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Report ULM A-013/2020

Accident involving a TECNAM
P96-G aircraft, registration
EC-ZEK, on 27 September 2020,
at the La Juliana Aerodrome
(Seville)



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DE ESPAÑA

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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 object of the investigation, its probable causes and its 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 (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, 4 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 detailed 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(s), minute(s) and second(s)
%	Per cent
°C	Degree(s) Celsius
AAE	Asociación de Aviación Experimental (Experimental Aviation Association)
AEMET	Spain's State Meteorological Agency
AESA	Spain's National Aviation Safety Agency
AFM	Aircraft flight manual
AMM	Aircraft maintenance manual
ATPL	Airline Transport Pilot License
cm ³	Centimetre(s) cubed
DGAC	General Directorate of Civil Aviation
h	Hour(s)
HP	Horsepower
kg	Kilogramme(s)
km	Kilometre(s)
km/h	Kilometre(s)/hour
LAPL	Light Aircraft Pilot License
LEJU	ICAO code for La Juliana Aerodrome (Seville)
m	Metre(s)
m ²	Metre(s) squared
MAF	Multi-axis fixed-wing
mm	Millimetre(s)
MHz	Megahertz(s)
N	North
s/n	Series number
W	West
PPL	Private Pilot License
rpm	Revolutions per minute
SEP	Single-engine piston
TMA	Aircraft maintenance mechanic
TORA	Take-off run available
TULM	Ultralight aircraft pilot license
ULM	Motorised ultralight aircraft
VFR	Visual Flight Rules

Synopsis

Owner and operator:	Private
Aircraft:	TECNAM P96-G, registration EC-ZEK, s/n: 00078-1467
Date and time of accident:	Sunday, 27 September 2020, 12:15 local time
Site of accident:	La Juliana Aerodrome (LEJU) - Seville
Persons on board:	One pilot / one passenger
Type of flight:	General Aviation - Private
Phase of flight:	Taxiing to parking stand
Flight rules:	VFR
Date of approval:	25/FEB/2021

Summary of incident

On Sunday, 27 September 2020, the ultralight aircraft TECNAM P96-G, registration EC-ZEK, made a local round-trip flight from La Juliana Aerodrome in Seville with the pilot and a passenger on board. Following an uneventful landing, as it reached the end of the runway and turned to head towards the parking area, its nose gear leg broke, causing damage to the propeller and the underside of the fuselage.

The occupants were unharmed and exited the aircraft without assistance.

The investigation into the accident has determined it was caused by the breakage of the nose gear fork assembly, which occurred as the aircraft turned to taxi towards its parking stand.

Poor preventative maintenance of the aircraft is believed to have contributed to the accident.

This report contains a safety recommendation addressed to the AAE, recommending the dissemination of said technical report among owner-pilots of amateur-built aircraft, in order to raise awareness of the importance of inspecting the aircraft thoroughly and carrying out proper preventative maintenance.

1. FACTUAL INFORMATION

1.1. History of the flight

On Sunday, 27 September 2020, the pilot-owner of the ultralight aircraft TECNAM P96-G, registration EC-ZEK, made a local round-trip flight from La Juliana Aerodrome in Seville with one passenger on board.

During the flight, he performed two landings and take-offs without incident, then flew to an area located approximately 10 km from LEJU.

The aircraft landed without incident for the third time. When it reached the end of runway 27, the pilot increased the power (around 800 rpm) to make the turn back towards the parking area. The aircraft then travelled to the left, about 20 m from the end of the runway.

The nose landing gear leg broke, causing the aircraft's nose to drop onto the runway and damaging the propeller and the underside of the fuselage.

The occupants were unharmed and exited the aircraft without assistance.



Photograph 1. Accident aircraft in the hangar after the incident

1.2. Injuries to persons

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

1.3. Damage to the aircraft

The aircraft suffered significant damage to the engine propeller, the underside of the nose cone and the nose landing gear.

