Technical report
ULM A-012/2022

Accident on 29 May 2022 involving a Tecnam P92 aircraft, registration EC-HZC, in the municipality of Rodezno (La Rioja)

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GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA
SUBSECRETARÍA
COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Notice

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

In accordance with the provisions in Article 5.4.1 of Annexe 13 of the International Civil Aviation Convention; and with Articles 5.6 of Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010; Article 15 of Law 21/2003 on Air Safety; and Articles 1 and 21.2 of RD 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent their recurrence. The investigation is not intended to attribute any blame or liability, nor to prejudge any decisions that may be taken by the judicial authorities. Therefore, and according to the laws specified above, the investigation was carried out using procedures not necessarily subject to the guarantees and rights by which evidence should be governed in a judicial process.

Consequently, the use of this report for any purpose other than the prevention of future accidents may lead to erroneous conclusions or interpretations.

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Abbreviations

°	Sexagesimal degree
°C	Degrees Celsius
AESA	Spain's National Aviation Safety Agency
ARN	Ribonucleic acid
CIAIAC	Civil Aviation Accident and Incident Investigation Commission
ft	Feet
h	Hours
HP	Horsepower
hPa	Hectopascals
kg	Kilograms
km	Kilometres
km/h	Kilometres per hour
kt	Knots
kW	Kilowatts
LAPL	Light aircraft pilot license
LEAM	Code for Almería Airport
LEAX	Code for La Axarquía Aerodrome
LEMG	Code for Málaga-Costa del Sol Airport
m	Metres
ml	Millilitres
METAR	Aviation routine weather report
PPL (A)	Private aircraft pilot license
QNH	Atmospheric pressure adjusted to mean sea level in the aerodrome area
rpm	Revolutions per minute
s	Seconds
SEP	Single-engine piston rating
t	Time
TULM	Ultralight aircraft pilot license
UTC	Coordinated universal time
VFR	Visual flight rules

Technical report ULM A-012/2022

Operator:	Private
Aircraft:	Tecnam P92-Echo, EC-HZC (Spain)
Persons on board:	1 (crew)
Type of flight:	General Aviation – Private
Phase of flight	Landing
Flight rules	VFR

Date and time of the accident: 29 May 2022, 07:50 UTC[1]

Site of the accident: Municipality of Rodezno, La Rioja

Date of approval: 01 March 2023

Synopsis

Summary of the investigation:

On 29 May 2022, the Tecnam P92-Echo aircraft with registration EC-HZC took off for a local flight from San Torcuato Aerodrome (La Rioja) at approximately 07:20 UTC, with the pilot as the only occupant.

Thirty minutes after take-off, while flying over the municipality of Rodezno (La Rioja) at an altitude of approximately 1,000 ft above the ground, the aircraft experienced an engine shutdown. The pilot made an emergency landing over a densely vegetated rapeseed field.

The thick vegetation damaged the propeller and caused the nose leg to collapse. The aircraft's windscreen was also damaged but the cockpit interior remained intact. The left wing strut was bent inwards.

The pilot was unharmed and was able to exit the aircraft without assistance.

The investigation has concluded that the cause of the accident was an emergency off-airfield landing following an in-flight engine stoppage caused by the ingestion of water into the carburettors.

A safety recommendation is issued to Tecnam.

1. FACTUAL INFORMATION

1.1. Overview of the accident

1 All times used in this report are UTC. Local time can be calculated by adding 2 hours to UTC

On 29 May 2022, the Tecnam P92 aircraft, registration EC-HZC, suffered an accident during an emergency landing in a rapeseed field in the municipality of Rodezno (La Rioja).

On the day of the accident, the pilot bought petrol at a petrol station and filled each of the aircraft's tanks with 5 litres. After refuelling and conducting the pre-flight inspection, the pilot took off for a local flight from San Torcuato Aerodrome (La Rioja) at approximately 07:20 UTC.

For the first approximately 30 minutes of the flight, the pilot didn't notice anything unusual in the behaviour of the aircraft. At approximately 07:50 UTC, the aircraft experienced an engine shutdown while performing a gentle climb.

According to the information provided by the pilot, since take-off, the aircraft had been using the left fuel tank, and a few minutes before the engine stalled, the pilot had opened the fuel valve on the right tank.

