Instrument flight rules
IR	Instrument rating
ITT	Interstage turbine temperature
KCAS	Calibrated airspeed in knots
kg	Kilograms
KIAS	Indicated airspeed in knots
km	Kilometers
km/h	Kilometer/hour
Kt	Knots

KW	Kilowatts
l	Liters
LAPL	Light aircraft pilot license
LEAP	ICAO code for the aerodrome of Empuriabrava (Girona)
LT	Local time
m	Meters
m^2	Square meters
METAR	Aerodrome weather report
Mhz	Megahertz
mph	Miles per hour
N	North
Ng	Engine gas generator RPM
Np	Propeller RPM
NW	Northwest
ORS	Safety Regional Office
PPL	Private pilot license
RPM	Revolutions per minute
S	South
SEP	Single-engine piston
SHP	Shaft horsepower
S/N	Serial number
SNS	AESA Occurrence reporting system
SW	Southwest
STOL	Short takeoff and landing
TORA	Takeoff runway available
TSN	Time since new)
TSO	Time since overhaul
VFR	Visual flight rules
VFR-HJ	Visual flight rules in daytime hours
V_{ne}	Never exceed speed
V_s	Stall speed
W	West

Synopsis

Owner and Operator:	Jip Aviació, S.L.U.
Aircraft:	PILATUS PC-6/B2-H2, registration EC-EMZ
Date and time of accident:	Thursday, 23 November 2017 at 11:30 local time
Site of accident:	Aerodrome of Empuriabrava (Girona, Spain)
Persons on board:	1 crew - uninjured
Type of flight:	Aerial work – commercial – parachute drop
Phase of flight:	Approach
Flight rules:	VFR
Date of approval:	30 January 2019

Summary of event:

On Thursday, 23 November 2017, a PILATUS PC6-B2-H2 aircraft, registration EC-EMZ and S/N 672, after doing a parachute drop and while descending for the runway 17 approach to the aerodrome of Empuriabrava (LEAP), experienced an engine stoppage. After unsuccessfully attempting to re-start the engine, the pilot made an emergency landing in the vicinity of the airfield.

The pilot was not injured and exited the aircraft under his own power.

The aircraft sustained significant damage, especially to the landing gear, left wing and propeller.

The investigation into the event has determined that the accident was caused by an emergency off-field landing in the vicinity of the aerodrome following an unsuccessful recovery from an engine stoppage at low altitude.

The investigation has concluded that neither the engine nor the aircraft had a technical problem that could have caused the engine stoppage, meaning the stoppage could have been the result of a flameout in the combustion chamber caused by an improperly performed rapid descent.

Contributing to the accident was the improper execution of the emergency procedures for an engine failure and restart in flight.

No safety recommendations are issued in this report.

1. FACTUAL INFORMATION

1.1. History of the flight

On 23 November 2017, the pilot of a Pilatus Porter PC-6/B2-H2, S/N 672 and registration EC-EMZ, owned by a company that engages in sports skydiving activities, arrived at the aerodrome of Empuriabrava (LEAP) at 09:30 LT and activated the skydiving flight plan with the air traffic office in Girona.

After doing the pre-flight check of the aircraft and not finding any problems, the airplane was deemed operational at 10:00 LT. The fuel tanks had a total of 180 liters of fuel between the two wing tanks.

At 10:27 LT, the engine was started in preparation for the skydiving operation, which was executed normally. The total time between blocks was 21 minutes, with an effective flight time of 18 minutes.

After landing normally, at 10:48 LT he stopped the engine at the aerodrome parking apron, in front of the gasoline station, where he took on 50 liters of fuel, 25 in each wing tank. At 10:50 LT, the pilot verified that the total amount of fuel in the tanks was about 175 liters.

Photography 1. Aircraft at accident site

At 11:10 LT, the pilot again started the aircraft engine in preparation for a second skydiving flight. The flight was uneventful.

After dropping the parachutists, he descended to join the left-hand traffic pattern for runway 17 at the aerodrome and land.

As he was starting the base leg of the pattern, upon increasing power to stabilize the descent and continue the pattern, the engine did not respond. He made one unsuccessful attempt to restart the engine and given the low altitude available to complete the standard pattern, since he was at 1500 ft, he prepared to make an emergency landing as soon as possible. When the engine stopped, the aircraft had a speed of 80 kt.

Once in the vicinity of the airfield, at a low airspeed, below 50 kt, the aircraft fell to the ground after the landing gear impacted the edge of a canal.

The pilot was not injured and exited the airplane under his own power.

The accident was then reported to emergency services, the regional police, SNS-AESA and the CIAIAC.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor				
None	1		1	
TOTAL	1		1	

1.3. Damage to aircraft

As a result of the emergency landing, the aircraft sustained visible damage to the propeller, the underside of the fuselage, the front, the flaps and aileron on the left wing and the landing gear.

1.4. Other damage

There was no other damage.

1.5. Personnel information

1.5.1 Pilot

The pilot, a 32-year-old French national, had the following pilot licenses, issued by France's Direction Générale de l'Aviation Civile (DGAC):

- Private pilot license (PPL) since 17 January 2011, with the following ratings:
- Single-engine piston (SEP) (land), valid until 31 January 2018.
- Type rating: Pilatus PC6 SET, valid until 31 October 2019.
- Type rating: BE90/99/100/200 with instrument rating (IR) valid until 31 October 2018.
- Type rating: DHC6 with instrument rating (IR) valid until 30 September 2018.
- Commercial pilot license (CPL) since 17 January 2011.

He had a class-1 medical certificate that was valid until 18 December 2017 and a class-2 and LAPL certificate that was valid until 18 December 2021.

Of note involving the pilot's training is his four-year time of service in the French air force, where he took the skydiving course, which he also took subsequently in the civil sector.

According to information provided by the pilot, at the time of the accident he had a total of 2550 flight hours, of which 460 hours 55 minutes had been on the type of accident airplane.

He also had flight experience on other aircraft types, including the DHC-6, BE-99 and Cessna 206.

According to the aircraft log book, the last flights made by the pilot on the accident aircraft had been as follows:

- On 31/10/2017, flight lasting 1 hour 37 minutes, making 6 landings.
- On 21/11/2017, flight lasting 1 hour 17 minutes, making 5 landings.
- On 22/11/2017, flight lasting 1 hour 39 minutes, making 5 landings.

1.5.2 Maintenance personnel and organization

The organization responsible for maintaining the aircraft is a French EASA CAMO and EASA-Part 145 approved by the French aeronautical authority, which had the accident aircraft included in its scope.

The technician tasked with maintaining the aircraft is an AMT with a valid EASA Part-66 license issued by AESA, with a B1.1 category for turbine-powered airplanes and a Pilatus PC-6 Series (PWC PT6) type rating since 12 June 2009. He also has certifying authority from the maintenance organization and does the aircraft's line maintenance.

1.6. Aircraft information

1.6.1 General information

The Pilatus Porter PC-6/B2-H2 is a single-engine airplane made in Switzerland with a single, braced high wing and configured for STOL operations. It has a fixed landing gear and a tail wheel. The structure is completely metallic. It has 10 seats for passengers and one for the pilot.

The engine is a Pratt & Whitney PT6-A34 turboprop and the propeller is a Hartzell three-bladed HC-B3TN-3D.

The aircraft allows for different types of operation depending on the instrumentation installed: daytime, nighttime, VFR and IFR.

The aircraft is used for aerial work, skydiving, training and passenger transport.