1.4. Other damage

There was no third-party damage.

1.5. Personnel information

1.5.1. Pilot/Owner

The 74-year-old Spanish pilot had the following pilot license issued by Spain's National Aviation Safety Agency (AESAs):

- Ultralight Pilot License (TULM) issued on 27/04/1994, with a Multi-Axis Fixed-wing (MAF) rating, valid until 31/07/2021.
- Private aircraft Pilot License (PPL) issued on 11/09/2002 with a single-engine piston rating (SEP), valid until 30/11/2020.

His class 2 medical certificate was valid until 20/08/2021, and his LAPL certificate was valid until 20/08/2022.

The pilot had a total of 280 flight hours and 146:67 flight hours in the type of aircraft involved in the incident.

He also had experience flying ultralight aircraft Quick Silver, CESSNA 150 and CESSNA 172 aircrafts.

According to his testimony, the pilot flew almost every week, performing circuits of the La Juliana Aerodrome (Seville) and short journeys within around 10 km from the aerodrome. He usually flew for around 30' to an hour per week.

The aircraft was his property, and he had purchased it directly from the amateur builder responsible for its manufacture and approval.

1.6. Aircraft information

1.6.1. General information

The aircraft involved in the accident was a TECNAM P96-G Italian designed kit-built ultralight.

It is a two-seater, single-engine, cantilevered low-rectangular-wing aircraft with a fixed tricycle-type landing gear and steering controlled by the nose wheel.

Characteristics:

Wingspan: 8.7 m

Length: 6.4 m

Height: 2.3 m

Wing area: 12.18 m²

Empty weight: 280 kg

MTOW: 450 kg

Minimum speed without flaps: 105 km/h

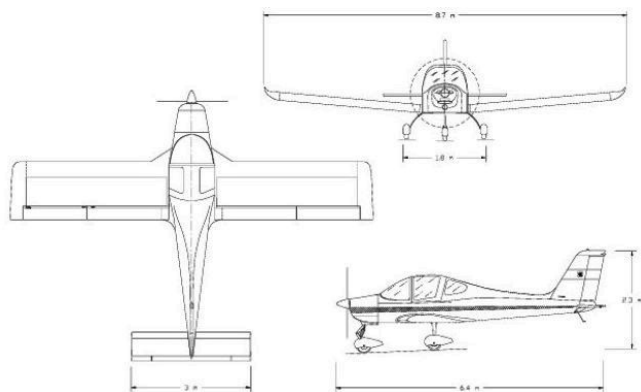


Figure 1. TECNAM P96-Golf

Power plant:

The aircraft was equipped with a ROTAX 912 ULS four-stroke engine, s/n: 4427100, with four horizontal cylinders, double carburettor and double electronic ignition. It has a maximum power of 100 HP at 5,800 rpm, with a 1:2.43 gearbox and a cylinder capacity of 1,352 cm³.

Propeller:

The propeller installed was a two-bladed wooden traction propeller with variable pitch made by F.lli Tonini Giancarlo & Felice S.n.c. Model: GT- ECHO 172/164 diameter 1,720 mm.

Fuel:

The aircraft had two fuel tanks, one for each wing, with a total capacity of seventy litres.

The authorised fuel type is 95 or 98 octane petrol.

Procedures

The applicable procedures for both normal operation and emergency situations are those included in the aircraft flight manual (AFM).

In relation to the investigation, it should be noted that the condition of both the main and nose landing gear should be checked during the pre-flight inspection. Specifically, the integrity of the nose leg, the tyre inflation pressure (1.0 bar) and the general condition of the shock absorber and the wheel fork must be checked.

During this inspection, the pilot noticed a crack in the nose gear fork that he had already observed on previous occasions. He considered it to be a superficial and insignificant crack in the paintwork.