At the time of the engine shutdown, the aircraft was flying over the municipality of Rodezno at an altitude of approximately 1,000 ft above the ground. The pilot made an emergency landing on a rapeseed field.

The aircraft sustained significant damage to its propeller, nose landing gear and wings.

The pilot was unharmed and was able to exit the aircraft without assistance.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor				
Unharmed	1		1	
TOTAL	1		1	

1.3. Damage to the aircraft

The emergency landing in a rapeseed field fractured the aircraft's landing gear nose leg and damaged its propeller. Its wings also sustained impacts from the vegetation.

1.4. Other damages

There was no other damage

1.5. Information about the personnel

1.5.1. Pilot

The 52-year-old pilot had an ultralight pilot licence (TULM) issued on 13 December 2021 and valid until 2023.

His total experience was 40 flight hours, all in type.

His LAPL medical certificate (Light Aircraft Pilot) was valid until 05/05/2023.

1.6. Information about the aircraft

The Tecnam P92-Echo aircraft, registration EC-HZC, had a registration certificate issued by AESA on 17/08/2001, with serial number P-92-E-011. The aircraft was built in 2001.

The aircraft had a valid certificate of airworthiness in force at the time of the accident.

It has a maximum take-off weight of 450 kg and a Rotax 912 engine with an 80 HP (59 kW) output at 5,800 RPM. The aircraft had 2,891 flight hours, and the engine had 1,798 flight hours.

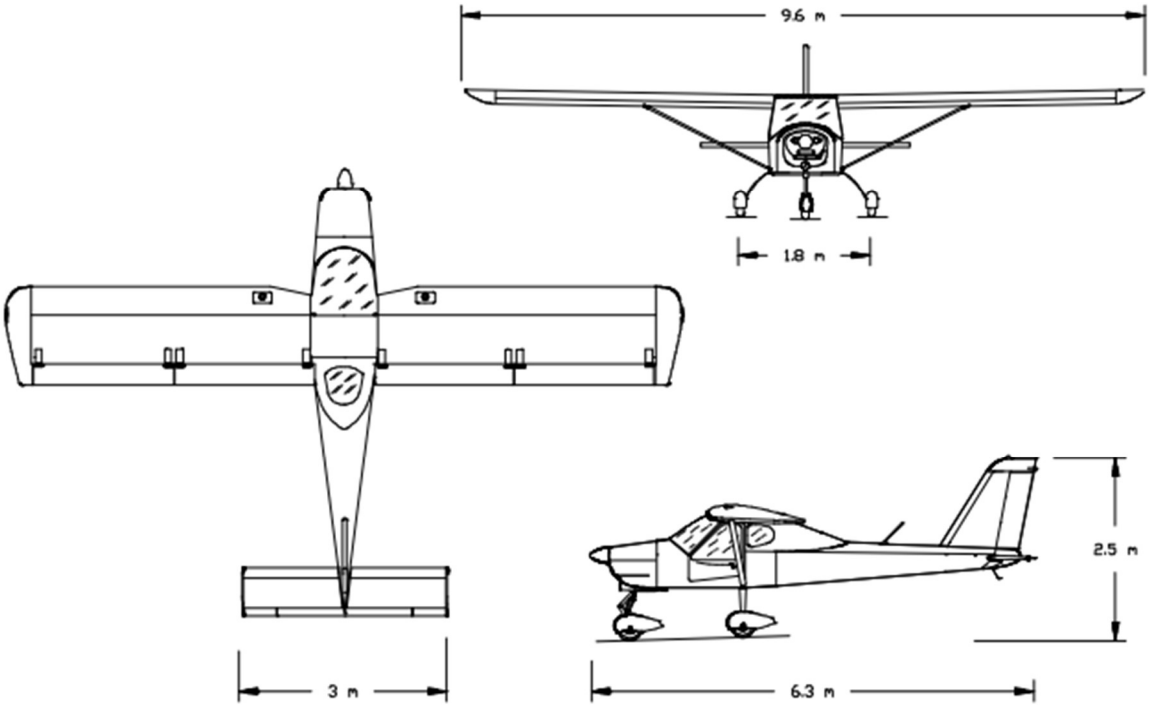

Illustration 1 Tecnam P92-Echo aircraft

The pilot and owner of the aircraft acquired it in the summer of 2021, with the last flight in 2021 being made on 04/07/2021. The aircraft then remained on the ground until 13/02/2022, when the pilot and owner of the aircraft made his first flight that year.

