CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE **A**CCIDENTES
E **I**NCIDENTES DE
AVIACIÓN **C**IVIL

Report
ULM A-007/2020

Accident on the 21 June 2020, involving a Tecnam P2002 SIERRA aircraft, registration EC-FM8, in the municipality of Aibar (Navarra)

GOBIERNO
DE ESPAÑA

MINISTERIO
DE TRANSPORTES, MOVILIDAD
Y AGENDA URBANA

Edita: Centro de Publicaciones
Secretaría General Técnica
Ministerio de Transportes, Movilidad y Agenda Urbana ©

NIPO: 796-22-021-7

Diseño, maquetación e impresión: Centro de Publicaciones

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Tel.: +34 91 597 89 63
Fax: +34 91 463 55 35
E-mail: ciaiac@mitma.es
http://www.ciaiac.es
C/ Fruela, 6
28011 Madrid (España)

Notice

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 5.6 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 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.

Contents

Abreviations

%	Per cent
ºC	Degrees Celsius
AEMET	Spain's State Meteorological Agency
AESA	Spain's National Aviation Safety Agency
AGL	Above ground level
CV	Metric horsepower
DGAC	Civil Aviation General Directorate
ft	Feet(s)
GPS	Global Positioning System
h	Hours
hPa	Hectopascal
kg	Kilogrammes
km	Kilometres
km/h	Kilometres per hour
LAPL	Light Aircraft Pilot Licence
LT	Local time
m	Metres
MAF	Multi-axis fixed-wing
METAR	Aviation routine weather report (in aeronautical meteorological code)
min	Minutes
QNH	Altimeter setting to obtain elevation above sea level when on the ground
rpm	Revolutions per minute
TULM	Ultralight Aircraft Pilot License
ULM	Motorised ultralight aircraft
UTC	Coordinated universal time
VFR	Visual flight rules
VFE	Maximum flaps-extended speed

Synopsis

Operator:	Private
Aircraft:	Tecnam P2002 SIERRA
Date and time of accident:	21 June 2020, 12:31 LT[1]
Site of accident:	Municipality of Aibar (Navarra)
Persons on board:	One seriously injured and one unharmed
Type of flight:	General Aviation - Private
Phase of flight:	En route - cruising
Type of operation:	VFR
Date of approval:	28/April/2021

Summary of incident

On 21 June 2020, the Tecnam P2002 SIERRA aircraft, registration EC-FM8, suffered an accident while carrying out an emergency off-airfield landing due to an in-flight engine power loss.

The aircraft had taken off from Tudela Aerodrome (Navarra) to carry out a local round-trip flight with two occupants on board.

During the cruise phase of the flight, the aircraft suffered an engine stoppage that led to the pilot making an emergency landing in a cereal crop field.

After landing, the aircraft travelled over the terrain until its nose leg collapsed, causing the aircraft to slide along the ground until it finally flipped over.

The pilot incurred serious injuries, but the passenger was unharmed. The aircraft sustained significant damage.

The investigation has determined the cause of the accident was the emergency off-airfield landing carried out as a result of inadequate fuel management that led to an in-flight engine stoppage.

[1] Unless specified otherwise, all times in this report are local. On the day of the incident, local time was equivalent to UTC+2 hours.

1. FACTUAL INFORMATION

1.1. History of the flight

At 11:49 h on 21 June 2020, the TECNAM SIERRA P2002 aircraft, with registration EC-FM8, took off from Tudela Aerodrome for a local flight within the Sangüesa region of the Autonomous Community of Navarra with a pilot and a passenger on board.

They intended to make a recreational 1 h and 15 min flight to the Yesa reservoir, with a 35 min outward journey, a 10 min flight over the reservoir and a 30 min return journey.

During the pre-flight inspection, the pilot checked the fuel level on the cockpit gauges. The gauges showed that both tanks were approximately 50% full, representing about three hours of flight autonomy when cruising at 75% power.