Instrument panel



Photograph 2. Instrument panel of the accident aircraft

1.6.2. Maintenance information

The aircraft of the event was built by its previous owner in 2001 according to type certificate No. 246-I dated 11/04/2002. It was maintained, in accordance with current legislation, by its current owner and pilot under the maintenance programme approved by AESA on 26/10/2016.

The programme establishes the following required inspections:

- After 25 flight hours: the pre-flight inspection
- After 50 flight hours: the basic inspection (B)
- After 100 flight hours or 12 months, whichever comes first: the periodic inspection (C)
- After 200 flight hours or 24 months, whichever comes first: the general overhaul (D)

At the time of the event, both the aircraft and the engine had 876:50 flight hours, and since the last general overhaul, it had performed forty cycles.

The last maintenance checks carried out on the aircraft were general overhauls noted in the aircraft's logbook without details or reference to the tasks performed. The most recent was carried out on 26/01/2020 when the aircraft had 864:20 flight hours, and the one prior to that was carried out on 02/02/2018, when the aircraft had 827:20 flight hours.

The last engine inspections noted in the engine book dated 18/10/2002 were a general engine overhaul when it had 846:20 flight hours, coinciding with the aircraft's general overhaul on 26/01/2020. Prior to that, there was an overhaul dated July 2003, when the aircraft had 360 flight hours, during which a gearbox leak was repaired. And prior to that, there was an overhaul in December 2002, when the aircraft had 300 flight hours, which entailed changing the oil and filter, and cleaning the carburettor.

1.6.3. Airworthiness status

According to AESA's record of active registrations, the aircraft with serial number 01016-1553 and registration EC-ZEK was registered on 21/08/2001, with registration number 6131. The registration certificate dated 08/11/2013 was issued to the current owner and states the aircraft's base as the Almonte airfield in Huelva.

The aircraft had a restricted special airworthiness certificate issued by DGAC dated 06/08/2002, with number A-736 and valid until 06/12/2020 for the "Private 3 Normal ULM" category.

It also had a revised aircraft station license issued on 26/06/2002 and valid until 09/12/2020, which included its ICOM A200 equipment.

1.7. Meteorological information at the accident site

As there is no AEMET station at La Juliana, we analysed the conditions at the closest stations: Tomares (13 km to the north-east), Tablada (16 km to the north-east), and Carrión de los Céspedes (17 km to the north-west).

The data obtained on temperature (between 23 and 26°C), relative humidity (46 and 55 per cent), average wind (between 9 and 14 km/h from the north-northwest) and maximum wind (between 18 and 23 km/h from the north-northwest), as well as the remote sensing images, confirm there was no cloud, no convective activity, and no significant predicted weather phenomena. Visibility was good.

1.8. Aids to navigation

Not applicable.

1.9. Communications

Not applicable.

1.10. Aerodrome information

La Juliana aerodrome (LEJU) is located in the province of Seville, 15 km from the provincial capital (Seville), between the towns of Mairena del Aljarafe, Palomares del Río, Coria del Río and Bollullos de la Mitación.



Photograph 3. La Juliana Aerodrome–LEJU(Seville)

It has a paved 09/27 orientation runway measuring 925 x 17 m with no lighting and 890 m of TORA. It has an elevation of 45 m, and its geographical coordinates are:

37° 17' 43" N – 006° 09' 48" O.

The aerodrome's procedures include the following:

- Prior to taxiing and when still on the stand, all aircraft must notify their intention to depart on the La Juliana frequency: 123,500 MHz.
- Aircraft must then taxi with caution, using the yellow painted taxiways, towards holding points H1, H2, H3 and H4, completing the before take-off checks.
- It will be notified before crossing or aligning with the runway, fitting in with any other traffic in the taxi zones and aerodrome circuit.
- To enter the parking apron, all aircraft landing at La Juliana must join P1 and, following the yellow line, position themselves on one of the parking stands marked on the apron.

1.11. Flight recorders

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder, as the aeronautical regulations in force do not require any recorders on this type of aircraft.