Between February 2022 and the accident flight on 29/05/2022, the aircraft made 8 flights, all of which were flown by the owner as pilot in command. These 8 flights amounted to 7 hours of flight time in total.

1.7. Meteorological information

There were no limiting meteorological conditions for the flight.

The nearest weather station to the accident site is located 6 km away in Haro.

The average temperature recorded by the HARO station for the day of the accident was 18°C, ranging from a minimum of 9°C to a maximum of 27°C. The average relative humidity for the day was 57%, ranging from 30 to 89%.

Specifically, at 08:00 UTC, the temperature was 16°C, with a relative humidity of 57%. According to the pilot's statement, the wind speed on the day of the accident was approximately 3-4 kt in a north-easterly direction.

The natural light conditions were daylight.

1.8. Aids to navigation

N/A.

1.9. Communications

N/A.

1.10. Information about the aerodrome

San Torcuato Aerodrome is located in the autonomous region of La Rioja, 11 km south of Haro, at an elevation of 650 m.

It has a 17/35 grass runway measuring 700 m x 90 m.

1.11. Flight recorders

The aircraft was not equipped with a conventional flight data recorder or a cockpit voice recorder. The applicable aeronautical regulations do not require the installation of any type of recorder on this type of aircraft.

However, the aircraft has a GPS, so we were able to retrieve the most recent flightpath data.

1.11.1. GPS data retrieved from the EC-HZC aircraft

The EC-HZC aircraft's GPS provided information on its position, speed and altitude. The following image shows the aircraft's flightpath in the moments before the emergency landing in a rapeseed field.