Forty-two minutes into the flight, having flown over the Yesa reservoir and on the way back to the departure aerodrome, the engine stopped. After several unsuccessful attempts to start the engine, the pilot decided to focus on making an emergency landing.

Despite flying over and perpendicular to a potential landing strip (Sangüesa's old runway), the pilot decided it was too risky to make the sharp turns that would be required to line up with the runway and opted to land in a cereal field located slightly to the right of his path instead.

After flying over a high voltage line that ran across the chosen field, the aircraft landed without flaps at a speed of approximately 90 km/h. After taxiing for 40 m, the nose leg collapsed, and the aircraft flipped over.

The pilot and passenger evacuated the aircraft without assistance after breaking the windshield.

The pilot incurred serious injuries, but the passenger was unharmed.

The aircraft sustained significant damage.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Other
Fatal				
Serious	1		1	
Minor				
None		1	1	
TOTAL	1	1	2	

1.3. Damage to the aircraftt

The aircraft sustained significant damage to the landing gear, tail assembly and fuselage.

1.4. Other damage

The aircraft made the emergency landing in an unharvested cereal field. As a consequence of the manoeuvring and movements of the assistance vehicles employed to recover the aircraft, the farmer lost the crop harvest in the affected area.

1.5. Information about the personnel

1.5.1 Information about the crew of the aircraft

The 47-year-old pilot had an ultralight pilot license (TULM) with a multi-axis fixed-wing rating (MAF), issued by Spain's National Aviation Safety Agency (AESA) on the 02 October 2019 and valid until 30 September 2021. He also had a LAPL medical certificate, valid until 06 June 2021.

He had 50 hours of flight experience, all of which had been in the type of aircraft involved in the accident.

1.6. Aircraft information

1.6.1 General information

The aircraft was a single-engine, low-winged TECNAM P2002 SIERRA motorised ultralight (ULM) with tricycle landing gear and a maximum take-off weight of 450 kg.

It has a fixed-pitch wooden three-bladed propeller and a Rotax 912 ULS 100 CV engine installed during the aircraft's manufacture.

The serial number of the aircraft involved in the accident is P2002-321. It was manufactured in 2008 and registered on 01 October 2008.

It had a restricted Airworthiness Certificate issued on 10 October 2008 by the Civil Aviation General Directorate (DGAC).

The current owners acquired the aircraft in July 2019, when both the airframe and engine had 720 hours.

At the time of the accident, both the aircraft and engine had 808.94 flight hours.

1.6.2 Maintenance information

According to the information provided by the pilot, when he purchased the aircraft in July 2019, he ordered an in-depth overhaul of both the engine and the aircraft, which had 720 flight hours. During this inspection, several deficiencies were detected and corrected.

A problem in the electrical system was subsequently detected in 2019, which resulted in the battery charge regulator, condenser and battery being replaced and the engine being re-checked.

In February 2020, the scheduled 800 h inspection was carried out, which included a visual inspection of the engine systems, gearbox control, cleaning the gascolator and air filters and changing the oil and filters. The radiator and its coolant liquid were also replaced.

1.6.3 Information about the fuel system

The fuel system diagram shows the supply pipes running from the two fuel tanks to the engine and a shut-off switch in the cabin, which is used to manage the differential fuel consumption of the two tanks.