The general characteristics of the aircraft are as follows:

Aircraft structure and performance

- Wingspan: 15.84 m
- Length: 7.32 m
- Wing surface: 30.15 m2
- Maximum height: 3.20 m
- Empty weight: 1205 kg
- Maximum takeoff weight: 2197 kg
- Fuel capacity: 2 x 243 l
- Never-exceed speed (V_{ne}): 151 KCAS
- Average cruise speed: 118 KCAS
- Stall speed (V_s):
  - Flaps 0º: 52 KCAS
  - Flaps 30: 56 KCAS
  - Flaps 60º: 74 KCAS

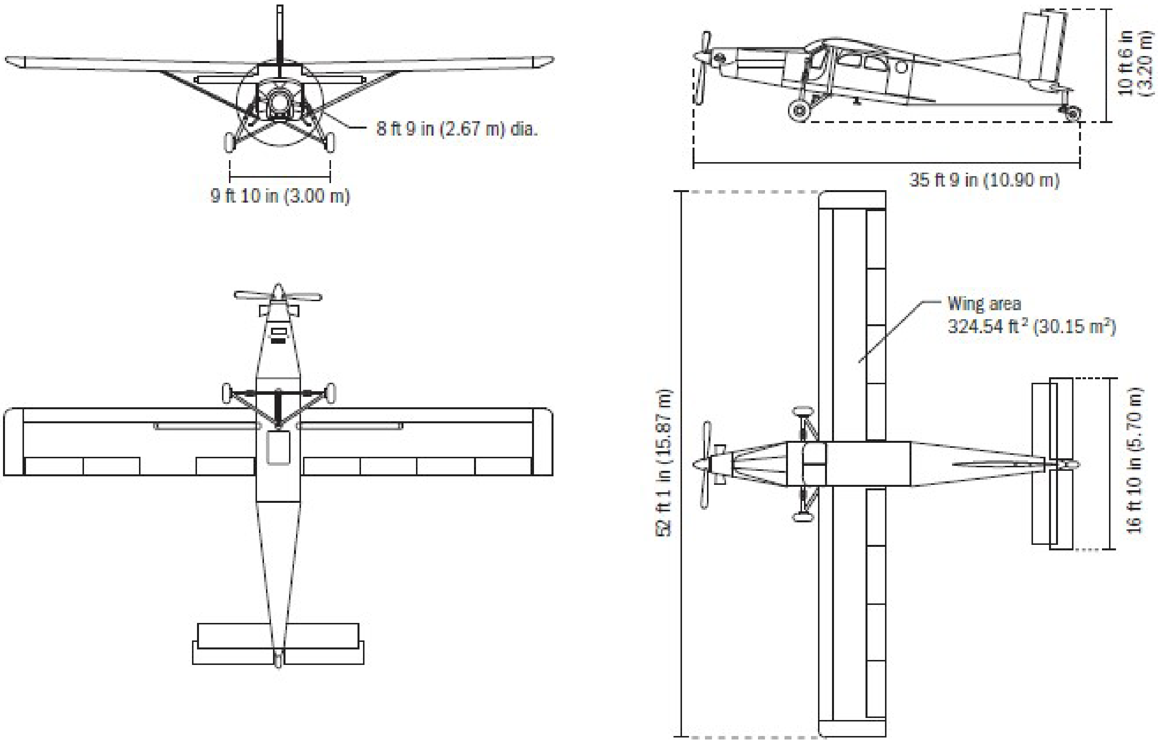


Figure 1. Pilatus Porter PC-6/B2-H2

Instrument panel in the cockpit

Photographs of the instrument panel in the cockpit at the accident site after the event.


Powerplant:

The aircraft had a Pratt & Whitney Canada PT6-A34 turboprop engine, S/N RB0104. Characteristics:

- Free or power turbine and compressor turbine
- Speed of rotation:
  - Compressor: 38100 RPM
  - Free turbine: 33000 RPM
- Shaft horsepower:
  - On takeoff: 550 SHP (400 KW)
  - Maximum continuous: 500 SHP (400 KW)
- ITT[1] reference values:
  - Normal operation: 300 to 725 °C
  - Maximum, takeoff or reverse: 725 °C
  - Maximum, start: 1090 °C

Propeller:

Three-bladed Hartzell HC-B3TN-3D propeller with a 2.56-m diameter and a rated rotation speed of 2200 RPM. Hydraulically actuated, constant speed, variable pitch

[1] ITT: Interstage turbine temperature. The temperature measured by probes and thermocouples located between the compressor and the "free", or power, turbine. This is a very important parameter, since it indicates if the engine is overheating.

propeller with feathering and reverse functions.

Beta Mode: This type of aircraft offers the mode of propeller operation called Beta, which is used in flight to decelerate quickly at high descent speeds. In this performance regime, the blade pitch angle is very small and positive, which yields a braking effect on steep, controlled descents.

In Beta mode, the pitch of the propeller blades is controlled by the throttle lever, not with the governor. The position is below the IDLE position on the throttle lever but above the reverse position. According to the airplane flight manual, the Beta mode works best when the speed is reduced below 100 mph.

Fuel:

- Type of fuel authorized and used: Jet A1.
- The aircraft has two tanks, one in each wing, with a capacity of 243 liters each.
- The airplane was refueled with 50 liters, 25 liters per wing, at the gas station located in the aerodrome. Before the flight, the pilot verified that the total amount of fuel in the tanks was approximately 175 liters.

Oil

The oil used in the aircraft was a synthetic oil for turbine engines, certified as per the MIL-PRF-23699 STD technical specification and the Eastman Turbo Oil 2380 analysis certificate.

1.6.2 Maintenance record

The aircraft was built in 1968 and had serial number 672. The maintenance was performed by a maintenance center approved by the French aeronautical authority as an EASA CAMO and EASA Part-145 organization, with approved maintenance program AMP/EC-EMZ, Ed.1. Rev.2 of 21 March 2017.

The last checks performed on the aircraft as per the approved maintenance program were as follows:

1. Annual or 100-h check done on 22 October 2017:
   - The aircraft’s TSN was 31274:02 hours; TSO – 5234:11 hours; and number of cycles – 58523.

  - o Engine: TSN – 9534:56; TSO – 1724:02;
  - o Various components at the end of their service life were replaced, the actions required by valid service bulletins were carried out, and the following parts were replaced:
    - the Romec pump installed was replaced with the original overhauled pump with CRS dated 24 March 2017 and FAA Form 8130 dated 12 September 2017,
    - the corrosion treatment on the curved coating on the left side of the engine was repaired,
    - replacement of the brake disc and pads.

2. Annual or 100-h check done on 9 August 2017:
   - o The aircraft's TSN was 31174:10 hours; TSO – 5134:19 hours; and number of cycles – 58215,
   - o Engine: TSN – 9534:56; TSO – 1625:02;
   - o Various components at the end of their service life were replaced, the actions required by valid service bulletins were carried out, the vertical stabilizer antenna was inspected, no corrective actions taken.

3. Annual or 100-h check done on 20 June 2017:
   - o The aircraft's TSN was 31074:37 hours; TSO – 5034:46 hours; and number of cycles – 57888;
   - o Engine: TSN – 9435:23; TSO – 1525:29;
   - o Various components at the end of their service life were replaced, the actions required by valid service bulletins were carried out, no corrective actions taken.

As for the PT6-A34 engine, S/N RB0104, the log book was issued to the owner on 5 September 2013. The final flight recorded, lasting 2 hours 14 minutes, was on 22 November 2017, with a total flight time of 9663 hours 25 minutes.