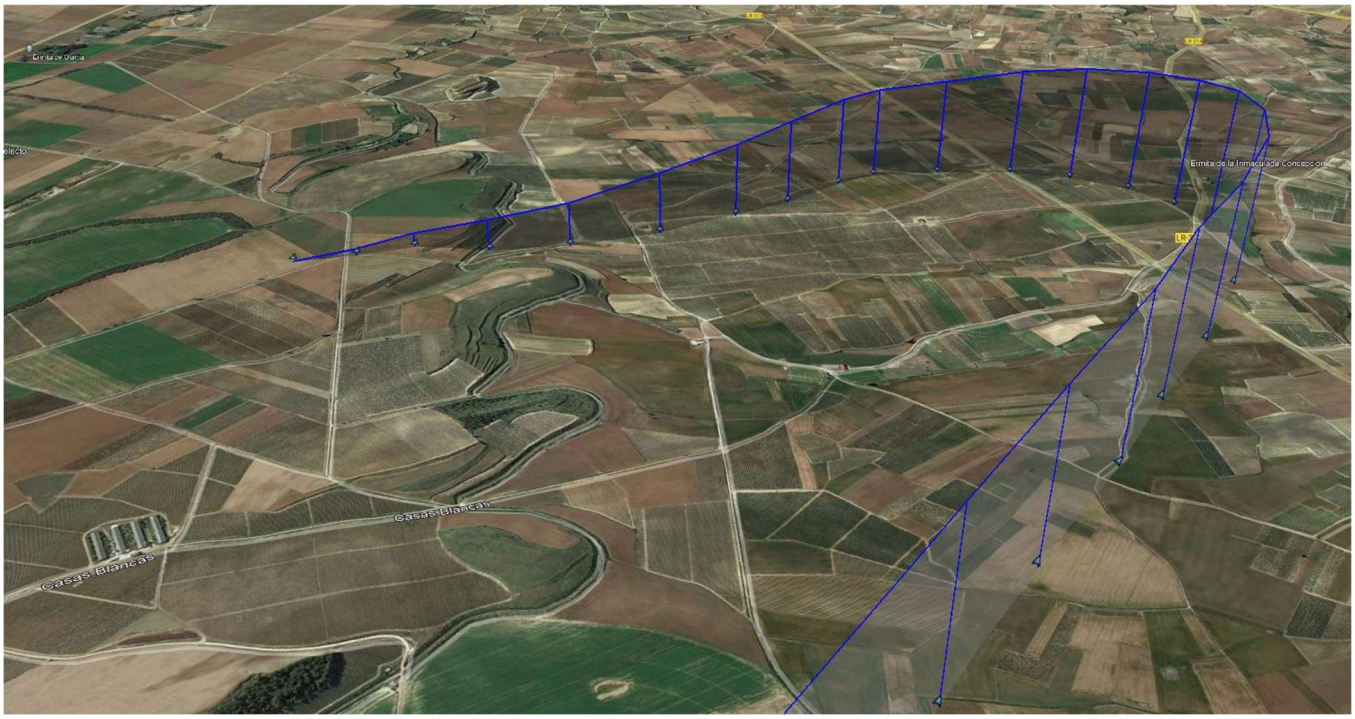

Illustration 2 Flightpath of the EC-HZC aircraft

The GPS data shows that moments before the engine stalled, the aircraft was flying over the municipality of Rodezno at an altitude of approximately 1,000 ft above the ground, maintaining an average speed of approximately 70 kt.

The following table shows the aircraft's speed, altitude and heading in the minutes prior to the accident:

Time in UTC	Ground speed (kt)	Height above the ground (ft)	Direction
07:45:21	70	885	039º
07:45:31	68	936	037º
07:45:42	66	1032	039º
07:45:56	66	1095	039º
07:46:10	62	1173	035º
07:46:23	62	1218	031º
07:46:40	61	1275	032º
07:46:53	61	1254	032º
07:47:05	67	1270	034º

07:47:15	63	1328	031º
07:47:26	61	1360	033º
07:47:38	61	1344	028º
07:47:46	54	1351	017º
07:47:54	50	1350	002º
07:48:00	51	1304	338º
07:48:06	51	1255	318º
07:48:13	50	1201	298º
07:48:20	51	1142	281º
07:48:28	56	1065	266º
07:48:35	59	946	256º
07:48:40	56	886	233º
07:48:49	53	844	222º
07:48:57	50	770	228º
07:49:07	49	693	237º
07:49:18	48	530	240º
07:49:27	47	333	249º
07:49:36	41	205	258º
07:49:43	42	116	245º
07:49:51	38	54	251º

According to the data, the aircraft's speed reduced by 20 kt in approximately 2 minutes and 30 seconds (between 7:45:21 UTC and 7:47:54 UTC). After this, it turned left, changing course by approximately 140° and landing in a rapeseed field.

1.12. Aircraft wreckage and impact information

The aircraft made an emergency landing on a densely vegetated rapeseed field with growth up to approximately 1.5 m high. According to the pilot's statement, he saw two possible landing fields and chose the one planted with rapeseed. Just before the landing, the pilot noticed the height of the vegetation, which was not evident from the air.

The following image shows an aerial photo of the aircraft's final position on the rapeseed field.

Illustration 3 Aerial photograph of the aircraft's final position

The following image shows a close-up of the aircraft in its final position and the height of the vegetation. It also shows that the aircraft landed with maximum flaps.

Illustration 4 Aircraft on the rapeseed field

The impact with the vegetation fractured the aircraft's nose leg and damaged one of the propeller blades without breaking it completely.

Illustration 5 Condition of nose leg and propeller

The left wing strut also fractured, causing the left wing to flex downwards and break the windscreen. The pilot's door was rendered unusable.

Illustration 6 Final condition of the strut and windscreen

1.13. Medical and pathological information

N/A.

1.14. Fire

N/A.

1.15. Survival aspects

The cockpit retained its structural integrity, and the restraints performed their function effectively, allowing the pilot to escape without injury.

The fractured strut caused the left wing to bend downwards, rendering the pilot's door unusable and blocked. As a result, the pilot was forced to evacuate the aircraft through the co-pilot's door.

1.16. Tests and research

1.16.1. Dismantling the wings and towing the aircraft

A crane was used to remove the aircraft from the rapeseed field. To facilitate this operation, the aircraft's wings were dismantled, and while doing so, water was observed in the right-hand fuel tank, spilling out of the overflow pipe.

1.16.2. Inspection of the aircraft's engine

In order to determine the cause of the engine stall referred to by the pilot, the aircraft's Rotax 912 model engine was inspected with the help of a qualified Rotax engineer.

Water was found in both of the two carburettor float bowls. There was also evidence of the presence of water in the fuel line to the carburettors. The following images show the contents of the float bowl, which when collected in a glass, clearly show the separation into both fuel and water.

Illustration 7 Presence of water in the carburettors

In addition, rust marks were observed on the bottom of the float bowls, confirming the presence of water at the base of the carburettor.