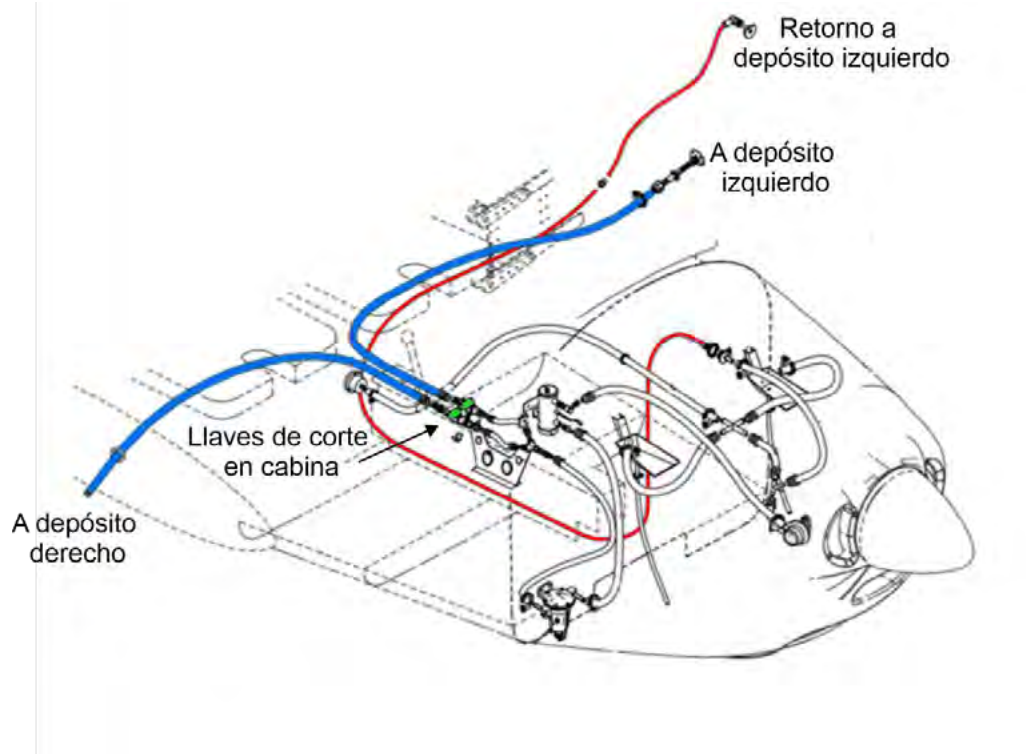

Fig. No. 1.- Diagram of the fuel system.

It also shows the excess fuel return pipe, which carries excess fuel to the left tank.

1.7. Meteorological information

According to the information provided by the State Meteorological Agency (AEMET), the meteorological conditions in the area at the time of the accident were northerly winds above 20 km/h in areas exposed to that direction, good visibility and virtually clear skies.

There are no indications of significant weather phenomena in the remote sensing images and forecasts.

AEMET does not have a meteorological station in Aibar; the closest stations are in Cáseda (8 km to the northwest), Monreal (17 km to the northwest) and Olite (17 km to the southwest).

The data recorded at these stations were as follows:

Cáseda: temperature 27 °C, relative humidity 41 %, average wind 5 km/h and maximum 10 km/h from the northwest.

Monreal: temperature 25 °C, relative humidity 44 %, average wind 20 km/h and maximum 28 km/h from the northwest.

Olite: temperature 26 °C, relative humidity 36 %, average wind 13 km/h and maximum 25 km/h from the northwest.

The closest airport is Pamplona, located 40 km to the northwest.

The aerodrome reports (METAR) recorded at the time of the accident showed winds between 7 kt and 14 kt, coming from the northwest, good visibility with clear skies, temperature 24º/25ºC and QNH 1024/1025 hPa.

METAR LEPP 210930Z 33007KT 300V360 CAVOK 24/11 Q1024=
METAR LEPP 211000Z 34008KT 290V020 CAVOK 24/10 Q1024=
METAR LEPP 211030Z 33013KT CAVOK 25/06 Q1024=
METAR LEPP 211100Z 33014KT 300V360 9999 FEW040 25/09 Q1025=

1.8. Aids to navigation

The flight was operating under visual flight rules (VFR).

1.9. Communications

There is no monitoring frequency in the area, nor did the pilot report the emergency from the aircraft's radio equipment, although he did use his mobile phone to ask his usual instructor for instructions before getting out of the aircraft.