According to information provided by the owner, at the time of the accident, the engine's TSN was 9665:50, TSO: 1755:56, CSN: 14056 and CSO: 3260.

The engine was last overhauled on 8 August 2013, with a TSN of 7909:54 hours and a CSN of 10796 cycles. The overhaul was done by the aircraft manufacturer in Switzerland in order to install it on the accident aircraft. The engine had been taken from a DHC-6-200 MSN 205 aircraft, registration EC-ISV.

During this check, the most recent applicable service bulletins were implemented and functional tests were run on various systems and engine devices, such as the fuel control unit (FCU), the governor, the air bleed valves, the starter control, fuel pumps, ignition system and lubrication system.

1.6.3 Airworthiness status

According to the list of active registrations of Spain's National Aviation Safety Agency, the aircraft with serial number 672 and registration EC-EMZ was registered on 27 March 1989, with registration number 2421. The registration certificate showed its home base as the aerodrome of Empuriabrava.

The current owner of the aircraft is a private company whose primary activity is skydiving, though it also does photography, aerial advertising and tourism flights. It is also a school that offers a private pilot license (PPL) course.

The aircraft has Certificate of Airworthiness #2825, issued by the National Aviation Safety Agency on 5 August 2010, as a "Normal Category Airplane"[2]. The manufacturer is shown as Pilatus Aircraft Ltd. It also has an airworthiness review certificate issued by the CAMO+ maintenance center responsible for maintaining the aircraft, dated 17 August 2017 and valid until 24 August 2018.

The last aircraft logbook entry, dated 28 November 2016, shows that the list flight made on 22 November 2017, the day before the event, lasted 33 minutes and involved two landings. The total flight time was 31308 hours 13 minutes.

As an example of the operation of the accident aircraft, consider the flights made in the month of November prior to the event, which occurred on 23 November 2017. According to the aircraft flight log, it flew on 15 out of the 23 days that month, flying two or three times on some days and making a total of 23 flights, including the accident flight, with a total of 22 flight hours and 73 landings.

The aircraft also had the following authorizations:

- Aircraft station license # 2825/89-3/4, issued by AESA on 10 December 2014, which included the COMMUNICATION 1, 2, NAVIGATION, TRANSPONDER 1 and 2, ELT AND 2 GPS units.

The aircraft was flown by different pilots at the organization. Specifically, the last flight prior to the accident flown by the accident pilot took place on the same day

[2] Normal (does not allow acrobatic flights or spins).

of the event and lasted 21 minutes, from 10:27 LT until 10:48 LT. At 11:10 LT he began what would be the accident flight, which lasted 20 minutes before the aircraft impacted the terrain.

The aircraft had an accident insurance policy that was valid until 22 December 2017.

1.7. Meteorological information

1.7.1. General situation

At low levels, there was an extensive low-pressure area over the Atlantic with numerous centers. The prevailing wind was from the S and SW, and was very intense over the NW part of the peninsula. The cold front generated abundant cloud cover over much of the peninsula, except for the eastern and southern parts.

1.7.2. Situation in the accident area

AEMET does not have a station in Empuriabrava, so the closest stations, which are Castelló de Empuries (about 3 km west) and Figueres (13 km west), were taken as reference.

The forecast called for low clouds in the area of the Gulf of Rosas.

The nearest airport is Girona-Costa Brava, less than 50 km southwest.

The data from these stations were as follows:

Castelló de Empuries:

- Wind from the northwest at about 2 km/h, gusting to 4 km/h
- Temperature around 14º C
- Relative humidity of 84 %

Figueres:

- Wind from the east at 1 km/h, gusting to 4 km/h
- Temperature around 14º C
- Relative humidity of 74 %

The METAR for the Girona-Costa Brava Airport at the time of the accident was:

METAR LEGE 231030Z VRB01KT CAVOK 15/10 Q1017

There were few clouds, visibility was good, and remote images (satellite, lightning and radar) did not reveal any convective phenomena.

The accident occurred during daytime hours.

1.8. Aids to navigation

The flight was conducted under VFR.

1.9. Communications

According to the manager of the organization that owns the aircraft, the communications were standard, according to the procedures and agreements in place with ACC Girona. That is, the start of the flight was reported to Girona and the pilot monitored Barcelona throughout the flight. Since there were no events until that moment, it is of no interest to the investigation to detail said communications.

When the engine failure was detected, and given the low altitude, since the airplane was already on approach, the situation was only reported on the Empuriabrava frequency.

1.10. Aerodrome information

The aerodrome of Empuriabrava (LEAP) is located in the town of Alto Ampurdán, province of Girona, in the Empuriabrava marina.

Its geographic coordinates are 42° 15′ 36″ N 3° 6′ 35″ E.

Communications frequency: 122.4 MHz.

Aerodrome classification: 1C.

Managed by the company that owns the accident aircraft, it has one asphalt runway in a 35/15 orientation, with a TORA of 498 m and width of 21 m. It is at an elevation of 2 m above sea level.

Its facilities offer hangars, parking, repair shop, fuel supply, offices and a social club.

Only VFR-HJ, or daytime visual flights, are allowed at this aerodrome.

Photograph 2. Aerodrome of Empuriabrava (Girona)

1.11. Flight recorders

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder, since the applicable law does not require either for this aircraft type by.

Photograph 3. Damage to flap and aileron on left wing

1.12. Wreckage and impact information

- Left wing:
  - Warping of the leading edge of the wing.
  - The flaps on both wings were extended and the left flap exhibited external damage.
  - There was warping and tearing on the left aileron, next to the trim tab actuating rod.
  - In the top part of the wing, windshield frame was displaced upward some 20 cm.

- Main landing gear:
  - Left gear:
    - The wheel was bent backward and toward the fuselage, warping the sheet metal on the lower part of the pilot access door, preventing it from opening.
    - Broken shock absorber.
    - Leg attachment struts bent backwards.
  - Right gear:
    - The wheel was bent backward and toward the fuselage.
    - The warped wheel had damaged the access step to the passenger cabin.
    - Broken shock absorber.
    - Leg attachment struts bent backwards and broken.

Photograph 4. Damage to landing gear

- Windshield:
  - o Broken in the center.
  - o Frame loose in the top corner of the right wing.

- Engine cover:
  - o Bottom rear portion, behind oil radiator, abraded.

Fotografía 5. Aeronave en el lugar del suceso

- Propeller:
  - o All three blades were deformed and bent backward at an angle of about 90°. Pitch confirmed to be low.

Fotografía 6. Deformación en hélice

Fotografía 7. Daños en parte inferior del fuselaje

- One of the blades was deformed at the leading edge, in the part furthest away from the hub. There were also abrasions on the trailing edge.
- One of the blades exhibited a loss of material on the leading edge, in the part furthest away from the hub, as well as abrasions on the trailing edge.

The structure and characteristics on rest of the aircraft were intact and showed no apparent damage.

1.13. Medical and pathological information

The pilot was not injured and exited the aircraft under his own power.

1.14. Fire

There was no fire during the event

1.15. Survival aspects

The landing did not cause injuries to the pilot, who exited the aircraft under his own power.

1.16. Tests and research

1.16.1. Statements

1.16.1.1 Pilot's statement

The pilot provided the following description of the event:

"The tailwind was a little higher than normal, and he wanted to go out of Beta mode in order to finish the pattern with power.

He pushed the power lever forward slowly to go out of Beta mode, but the engine did not respond.

He tried to apply more power to see if he could get something, but none of the engine instruments moved. In the pilot's opinion, no engine readings were normal and he thought there must have been a problem with the engine.