Illustration 8 Rust marks in the carburettor float bowls

The fuel filter is located where the fuel lines from the two wing tanks meet. Once both fuel lines are unified, the fuel passes through the filter and into the gascolator before going to the carburettor bowls.

A considerable amount of water was found in the fuel filter when it was disassembled, as shown in the following image.

Illustration 9 Presence of water in the fuel filter

A functional test of the condition of the spark plugs found that they were working correctly. The magnetic screw and the oil filter were also checked, and both were in good condition.

1.16.3. Inspection of the fuel tanks

The external access to the fuel tanks on the wings consists of an aluminium plate over a glass-fibre tank. On this external face, there were signs of corrosion on the metal part of the overflow.

A borescope was used to check the interior condition of the fuel tanks.

Illustration 10 Fuel tank access plate

There were no signs of interior corrosion on either the glass-fibre or aluminium parts of the tank. However, there was a considerable amount of water inside the fuel tank on the right wing.

1.16.4. Composition of the water

A 185 ml sample of the water obtained during the engine inspection was recovered to analyse its composition and determine its possible origin. The sample was subjected to a metagenomic characterisation of microbial biodiversity.

This process involves studying the prokaryotic ribosomal 16S RNA gene, which contains nine variable regions interspersed between conserved regions. These 16S RNA variable regions are frequently used in phylogenetic and/or taxonomic classifications in various studies of microbial populations.

The primary analysis undertaken was a comparison of the "measure of species diversity" between the sample from the fuel tank and environmental samples of natural waters.

The conclusions of the comparative study between the control sample and the sample recovered by the CIAIAC are as follows:

- lower microbial biodiversity in the problem sample (CIAIAC).
- low diversity, comprising a reduced number of individuals belonging to taxa directly linked to hydrocarbon-contaminated environments and fuel tanks.
- The taxonomic characterisation of the problem sample (CIAIAC) is consistent with those reported in the available literature as typical of hydrocarbon-contaminated environments, with an almost total absence of other taxa typical of natural aquatic resources.

The results of the study prove that the sample water originated from condensation inside the tank itself, as a result of environmental humidity and/or, with less probability, rainwater. The study did not detect the presence of any microbial taxa specific to natural aquatic environments or drinking water.

1.17. Organisational and management information

N/A.

1.18. Additional information

1.18.1. Emergency landing procedure: aircraft flight manual

The Tecnam P92-Echo aircraft flight manual sets out the emergency procedures to be followed in the event of an emergency landing without engine power:

ATERRIZAJE FORZOSO SIN MOTOR
1. La velocidad óptima de planeo es de 110 km/h
2. Identificar el terreno más adecuado para un aterrizaje de emergencia, a ser posible contra el viento
3. Válvula de combustible: *OFF*
4. Interruptor de encendido: *OFF*
5. Apretar el cinturón de seguridad; desbloquear las puertas de la cabina
6. Flaps: como corresponda
7. Cuando se esté seguro de que se va a aterrizar, llave interruptor general *OFF*

1.18.2. Refuelling by the pilot

The aircraft's last flight before the accident took place two days earlier. It then remained in the hangar with approximately 5 litres of fuel in the right tank and 10 litres in the left tank.

On the day of the accident, the pilot bought petrol at a petrol station on the way to the airfield, collecting it in a jerry can. According to the pilot's testimony, he put 5 litres of fuel into the tanks on each wing of the aircraft.

The pilot used a funnel with a cloth as an inlet filter to refuel the aircraft from the jerry can. He did not notice any water in the fuel in the jerry can.

The CIAIAC analysed the leftover fuel in the jerry can used to refuel the aircraft before the accident flight and did not find any evidence of water. Furthermore, a fuel sample was taken from the petrol station that sold the fuel to the pilot, and no traces of water were observed in the fuel collected.

1.18.3. Pre-flight inspection

The Tecnam P92-Echo aircraft does not have fuel vents in the wing tanks. Fuel can only be purged at the engine gascolator.

According to the information provided by the pilot, during the pre-flight inspection, he purged the gascolator and did not see any water. This excess fuel was returned to the jerry can used for refuelling. The CIAIAC subsequently checked this excess fuel and did not find any water.
According to the Spanish version of the aircraft's Flight Manual, the external pre-flight inspection must be performed as follows:

T Abrir la capota del motor y efectuar las siguientes comprobaciones

I. Comprobar que no hay cuerpos extraños.

II. Comprobar el circuito de refrigeración en busca de posibles fugas de las conducciones, verificando el nivel del líquido refrigerante en el depósito, comprobar que el panel de abeja del radiador no esté obstruido.