1.12. Wreckage and impact information

The accident occurred at the end of runway 27 as the aircraft was turning to backtrack towards the parking area, d to the left about 20 m from the end of the runway.

The main damage caused to the aircraft was as follows:



Photograph 4. Path of the aircraft during the event

- Underside of the nose cone and the nose landing gear housing: Photograph 5 shows the damage to the underside of the aircraft's nose and landing light.



Photograph 5. Nose landing gear housing damage

The nose landing gear clamping piece to the engine bench can be seen disassembled.

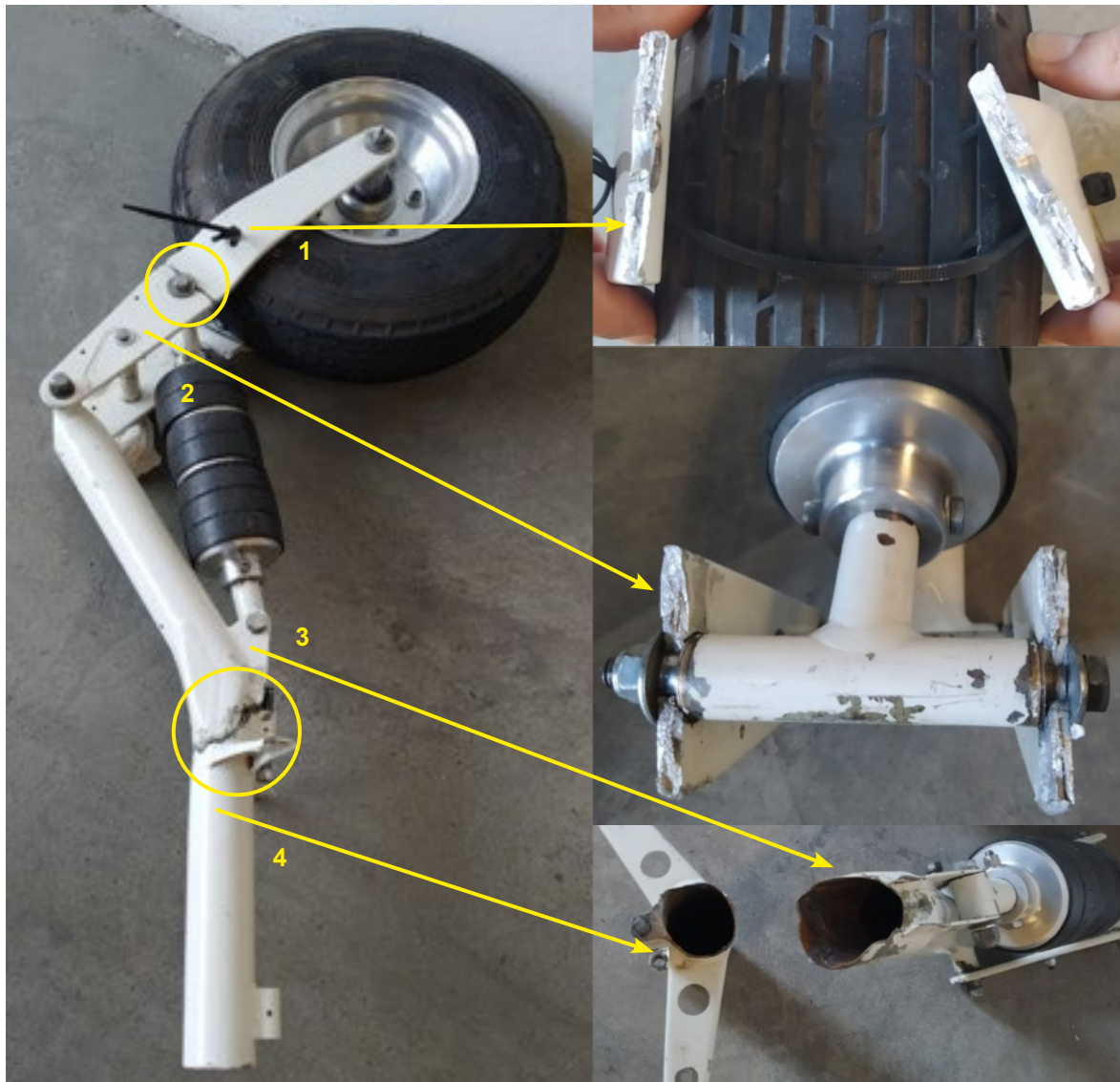
- Propeller: the wooden blades were destroyed, with the breakages occurring close to where the propeller is attached to the nose cone.
- Nose landing gear: the nose landing gear leg broke into four fragments (photo 7).