1.10. Aerodrome information

N/A.

1.11. Flight recorders

The aircraft was not equipped with a conventional flight data recorder or a cockpit voice recorder, as it is not a requirement for this type of aircraft. The applicable aeronautical regulations do not require the installation of any type of recorder for this type of aircraft.

It did have a GPS, from which the following information has been extracted.

Fig. No. 2.- GPS trajectory.

The flight is first registered at the Tudela Aerodrome apron and then proceeds to ascend gradually during the first 70 km of the route. It then makes a steep descent toward the Yesa reservoir to fly over it and then begin the return to the Tudela airfield.

According to the data, when the aircraft was on the return leg, 108 km into the journey and at an altitude of 1115 m (3658.13 ft), it begins a continuous descent to the accident site and then remains there, at an elevation of 427 m (1401 ft). Thus, it travelled 114 km in total.

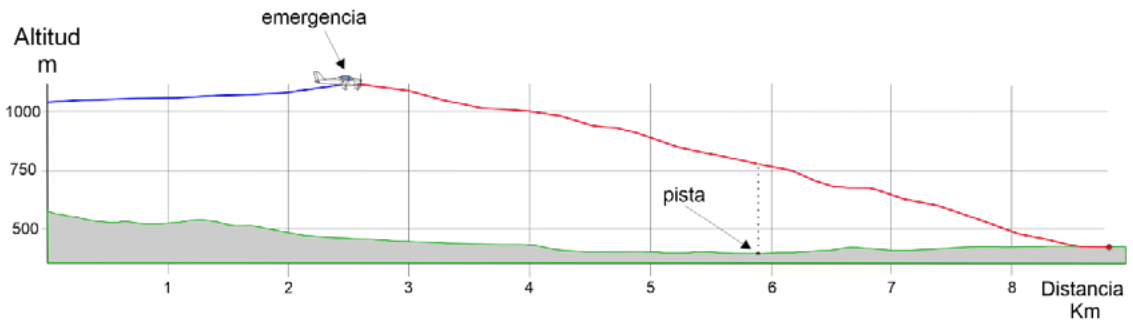

Fig. No. 3.- Profile of the emergency descent.

1.12. Aircraft wreckage and impact information

The aircraft was found in an inverted position with an east-west orientation, in a 1898 m long by 170 m wide unharvested cereal field with flat terrain and no appreciable slope.

On the ground, 55 m before the location of the wreckage, a 15 m section of crop 'combing' was visible, followed by two parallel 40 m-long tracks made by the main landing gear wheels as they rolled over the ground. Twelve metres after the start of the two parallel tracks, a third 28 m-long track appears, equidistant from the previous ones. This third track was made by the nose wheel as it travelled along the ground.