He engaged the booster fuel pump by placing the switch in the ON position, and turned the nose of the airplane toward the field. By that point, the speed was already below the glide speed and continued to drop with no solution.

The propeller was feathered, according to the pilot, and he then initiated the re-start sequence with “IGNITION” and “STARTER” in the “ON” position.

He put some flaps to give himself more time.

He then saw flames in the exhaust nozzles, only for a few seconds, since they went out by themselves.

While looking for a place to land, he felt as if the engine had started again.

After impacting the terrain, he confirmed that the engine was running, since it was making its usual sound. He then secured the airplane by cutting the fuel and turning the engine off, which again sounded normal.”

During the interview with the pilot, when asked about the position of the propeller control lever and the fuel valve, he confirmed that the former was forward at all times and the fuel valve was open.

1.16.2. Related reports/communications

1.16.2.1 Report from the Manager of the Organization

Following the official notifications of the accident and of the CIAIAC’s intention to open a technical investigation, the following information was received from the Manager of the Organization that owned the aircraft:

“The pilot arrived at the aerodrome at 09:30 LT, activated the skydiving flight plan with the Girona traffic office. He did the pre-flight check, finding no problems. The oil quantity was correct. The fuel filter and fuel tank were drained and no impurities were found. The tanks were dipped and determined to contain about 180 liters in total, divided equally between the two tanks, that is, about 90 liters each.

The pre-flight check was completed and the airplane deemed operational at around 10:00 LT.

The engine was started at 10:27 LT to make a skydiving flight, which was completed normally.

At 10:48 LT, the engine was stopped in the stand opposite the gas station. The total time between blocks was 21 minutes, with an effective flight time of 18 minutes.

The airplane was refueled with 50 liters (25 liters per wing) at 10:50 LT, after which the pilot again dipped the tanks and calculated the total amount of fuel at approximately 175 liters.

At 11:10 LT, the engine was restarted to make a second skydiving flight, which also proceeded normally. After the skydivers were dropped, during the descent the pilot joined the left-hand traffic pattern to land on runway 17. As he started the base leg, he tried to increase power to stabilize the descent and continue with the pattern, but the engine did not respond.

He attempted to restart the engine but could not do so, so he prepared to make an emergency landing in a SW heading since the altitude was not sufficient to complete the standard pattern.

Upon reaching the vicinity of the field at a low speed, the airplane plummeted, and as a result the landing gear impacted the edge of a canal, which stopped the aircraft and made it turn to approximately a S heading. The propeller also impacted the ground.

Once on the ground and having sustained no injuries, the pilot secured the aircraft and exited via the right sliding door.

The Manager noted that the effort to restart was unsuccessful until seconds before the impact, when flames appeared in the engine exhaust and the engine seemed to restart. In fact, during the impact, the engine seemed to be in the start sequence.

After the impact, the pilot immediately cut off the fuel supply, which finally stopped the engine.

The pilot was not injured and exited the airplane under his own power.

The accident was immediately reported to 112 and AESA, and the regional police reported to the scene."

During the investigation, the Manager confirmed that the speed and altitude parameters when the engine failed were approximately 80 kt and 1500 ft, respectively, and that the impact with the ground occurred at a speed below 50 kt.

1.16.2.2 Organization's report to the ORS

The skydiving organization that owned the accident aircraft provided the following report to AESA's ORS on 24 November 2017:

"After a fully normal skydiving drop, during the descent, it joined the left-hand pattern for runway 17 at the aerodrome to land, starting the base leg by applying power to stabilize the descent and continue the pattern. The engine did not respond. The pilot attempted to restart the turbine, which was unsuccesful, and prepared to make an emergency landing in a SW heading, at an angle to the runway, due to a lack of altitude to complete the standard pattern.

Reaching the vicinity of the field at a low speed, the airplane plummeted, and as a result the landing gear impacted the edge of a canal, which stopped the airplane and turned it to approximately a S direction, with the propeller impacting the ground.

Once on the ground and having sustained no injuries, the pilot secured the aircraft and exited via the right sliding door.

No one was injured and no property was damaged."

1.16.3. Tests/Inspections

The investigation began with an inspection of the accident site, as described in section 1.16.3.1.

Considering the statements and evidence identified at the accident site, and after the aircraft was taken to the hangar area in the aerodrome, investigators proceeded to inspect the engine, assisted by CIAIAC partner technical personnel and by the maintenance technician of the organization that owns the aircraft.

The results of this inspection are detailed in section 1.16.3.2.

When the aircraft was visually inspected, it was propped up on some hay bales, tilting to the left side, as a result of which the right wing was higher than the left. The nose was tilted down and the tail was elevated.

The positions of the engine controls in the cockpit were checked. They were secured, with the fuel cut off, the throttle lever at idle and the propeller in the low RPM position. All engine gauges in the cockpit read "0".

The pitch of the propeller, all three blades of which were bent backwards, was low. It was not feathered. The documents revealed that it had been overhauled in April 2017.

Fuel samples were taken in separate containers for each tank, the purge holes and the connection lines to the fuel pumps, the FCU and the filters. The fuel level was checked.

There was fuel throughout the engine, which indicated that it was properly distributed to the engine.

The right-wing tank was practically empty and the left tank, according to the dipstick, contained 150 liters. Both tanks were connected, and since the aircraft was titled to the left side, this meant that the contents had shifted.

The fuel was not contaminated nor were there suspended particles in any of the samples.

After the onsite inspection, and in light of the absence of a malfunction of the engine components, the investigation proceeded to have a specialized organization check the operation of the FCU. The results of this check are described in section 1.16.3.3.

For this same reason, and as a last resort, the investigators decided to send the engine to the aircraft manufacturer for disassembly and a functional check, as detailed in section 1.16.3.5. Data of interest to the investigation were also obtained after the FCU was sent to another specialized organization for an overhaul, as detailed in section 1.16.3.4.

In addition to the technical inspection of the engine's functionality, investigators also analyzed the pilot's execution of the emergency procedures following the engine stoppage and his attempted restart, as described in section 1.16.3.7.

1.16.3.1 Inspection of the accident site

The aircraft's possible path as it approached runway 17 until it impacted the ground is shown in Figure 2.

The aircraft came to a stop at coordinates 42° 15′ 50.68″ N - 003° 6′ 33.10″ E, which is at an elevation of 1 m.