Fragments 1 and 2 are part of the nose wheel fork, which comprises two oscillating arms that connect the wheel axle to the shock absorber and the nose gear leg.

The horizontal break perpendicular to the axis of the oscillating arm occurred in its central part coinciding with the hole of the bolt for fixing the shock absorber.



Photograph 6. Damage to the propeller



Photograph 7. Reconstruction of the nose landing gear showing the four fragments and the damage



Photograph 8. Fracture of fragment 1

The fractures seen in fragment 1 are typical of those caused by overstress due to material fatigue, with a smooth, progressive fracture zone and an instantaneous or sudden fracture zone with a rougher or crystalline appearance.

The fractures seen in fragment 2 (see detail in photograph 7) appear more worn and flatter than fragment 1.

Fragments 3 and 4 are from the intermediate part of the leg where its angle changes. Fragment 3 is the part that holds the shock absorber and fragment 4 is the part that hinges the leg to the engine mount, which fractured close to the two horizontal fins.



Photograph 9. Corrosion on fragment 3

The fractures seen in fragments 3 and 4 show corrosion, an angled breakage and deformation (photographs 7 and 9).



Photograph 10. Assembly accessory for attaching the nose gear leg to the engine mount

Photograph 10 shows how the nose gear leg was sectioned after the accident. Fragment 4 (circled in the picture) remained attached to the structure.

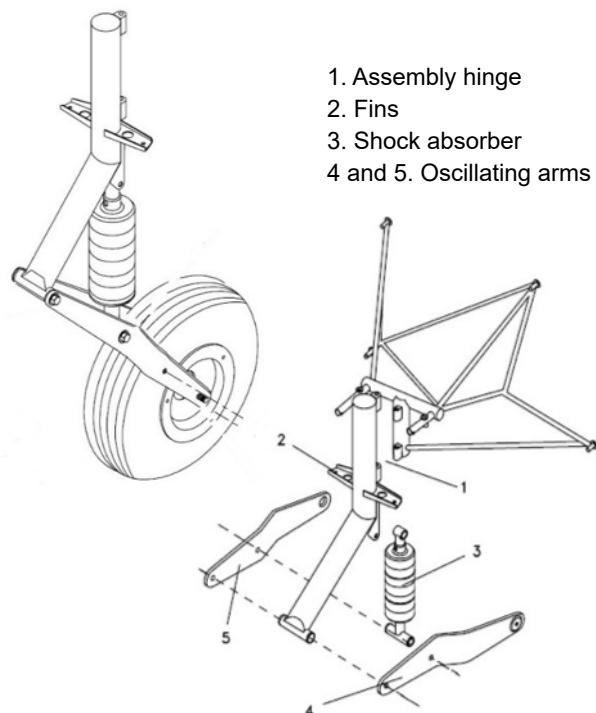


Figure 2. Exploded-view diagram of the nose gear leg

Figure 2 shows an exploded-view diagram of the nose gear leg taken from the aircraft's AMM, which clearly identifies the four fragments found after the accident.

1.13. Medical and pathological information

Not applicable.

1.14. Fire

Not applicable.

1.15. Survival aspects

The structure of the aircraft retained its shape and there was no damage to the cabin, which meant the crew were able to evacuate the aircraft without assistance.