III. Inspeccionar el circuito de lubricación en busca de posibles pérdidas de aceite en las conducciones, comprobar el nivel de aceite en el depósito.

IV. Abrir ambas válvulas de combustible, inspeccionar el circuito en busca de posibles pérdidas en los tubos, comprobar la integridad de las protecciones ignífugas. Cerrar las válvulas y empleando un recipiente adecuado, drenar el circuito mediante la válvula del depósito de decantación situada en el cortafuegos., verificando la ausencia de agua e impurezas.

¡ATENCIÓN!

El drenaje se efectuará con la aeronave aparcada en una zona llana.

Octubre1998 4-4

Section T, IV mentions that, prior to draining the fuel settling tank (gascolator), the fuel valves must be closed:

"Open both fuel taps, inspect fuel circuit for losses from tubing, check integrity of fireproof protection braids. ***Close the fuel taps and drain circuit using a container to collect fuel via the specific drainage tap located on the firewall****, verifying the absence of water or other contaminants"*

By contrast, in the English language version of the flight manual, this section is worded slightly differently:

T Open engine cowling and perform the following checklist:

I. Check no foreign objects are present.

II. Check the cooling circuit for losses from tubing, check coolant reservoir level, insure radiator honeycomb cooling fins are unobstructed.

III. Check lubrication circuit for losses from tubing, check oil reservoir level, insure radiator honeycomb cooling fins are unobstructed

IV. Open both fuel taps, inspect fuel circuit for losses from tubing, check integrity of fireproof protection braids, drain circuit using a container to collect fuel activating the specific drainage tap located on the firewall, shut fuel taps. Check for absence of water or other contaminants.

WARNING !

Drainage operation must be carried out with aircraft parked on level surface.

The English version therefore stipulates that the fuel taps should be closed after draining the circuit, not before.

1.18.4. Use of the aircraft

The aircraft remained parked in the hangar at San Torcuato Aerodrome (La Rioja) from July 2021 to February 2022. During these seven months, the aircraft was not used.

Between February 2022 and the accident flight on 29/05/2022, the aircraft made 8 flights, all of which were flown by the owner as pilot in command. These 8 flights were all short in duration, amounting to 7 hours of flight time in total.

According to the pilot's testimony, all the flights were flown using only the tank on the left wing. The tank on the right wing was never used, until the accident flight.

The reason given by the pilot for only using the left tank was that when he purchased the aircraft, its former owners mentioned a minor fuel leak from one of the rivets in the tank on the right wing. The pilot stated that as he had only made a few short flights, he preferred to use the tank on the left wing, as he had more confidence in it.

In addition, he stated that after flying, he left the tanks low on fuel and the aircraft parked in the hangar. He only refuelled on the days he intended to fly.

Because he wasn’t using the right-hand tank during flights, the pilot kept the right fuel valve closed. On the day of the accident, he carried out the pre-flight inspection with the right wing's fuel valve closed and therefore, when he performed the fuel purge, it only purged the fuel in the line coming from the tank on the aircraft's left wing.

1.19. Special investigation techniques

N/A

2. ANALYSIS

2.1. Operational analysis

The aircraft remained parked in the hangar at San Torcuato Aerodrome (La Rioja) for seven months (July 2021 to February 2022). It did not fly at all during that time. During this period, the fuel tanks were left with minimal fuel, which favoured the formation of water due to the condensation of the air volume inside the tank.

In the following three months and up to the accident date, the aircraft was only used to make 8 short flights, all of which were flown with the right-hand fuel valve closed. Similarly, all the pre-flight inspections of the aircraft, including the fuel purge, were carried out with the right-hand fuel valve closed.

On the day of the accident, moments before the engine shutdown, the pilot opened the right-hand fuel valve. The water held in the right fuel tank reached the fuel line and flooded both carburettors, causing the engine to stall.

2.2. Analysis of the aircraft's flight manual

The Tecnam P92-Echo aircraft does not have fuel vents in the wing tanks. Fuel can only be purged at the engine gascolator.