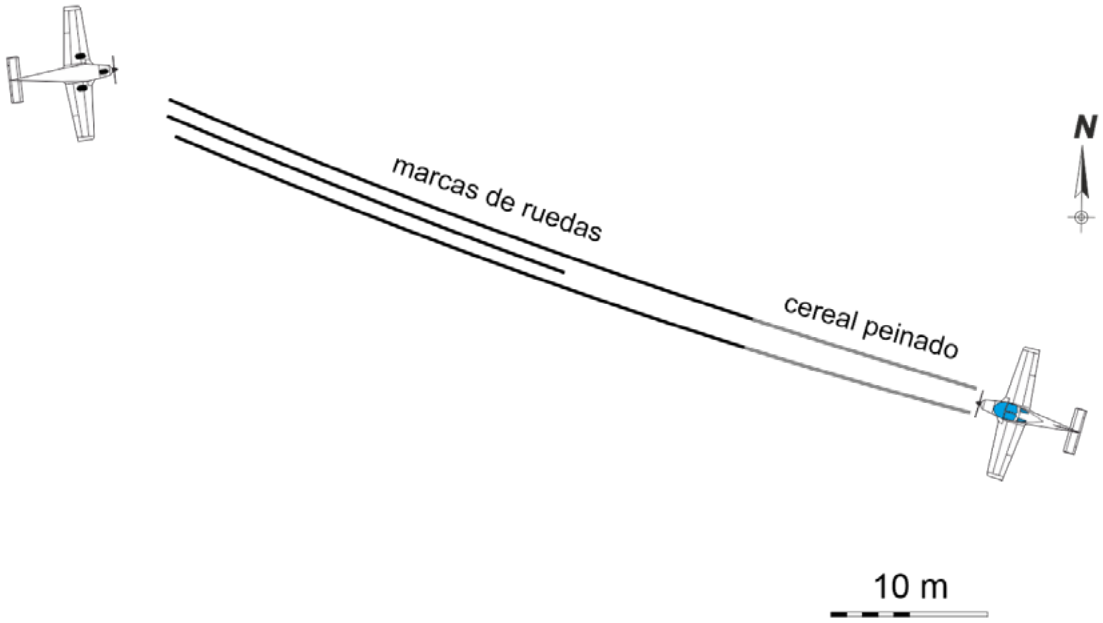

Fig. No. 4.- Track marks sketch.

The aircraft had fractures and deformities on its wingtips and on the rudder and upper part of its vertical stabiliser on the tail assembly. The lower part of the engine fairing and the cabin's methacrylate also sustained damage. The nose leg was bent, and two of the propeller blades were broken.

Fig. No. 5 - Aircraft in its final position.

1.13. Medical and pathological information

There is no evidence of any physiological factors or disabilities that may have affected the pilot's actions.

1.14. Fire

There was no fire in the aircraft or the surroundings.

1.15. Survival aspects

In the event of a roll-over in a low-winged aircraft like this, the cabin structure supports a large part of the aircraft's weight. However, in this incident, it proved perfectly resistant to this stress, and the cabin remained intact.

As the cabin is opened by sliding it backwards, the opening mechanism doesn't work when the aircraft is inverted. Therefore, the occupants were forced to break the polycarbonate to evacuate the aircraft.

The safety belts functioned adequately.

1.16. Tests and research

1.16.1 Interview with the pilot

The pilot of the aircraft has provided an account of the event:

I travelled to the Tudela Aerodrome on Sunday, 21 June 2020, between 11 h and 11:30 h, to carry out a flight around the Yesa reservoir, with a companion on board.

The flight plan comprised a 35-minute flight to the reservoir, a ten-minute flight around the area, and a thirty-minute journey back to the airfield. The total flight time was one hour and fifteen minutes.

During the pre-flight inspection, I checked the fuel level on the cockpit gauges. They showed that each tank was approximately 50% full (about 45-50 litres), which should be enough for around three hours of flight with cruise at 75% power.

The first 45 minutes of the flight passed without incident. Then, after flying over the reservoir, we made a 360º around "Javier Castle" to film a video. In the middle of this manoeuvre, as we were ascending to 3000 ft of altitude (1500 ft AGL) to fly over the mountain range at the entrance to the Ebro valley, I noticed the engine begin to behave irregularly, dropping from 4800 rpm to 4000 rpm and eventually stopping. I tried to re-start the engine three or four times without success, and after checking the cockpit

equipment, the electric pump, magnetos and fuel (with fuel gauges at 10% and 45%), I decided to give up and concentrate on flying the aircraft.

I passed a large runway on the left, but making a 180° turn seemed risky and considering I could see a wide enough wheat field in front of me at two o' clock, I decided to land there.

I remember successfully passing a power line in the first third of the chosen field, and then, flying over the wheat, I reduced my speed from 110 km/h to 90 km/h on landing. I didn't use the flaps because we were in the yellow arc.

Travelling through the wheat, I finally made contact with the ground and taxied for a while before the nose wheel collapsed and the aircraft flipped over.