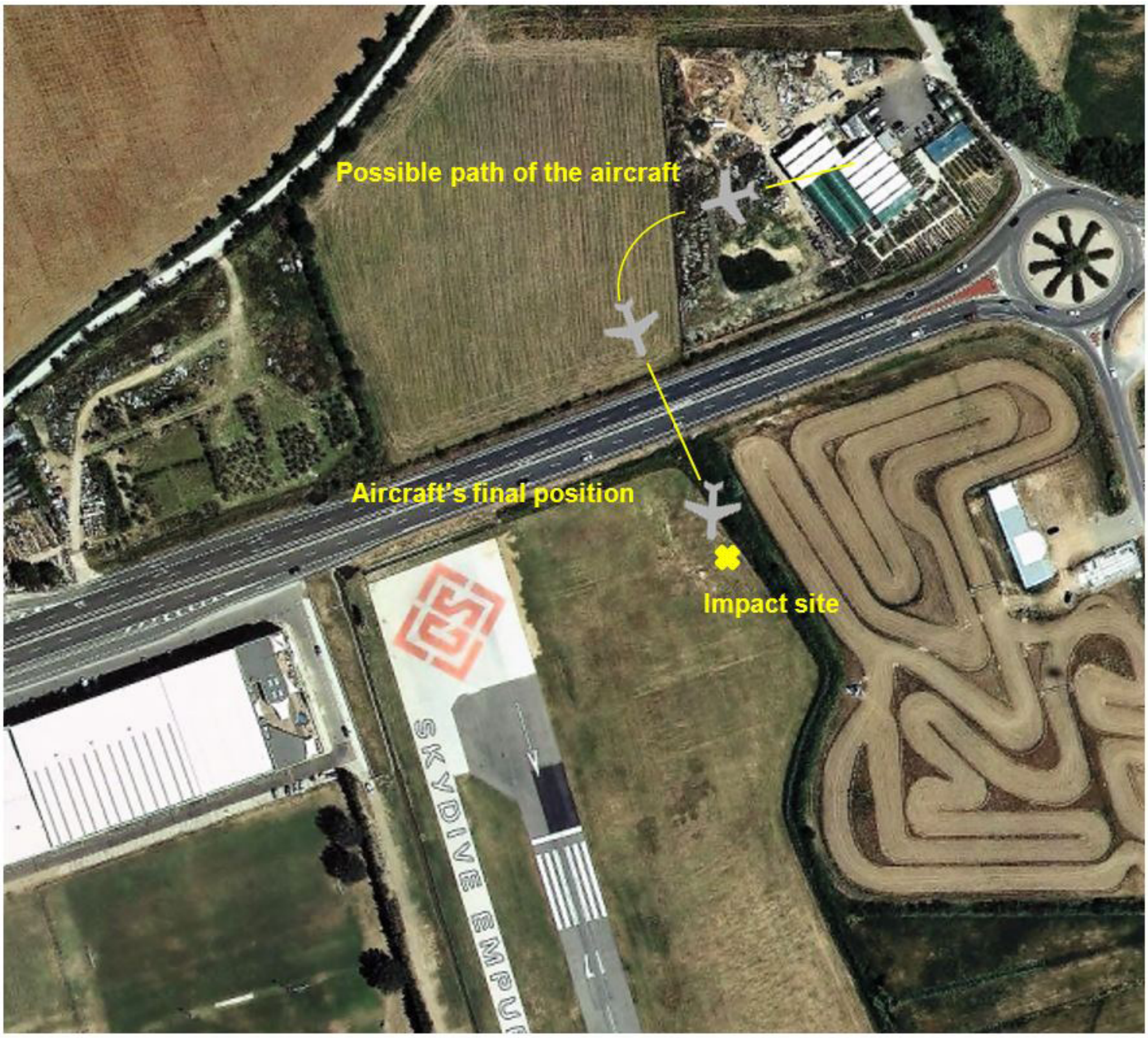


Figure 2. Path of the aircraft during the emergency landing until the moment of impact

1.16.3.2 Engine inspection

The engine was visually inspected before being disassembled so that the powerplant components and auxiliary devices could be checked.

The oil level in the engine was checked using a dipstick, which showed the level to be adequate, between marks 2 and 3 on the dipstick.

The travel and stops of the engine controls were checked and deemed to be correct.

The exhaust nozzles were in good condition and undamaged. The material outside the hot section of the engine was found to be free from warping, bending and wrinkling.

The flexible fuel line to the engine heat exchanger was then released and the battery was connected. The selector valve was opened and the booster pump connected to see if the fuel flow was adequate. The pump was left on for one minute to check its operation and a sample of this fuel was taken, an analysis of which was satisfactory.

The condition of the engine's air intake was checked. It was clear, though there were some leaves and grass in the compressor air intake screen, probably due to the aircraft's impact with the ground.

The spark plugs were removed and found to have white dust in the area where the spark is generated. They were tested and verified to work correctly.

The various fuel filters were removed:

- The filter in the line before the low-pressure pump. The pleats were checked and found to be clean.

- The high-pressure pump filters: there is a low-pressure and a high-pressure filter. When they were removed, fuel issued from both filters:

  - The low-pressure filter is metallic. It was clean and the bypass worked correctly.

  - The high-pressure filter, located at the discharge, is made of cardboard and it was also clean.

The low- and high-pressure fuel pumps were disassembled:

- Low-pressure pump: no fuel leaks were identified. Its overall appearance was good. The shaft was in good condition, though there was excessive grease. This was the last component to have been replaced in the engine and had 30 hours of operation. In reality, the pump was the same as the one that was previously installed on the engine, after it was overhauled. The CRS of the component was verified. It was checked because even though the tightening torque was correct and it worked properly, the joint leaked.

- High-pressure pump: the shaft was in good condition and there was no corrosion, though as with the low-pressure pump, there was excessive grease.

The FCU was then removed and verified to be in good overall condition. There were no fuel leaks, or evidence of past leaks. It was full of fuel. The plastic shaft joining it to the fuel pump was in good condition. The pumps and the starter were removed and a functional test verified they worked correctly.

The unit could not be further disassembled in the field, and so an additional analysis was arranged given the importance of the unit, though it had to be done in a specialized laboratory/workshop.

The position of the primary and secondary injectors was checked using the maintenance manual and verified to be in the correct position, 10 primary and 4 secondary.

The right exhaust nozzle was removed to access the power turbine. No damage was found, just a small white stain on the stator.

The chip detector was also removed. No chips were found. An oil sample was taken from the area.

The oil filter was then removed and also found to be free of particles. It was clean and an oil sample was taken. It was then inserted into a solvent to confirm the absence of particles. It had been replaced in the last maintenance check.

The screen/filter at the compressor air intake was removed. The first stage of the axial compressor was in good condition, despite some dirt on the right side, probably as a result of the impact.

The engine bleed valve was removed. The membrane was verified to be in good condition and the valve opened and closed correctly.

An external inspection of the hot section of the engine did not reveal any appreciable damage.

According to information provided by the organization's AMT, the engine had undergone a borescope inspection at 400 h that did not reveal any anomalies.

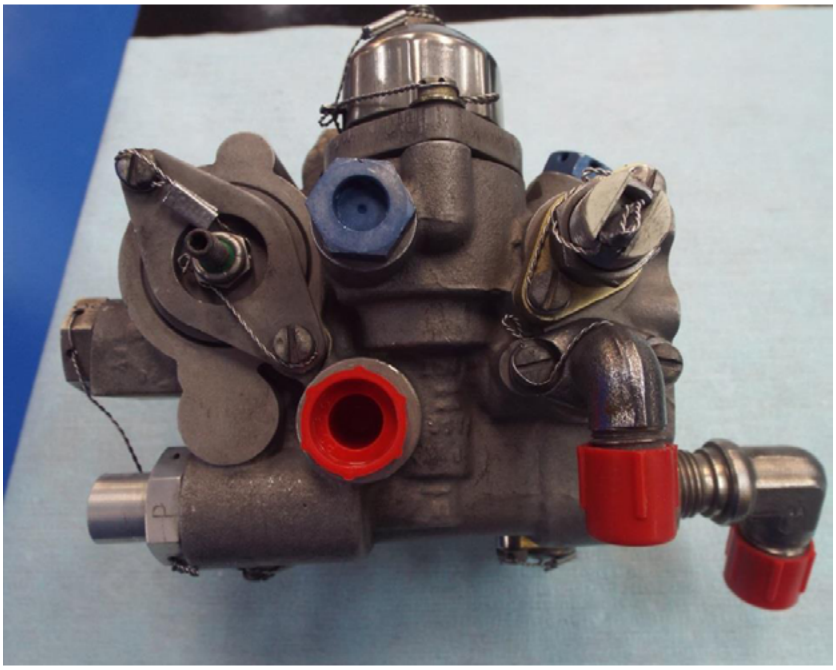
The governor and overspeed regulator were visually inspected. Nothing out of the ordinary was found.