The English language version of the aircraft Flight Manual stipulates that during the pre-flight inspection, the fuel circuit (gascolator) should be drained before closing the fuel valves.

However, the Spanish version of the aircraft's Flight Manual stipulates that the fuel valves should be closed before draining the gascolator. If the purge is performed according to the instructions in the Spanish flight manual, any water in the tanks would never reach the drainage point.

The Spanish instructions read as follows:

"Open both fuel taps, inspect fuel circuit for losses from tubing, check integrity of fireproof protection braids. ***Close the fuel taps and drain circuit using a container to collect fuel via the specific drainage tap located on the firewall****, verifying the absence of water or other contaminants"*

This discrepancy may be the result of an error in the translation of the Flight Manual from English to Spanish.

2.3. Analysis of the emergency landing

According to the data collected from the aircraft's GPS, when its engine stalled, it was flying at approximately 1,000 ft above the ground, in a gentle climb, and maintaining a speed of approximately 70 kt.

According to the aircraft's flight manual, the optimum glide speed in an emergency landing with no engine power is 60 kt (110 km/h).

According to the pilot, the aircraft’s speed reduced by 10 kt, from 70 kt to 60 kt within 2min after the engine shutdown. Once established at 60 kt, the pilot initiated a left turn, changing course by approximately 140° to land in a planted field. This turn further reduced the aircraft's speed by 10 kt over the next 30 seconds, after which it was flying at 50 kt.

Just before making the emergency landing, the pilot noticed that the field he had chosen was covered in dense vegetation, a factor that he had been unable to appreciate from the air. According to his statement, the neighbouring field would have been more suitable for the emergency landing as it was less densely vegetated.

The pilot touched down in the rapeseed field at approximately 38 kt with flaps fully extended. The dense vegetation broke the left wing strut, which prevented the pilot from evacuating the aircraft through the pilot-side door. He managed to evacuate the aircraft through the co-pilot's door.

2.4. Analysis of the engine and the origin of the water

The engine inspection found water in both carburettor float bowls and in the fuel line, the gascolator and the fuel filter located at the junction of the fuel lines coming from the tanks on each wing.

A functional test of the condition of the spark plugs found that they were working correctly. The magnetic screw and the oil filter were also checked, and both were found to be in good condition. An engine shutdown due to mechanical causes was therefore ruled out.

The engine shutdown was triggered by the presence of abundant water in the fuel line, which travelled to the carburettors. The water came from the fuel tank on the right wing.

The pilot took off with the right fuel valve closed and then opened it mid-flight, which allowed the water sitting in the right tank to enter the fuel line.

The metagenomic analysis of the composition of the water found in the engine identified the origin of the water as coming from condensation inside the fuel tank itself as a result of the condensation of environmental humidity. No microbial taxa typically associated with natural aquatic environments or drinking water were found.

The condensation was produced by the daily and continuous temperature and humidity changes that affected the air in the tank.

3. CONCLUSIONS

3.1. Findings

- The right fuel valve remained closed for 10 months.
- The pre-flight inspections were performed with the right fuel valve closed.
- The Spanish version of the Flight Manual incorrectly states that the engine gascolator should be drained during the pre-flight inspection with both fuel valves closed.
- The pilot opened the right fuel valve 30 minutes after take-off.
- The aircraft's engine cut out a few minutes after opening the right fuel valve.
- The impact with the vegetation fractured the left wing strut, rendering the pilot's door unusable for evacuation.
- The pilot evacuated the aircraft without assistance using the co-pilot's door.
- The engine examination revealed the presence of water in the carburettor bowls and the fuel line.
- The water was found to be coming from the right fuel tank.
- The metagenomic analysis of the water found that it originated from condensation inside the fuel tank.

3.2. Causes/contributing factors

The investigation has concluded that the cause of the accident was an emergency off-airfield landing following an in-flight engine stoppage caused by the ingestion of water into the carburettors.

4. OPERATIONAL SAFETY RECOMMENDATIONS

The investigation identified discrepancies between the Spanish and English versions of the Tecnam P92-Echo Flight Manual, and therefore the following safety recommendation is issued:

REC 04/23: It is recommended that TECNAM amend the Spanish version of the P92-Echo Flight Manual to ensure that it is consistent with the English version in stipulating, in the pre-flight inspection chapter, that fuel drainage should be carried out with the fuel valves open. The amendment should then be disseminated to the aircraft's operators.