We were trapped for about ten minutes before we managed to break the methacrylate to get out. When the emergency services arrived, they transferred me to the hospital with neck pain.

I think the engine probably cut out because it was starved of fuel. There was fuel in the tanks, but it wasn't reaching the engine. All the other systems were working correctly.

1.16.2 Engine inspection

A detailed inspection of the aircraft's engine and fuel system was carried out, highlighting the following aspects:

- The fuel tank caps were very tough to open.
- The fuel valves were open.
- Ignition "B" didn't work when cold.
- The spark plugs for cylinder No.1 show signs of self-ignition, which may indicate a lack of fuel.
- The carburettor float chamber for cylinders 1-3 was devoid of fuel, and the float chamber for cylinders 2-4 was wet.
- All fuel system lines were empty except for the gascolator.
- The fuel filters in the mechanical and electrical pumps were clean and devoid of fuel.
- We couldn't check the fuel tank ventilation pipes because they were damaged when the aircraft flipped over.

1.17. Organisational and management information

N/A.

1.18. Additional information

N/A.

1.19. Useful or effective investigation techniques

N/A.

2. ANALYSIS

2.1. Of the weather conditions

The data recorded at different meteorological stations in the area confirms non-limiting meteorological conditions for the flight.

2.2. Of the operation

The inspection of the engine and fuel system didn't find anything to suggest an engine malfunction but did find that the condition of several of the elements analysed was compatible with an absence of fuel in the engine.

Furthermore, the system's design returns the excess fuel pumped to the engine and not used back to the tank on the left wing only. This means that if the right tank is open, a part of its fuel is transferred to the left tank through the return system. Therefore, if the two tank valves are left open, the fuel is not consumed symmetrically, and the fuel level in the left tank may even increase.

According to the pilot's statement, he only checked the fuel levels on the cockpit gauges and kept both fuel valves open at all times throughout the flight.

In this regard, it should be noted that relying on the sometimes inaccurate cockpit gauges and not checking the fuel in the tanks themselves can lead to errors in terms of knowing exactly how much fuel is available on departure.

In addition, leaving both fuel tank shut-off valves open without continuously monitoring the comparative levels between one tank and another could lead to a situation in which all the usable fuel in the right tank is consumed, and despite there still being fuel in the left tank due to the return system, the engine could absorb air from the right tank, thus impoverishing the mixture and causing it to cut out.

According to the pilot's statement and the route recorded by the GPS, after the engine power loss occurred and the decision to make an emergency landing in a safe place had been taken, the aircraft flew, at an altitude of 774 m, over a 1000 m long old airfield with no obstacles and an elevation of 402 m, located to the south of the town of Sangüesa.

The pilot ruled it out because he believed he would have to make sharp turns to reach it and decided to land in a large wheat field with a partial headwind instead.

Given that the aircraft flew over the airfield at a height of 372 m, we believe this would have been sufficient to make a safe circuit of the aerodrome and land on runway 01, which, at that time and given the north wind conditions, offered a better chance of making a safe landing.

Once the decision was made to use the wheat field for the landing, the pilot identified a high voltage line that he could fly over and later prepared for the emergency landing.

According to the pilot's testimony, during the final approach, after passing the power line, he reduced his speed from 110 km/h to 90 km/h. Given that these speeds are below the maximum flaps-extended speed (V_{FE}), he could have extended the flaps to increase the chances of landing with less speed and forward momentum.

The fact that the wheat was at its tallest point of growth would have made it difficult for the pilot to calculate when to initiate flare because he wouldn't have been able to accurately distinguish the real height above the ground.

3. CONCLUSIONS

3.1. Confirmed findings

The engine became starved of fuel during the flight.

3.2. Causes/contributing factors

The cause of the accident was the emergency off-airfield landing carried out as a result of inadequate fuel management that led to an in-flight engine stoppage.

4. OPERATIONAL SAFETY RECOMMENDATIONS

None.