In general, the engine was in good condition, with no apparent oil or fuel leaks.

1.16.3.3 Test of the fuel control unit (FCU)

The fuel control unit (FCU) was sent to an organization that was certified as a repair center by the manufacturer of the unit in order to check its operation.

This involved doing a general visual inspection, a functional test with measurements of the main parameters, and finally the removal of its primary components.



Photograph 8. FCU prepared for tests

The visual inspection revealed that the unit was in good condition, clean and with no apparent damage.

The functional test showed that some elements were outside the limits specified by the manufacturer, but that this did not result in any malfunctions. The fuel flow was a little less than required and the RPM tended to divert slightly at the limits.

Photograph 9. FCU components: element 1 – governor spring, and element 2 – enrichment lever bearing

As concerns the partial disassembly of the unit, the condition of the body of the FCU was examined, and no components were found to be actually damaged, though the following findings were documented:

- The governor spring was slightly stretched (photograph 8, element 1)
- The bearing on the enrichment lever was rough on rotation (photograph 8, element 2)
- The Teflon tube on the drive shaft was worn, though it was normal operational wear.

1.16.3.4 Disassembly and analysis of the FCU

The following conclusions were drawn from the report provided by the organization to which the FCU was sent for overhaul, which consisted of completely disassembling the unit and doing a detailed inspection of each of its components.

1. Reasons why the unit was overhauled:
   - It was assumed that the turbine had flamed out[3] in flight.
   - A stoppage of the turbine in flight.
   - The unit had been partially disassembled for inspection during the investigation.

2. Findings following the overhaul:
   - Two components required repair after the disassembly, and another had to be replaced due to use.
   - The FCU bellows, a corrugated flexible tube, in effect the internal pump of the FCU, also had to be replaced since it did not pass the height test required during the overhaul.
   - The remaining components were in good operating condition.
   - The findings did not establish that there was an engine flameout. The only statement that could be made for certain is that the unit could have been operating uncalibrated because the bellows did not pass the required height test.

The second organization that inspected the FCU made findings in addition to those revealed by the tests conducted by the first organization. The unit required some repairs and some components had to be replaced due to wear, or due to (optional) upgrades as a result of modifications made by the manufacturer of the FCU.

In any event, no factor could be identified that caused or contributed to the in-flight failure of the engine.

1.16.3.5 Engine inspection report

The manufacturer of the PC-6/B2-H2, PILATUS AIRCRAFT, Ltd., which installed the PCE-RB0104 engine, conducted a detailed inspection of the engine by disassembling and testing its main components in order to verify the proper operation of the turbine as a whole.

The engine analysis was based on the consideration of the following facts by the manufacturer:

[3] **Flame-out:** Involuntary extinction of the flame in the combustion chamber.

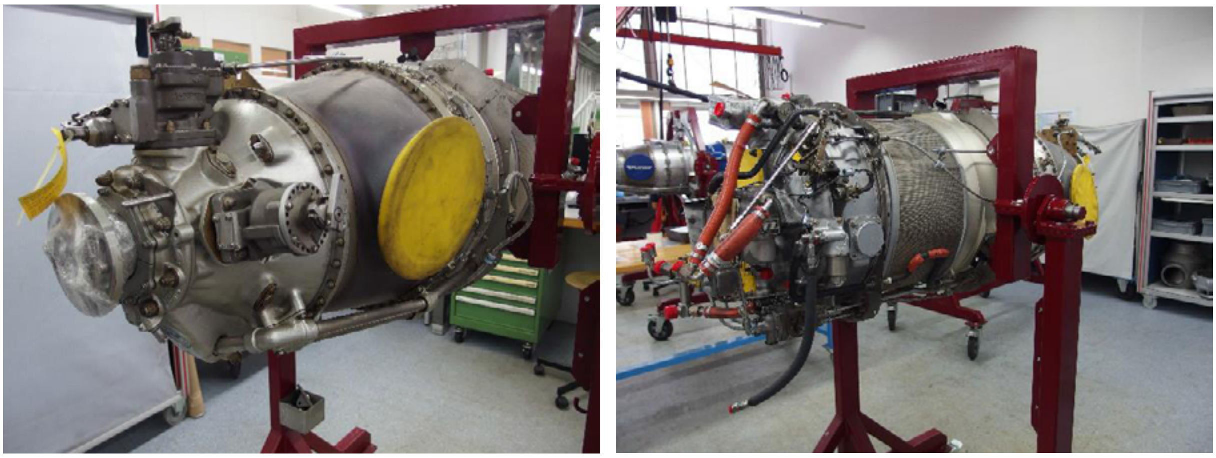
- The engine PCE-RB0104 probably experienced a flameout in flight, meaning the flame in the turbine was extinguished for an unknown reason.

- The engine restart procedure was attempted in flight, and flames were observed in the exhaust stubs. According to the pilot's statement, he was not watching the interturbine temperature indicator whilst the engine relight procedure.

- From these facts, an engine hot start can be highly suspected.

- An emergency landing was made, after which the pilot stated that he stopped the engine.

Based on these facts, and since it was not possible to confirm that the ITT was exceeded, it was decided to send two blades from the compressor turbine to a metallurgical laboratory to verify their structural integrity and check for potential additional damage to the engine, since an excess temperature in the area could have been identified by this laboratory by analyzing the materials.



Photograph 10. Engine on test bench: front view (r.) and rear view (l.)

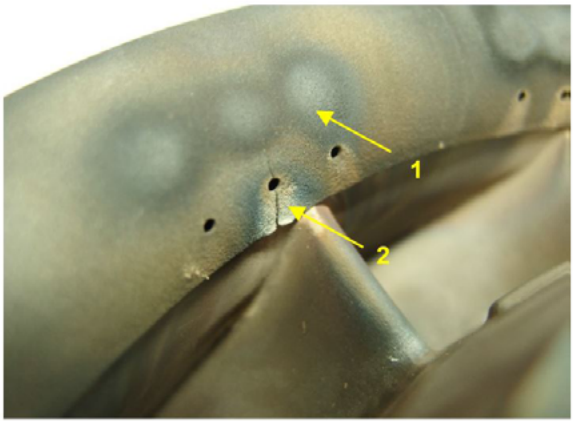
The main engine components were disassembled as per the manufacturer's "light overhaul" procedure.

All of the parts were cleaned, visual inspections were made, measurements were verified and non-destructive testing was conducted for selected parts.

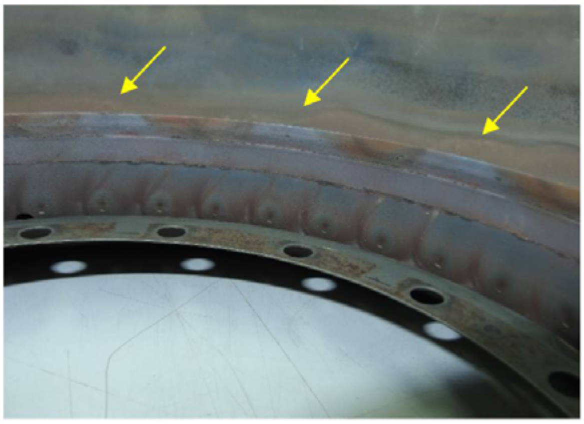
The main components checked were as follows:

- Reduction gearbox.

- Combustion chamber: inspected as a whole, which revealed that on the ring of fixed blades on the compressor turbine (photograph 11), the small exhaust holes on the housing cover had structural damage, and the material showed signs of overheating. The material in the large exhaust holes also showed signs of overheating (photograph 12).



Photograph 11. 1 – signs of overheating
2 – damage to small exhaust hole



Photograph 12. signs of overheating in large exhaust holes

- Compressor turbine: as part of the general inspection, due to the suspected high temperatures experienced, some of the blades were taken for metallurgical analysis.
- Interturbine ring cover: there was wear that caused it to be out of tolerance.
- Power turbine: its condition was checked, in particular the stator disc/joint.
- Exhaust system: check of the exhaust ducts.
- Gearbox system: check of accessory drive.
- Control and fuel accessory assemblies.
- Check of the FCU.
- Check of ignition system.
- Propeller system: check of inverted coupling on propeller.
- Interturbine temperature system: check of sensors and thermocouples.
- Propeller governor: check.
- Overspeed governor: check.

1.16.3.6 Emergency procedures

<u>In flight "Engine failure" procedure</u>

As part of the emergency procedures included in the aircraft flight manual, the one for the case in which an engine failure is identified in flight specifies the following actions:

1	Control IDLE/CUT-OFF	CUT-OFF
2	Propeller control	FEATHER
3	Thrust lever	Retard to detent
4	Booster pump	OFF
5	Fuel system valve	CLOSE
6	Generator	OFF
7	Electrical power	SWITCH OFF all non-essential equipment to maintain battery life.

The manufacturer provides an important notice in the manual that if the engine is known not to be operating normally, not to attempt to restart it.

If there is an in-flight engine failure, the airplane must be positioned to achieve the best possible glide speed, which must not fall below 65 KIAS, and to land immediately. The engine must not be turned off unless there are clear indications of faulty operation of the engine due to technical reasons.

Likewise, an engine restart must not be attempted if the engine failure is due to a technical problem.

Also included is certain information and emergency procedures for an air start and immediate restart, which are deemed to be of interest to an analysis of the pilot's actions.

Air start and flameout phenomenon

This start must be performed after an engine flameout, which is indicated by a drop in the ITT, the torque meter pressure, the RPM, Ng[4] and Np[5].

The symptoms of a flameout are normally the same as for an engine failure. If the cause is due to temporary operational factors and the altitude and speed conditions allow, the engine can be successfully restarted in flight.

The main factors that can lead to a flameout are generally:

- Rapid acceleration of the engine in which an excessively rich mix of air/fuel makes the fuel temperature fall below its combustion temperature.

- Insufficient air flow to maintain combustion.

[4] **Ng:** Engine gas generator RPM

[5] **Np:** Propeller RPM

- A poor air/fuel mixture can also extinguish the flame, as could happen, for example, when descending at low engine speed (throttle lever back) as the engine decelerates.
- Lack of oxygen at high altitudes.
- Lack of fuel.
- Low fuel pressure and low speeds, normally associated with flying at high altitude.
- Very low temperatures.
- Mechanical failure in the engine, such as a loss of compression.
- Ingesting large amounts of water (as might occur during heavy rain).
- Damage produced by the presence of foreign object debris, such as birds, hail, etc.

When this phenomenon occurs, the restart must be initiated as soon as possible, since in order for it to be successful, Ng must be higher than 50%.

If conditions allow and the restart is attempted, a wet start may occur, meaning that the start takes place with excess fuel in the engine ("flooded" engine). This can generate flames in the exhaust when the excess fuel is burned. This effect is normally identified by an increase in EGT[6] and RPM.

The technique for an air start is to initiate the restart procedure immediately after the flameout, assuming the flameout is not caused by a malfunction of the engine and that the airplane's altitude is insufficient to allow the normal restart procedure to be used.

If a flameout occurs at high speed/altitude, the speed and altitude will have to be reduced in order to restart the engine.

<u>Immediate restart</u>

Must only be attempted when the altitude is critical for a normal restart, and only in actual emergencies, never in training, since it results in a significant increase in ITT that can affect the engine.

[6] **EGT:** Exhaust gas temperature

The ability to restart the engine depends on the speed and altitude at which it is attempted.

The procedure is as follows:

1	Thrust lever	Retard to detent
2	STARTER switch	ON
3	IGNITION switch	ON
4	IDLE control lever	LOW-IDLE
5	ITT/Ng/Np/Fuel Flow readings	Monitor
6	Oil pressure gauge	40 psi minimum
When the engine is stable at LOW-IDLE		
7	STARTER switch	OFF
8	IGNITION switch	OFF
9	Control lever IDLE	HIGH-IDLE
10	Thrust lever	As required
11	Land as soon as possible	

If the engine does not restart, then the propeller must be feathered by taking the IDLE/CUT-OFF control lever to the CUT-OFF position. Once the fuel supply is resumed, or the unstable agent that was affecting the operation is eliminated, then the engine can be restarted by using the air start procedure.

The emergency procedure specifically warns not to attempt a restart if the Ng tach indicates a zero RPM value.

There are limits in the aircraft flight manual that apply to the restart attempts. The attempts must be spaced at least 30 seconds apart to allow the fuel to drain before making the next attempt. After three attempts, a 30-minute wait is required before another restart is attempted.

As mentioned earlier, the emergency procedure warns not to attempt an engine restart if the fault was due to a technical problem.

Limits to operating the throttle lever

Positioning the throttle lever below the IDLE stop in flight is absolutely prohibited. This position could cause a loss of control of the aircraft or could result in an engine overspeed condition, with the ensuing loss of engine power.

1.17. Organizational and management information

Not applicable.

1.18. Additional information

Not applicable.

1.19. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

2.1. Analysis of the weather situation

The weather conditions present in the area of the Empuriabrava aerodrome at the time of the event (11:30 local time) were suitable for the flight. There were no significant weather phenomena that could have contributed to the accident.

2.2. Analysis of the wreckage

The damage identified in the aircraft is consistent with the aircraft impacting the terrain, as described in the pilot's statement.

There was no scattering of debris, since the aircraft fell to the ground after the landing gear impacted the canal, which bent the gear backwards and caused the airplane, which had no speed left, to fall to the ground.

The abrasions and damage to the underside of the fuselage were caused as the airplane dragged along the ground before coming to a stop, a process that lasted some 18 m, which was the distance between the initial contact of the gear with the canal and the point where the aircraft stopped.

The damage to the propeller blades indicates that the engine was producing power at the moment of impact. The blades were in a low-pitch position, meaning the propeller was not feathered, as the pilot said when he provided his statement.

The damage to the wings was also consistent with impacting the vegetation on the ground, namely the shrubs and small trees located left of the airplane in the direction of motion.

It is reasonable to conclude that the damage to the aircraft was consistent with the pilot's description of the emergency landing, which provides no explanation, or even any clarification, as to what caused the accident.

2.3. Analysis of the flight

The segment of the flight that is of interest to the investigation into the accident spans from the time when the pilot wanted to exit the Beta mode of operation until the aircraft came to a complete stop.

Prior to that initiating moment, the flight had been uneventful, and thus of no interest to explaining what happened.

It should be noted that the accident flight was the second flight of the day made by the pilot with the same aircraft and involving the same skydiving operation, with the two flights spaced 20 minutes apart, during which time the aircraft was refueled. Also worth noting is the fact that until that moment, no problems with the engine or any other component had been identified in any of the flights prior to the accident flight, either on that day or in the previous days, by the accident pilot or by another pilot that flew the same aircraft. Skydiving operations require that the aircraft be properly maintained and an experienced pilot, due to the high frequency of flights that are made during skydiving season, as evidenced by the aircraft, engine and pilot log books.

The pilot was experienced and properly trained for the type of operation he was engaged in on the day of the event, and specifically accustomed to piloting that aircraft. It is thus safe to assume he was very familiar with it.

The pilot was presumably fit to fly, and perhaps due to the subsequent effects of the accident, was unable to recall any of the engine parameters, which indicates that he was not truly monitoring the engine gauges, probably due to excess trust in the aircraft and in its operation as a result of how often he made this type of flight.

Upon initiating the base segment of the pattern as he exited Beta mode and applied power to stabilize the descent and attempt to continue in the pattern, the engine failed to respond. In light of this, the pilot's reaction was to apply more power, to no avail. He then turned on the booster pump, an erroneous action according to the emergency procedure for an engine failure. This indicates that the pilot did not actually identify what was happening.

He was at 1500 ft and the speed was 80 kt and falling rapidly. According to the emergency procedure, if the engine fails in flight, the pilot has to place the IDLE/CUT OFF lever in CUT OFF, the propeller lever in the FEATHER position, the BOOSTER pump in OFF, close the fuel valve and place the generator in OFF. This procedure was not executed correctly.

The fuel valve was kept open at all times (IDLE/CUT OFF lever) and the propeller control lever was kept forward, that is, in a low-feather position, which is how the propeller was found after the impact.

In conclusion, during his attempt to recover from the engine stoppage, the pilot did not monitor the parameters needed to identify whether the engine was operating correctly or not, he kept the booster pump on, the propeller lever in, the throttle lever supposedly at low power and the fuel valve open.

When the engine stopped and flames exited the exhaust, he could have identified what had happened if he had checked the engine parameters, especially the ITT and Ng, since in the event of a flameout the loss of power is recoverable if, given sufficient altitude and speed, the emergency air start procedure is used to restart the engine immediately.

None of these actions was taken and the problem was never identified.

2.4. Analysis of engine performance

An analysis of the tests and inspections carried out with technical support personnel shows that neither the engine nor the FCU had significant defects that could have caused a loss of power or an engine stoppage.

Furthermore, the variations in the engine parameters that are noted in the technical reports are deemed to be typical, normal variations that are generally found in PT6 engines that are operated and maintained in keeping with the manufacturer's recommendations.

It may also be concluded from the inspection and disassembly of the engine that it was maintained and operated in keeping with the manufacturer's limitations and recommendations.

There were, however, indications that some components in the hot section of the engine had been subjected to relatively high operating temperatures, though this did not, in any event, contribute to the loss of power or engine stoppage, but that could have been consistent with an overheating event resulting from a restart operation in flight after an engine flameout, and the flames that were generated in the exhaust and which the pilot referred to in his statement.

The last component replaced in the engine during maintenance, the low-pressure fuel pump, which was replaced with the overhauled original pump, was presumably in good condition, following an evaluation of its performance as per its CRS and FAA Form 8130. The inspection confirmed its operation, and that of other important components, such as the FCU, ignition, etc.

According to the pilot, the loss of power occurred when he increased power to level out the airplane and turn. This could have caused a flameout, since the airplane had descended rapidly with the throttle lever continuously held back, below the IDLE position (operating limitation specified in the airplane flight manual). There is a high likelihood that the resulting poor air/fuel mixture caused a flameout. In fact, the aircraft manufacturer considers it a given that this phenomenon in fact took place.

What seems to be clear is that after noticing the loss of power, the pilot did not identify the possible causes. He did not monitor the engine parameters on the instrument panel and applied power continuously by keeping the throttle lever in the maximum power position.

When he attempted a restart, flames issued from the exhaust. This could have been due to starting with excess fuel in the engine, possibly flooding it, which caused the flames that the pilot saw and which were quickly extinguished when the excess fuel was burned off. Then, the start sequence having been initiated, the engine resumed operation.

If some engine parameter at the time of the event had been available as a reference, this phenomenon could have been confirmed, but the pilot was not monitoring the readings.

However, the inspection and subsequent tests of the engine confirmed there was no malfunction or fuel starvation at any point; in fact, the various engine components all had fuel in them as appropriate.

When the engine stops, the propeller is automatically feathered, but in this case, the propeller pitch was low, not feathered, on impact. Moreover, if it had been feathered, the airplane would probably have glided to the ground, which did not happen.

This all indicates that the engine was in fact running, not stopped, when the aircraft hit the ground, meaning the engine restarted in flight, but at a very low altitude, below 1500 ft and at a speed below 80 kt. This prevented the airplane from reaching the runway at the aerodrome, which it probably could have reached without any problem, given how close it was, if the pilot had correctly identified the problem.

In light of the above, an engine failure due to a technical problem is ruled out. Instead, the possible engine stoppage is deemed to have occurred due to a flameout caused by the operating conditions present during the aircraft’s descent, a flameout that was not identified by the pilot.

3. CONCLUSIONS

3.1. Findings

- The aircraft pilot had a valid private pilot license (PPL) with a Pilatus PC6 SET type rating.
- His class-1, class-2 and LAPL medical certificate was valid.
- The pilot had a total of 2550 flight hours, of which 460 hours 55 minutes had been on the type.
- The airplane was owned by a private company whose primary activity was skydiving.
- The aircraft was maintained at a maintenance center that was authorized by the French aeronautical authority as an EASA CAMO and EASA Part-145 organization, with a valid certificate.
- The aircraft had a valid certificate of airworthiness to conduct the operation.
- The aircraft had been built in 1968 and had logged 31308 hours 13 minutes, and the engine 9663 flight hours 25 minutes.
- The last scheduled maintenance check was done on 22 October 2017, with 31274 hours 2 minutes on the aircraft, a total of 58523 cycles and 9534 hours 56 minutes on the engine. There were no notes of interest to the event. All applicable Service Bulletins, Directives and Service Letters were implemented.
- The weather conditions were not limiting to visual flight.
- The last flight done prior to the event by the same pilot had been on the day of the event and lasted 21 minutes. Twenty minutes after that flight ended normally, the pilot started the accident flight.
- The emergency landing made is consistent with the damage identified in the aircraft.
- The inspection of both the aircraft and the engine, as well as the tests done after the fact, show that the maintenance and the operation were adequate.

- The tests done on the fuel control unit (FCU) concluded that even though certain parameters were out of tolerance, they could not have caused the unit to fail, and thus did not contribute to an engine failure.

- The aircraft manufacturer's inspection and disassembly of the engine showed that it was in perfect operating condition, though some of the components in the "hot" section of the engine showed signs of having been subjected to relatively high operating temperatures.

- The investigation ruled out a technical fault in the engine.

- The investigation revealed that the pilot did not execute the emergency procedures correctly after the engine failure and subsequent attempt to re-start the engine.

- The pilot did not monitor the engine parameters on the instrument panel gauges.

- The aircraft impacted the ground with the engine running, providing power, and with the propeller blades in a fine pitch position.
- The pilot was not injured and was able to exit the aircraft under his own power.

3.2. Causes/Contributing factors

The investigation into the event has determined that the accident was caused by an emergency off-field landing in the vicinity of the aerodrome following an unsuccessful recovery from an engine stoppage at low altitude.

The investigation has concluded that neither the engine nor the aircraft had a technical problem that could have caused the engine stoppage, meaning the stoppage could have been the result of a flameout in the combustion chamber caused by an improperly performed rapid descent.

Contributing to the accident was the improper execution of the emergency procedures for an engine failure and restart in flight.

4. SAFETY RECOMMENDATIONS

No safety recommendations are made.