Both occupants were wearing their four-point safety seat belts when the accident occurred, which worked efficiently.

1.16. Tests and research

1.16.1. Pilot's statement

According to the pilot's statement, on the day of the incident, he made a local round-trip flight from LEJU, as he does every week with flight durations of between thirty and fifty minutes to practise take-offs and landings and make a short crossing of roughly 10 km from the aerodrome.

On this occasion, the flight lasted thirty minutes, during which time he performed a couple of landings and take-offs without incident. On the third landing, he reached the end of runway 27 and turned, intending to backtrack along the same route towards the hangars to park the aircraft. As he turned, he increased the power, in his words, "because if I didn't, the aircraft wouldn't move," and the aircraft moved to the left. After travelling roughly 20 m, the nose gear leg broke and the nose hit the runway, destroying the propeller.

The pilot stated that he usually applied about 600 rpm but had applied around 800 rpm on this occasion. Perhaps, in his words, the manoeuvre was "slightly brusque". The pilot confirmed that he had long ago observed a crack in the two plates of the wheel fork that broke, but he thought it was a superficial crack in the paintwork and did not think it was significant.

The pilot bought the aircraft second-hand from its manufacturer and performed minor maintenance tasks such as oil and filter changes himself, always using original parts. He used a maintenance organisation for more major maintenance tasks such as cleaning the carburettor, etc. He confirmed that the engine mount had been installed new two or three years ago by a certified aircraft maintenance mechanic. The nose wheel fork that broke in the accident was the original part fitted to the aircraft when he purchased it in 2013.

1.17. Additional information

Not applicable.

1.18. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

2.1. Analysis of the meteorological conditions

The meteorological conditions in the area of the La Juliana Aerodrome - LEJU (Seville) around the time of the event (12:15 local time) were suitable for the flight, and no unexpected adverse conditions that could have contributed to the accident were recorded.

2.2. Operational analysis

The pilot carried out the flight without incident, following the usual manoeuvring patterns he regularly performed. He carried out two take-offs and landings before the accident, during which the landing gear withstood the stress of the manoeuvres. Subsequently, he made a crossing of around 10 km, which also passed without any apparent incidents.

It should be noted that the pilot saw the crack which led to the breakage of the wheel fork during the pre-flight inspection of the condition of the main and nose landing gear. However, he assumed it was a superficial crack in the paintwork and did not think it was significant despite having noticed it previously.

The pilot stated that the backtrack manoeuvre used to return in the opposite direction towards the parking area was performed abruptly and with more power than usual. The nose gear, which controls the aircraft's direction on the runway, made the 180° turn required for the return. Nevertheless, probably, considering that the oscillating arms were already damaged and the manoeuvre was carried out abruptly and with more power than usual, led to the final breakage of the fork assembly, detaching the wheel and causing the impact of the sectioned fork into the runway. This impact caused the bending of the landing gear leg to tear in the direction of travel, breaking the leg, dropping the aircraft's nose onto the runway and causing significant damage to the propeller and the underside of the nose cone.

The superficial and not rigorous inspection of the observed crack, as well as a forced operation to change direction on the runway at a higher speed than usual, provoked the breakage of the probably already damaged nose wheel fork.

2.3. Analysis of the aircraft's maintenance and damage

The owner pilot, as responsible for the aircraft's maintenance, carried out the scheduled maintenance checks of both the aircraft and the engine himself. It should be noted that he did not build the aircraft himself; he acquired it second-hand, and, as a result, his knowledge of it was limited.

The last inspection of the aircraft, recorded as a general overhaul in the aircraft logbook, was carried out on 26/01/2020 when it had 864:20 flight hours. The landing gear should have been checked during this overhaul but there are no detailed records of the tasks carried out. According to the pilot's own testimony, he had noted the cracks in the oscillating arms on several occasions prior to the accident but assumed they were non-structural cracks in the paintwork. Between the last overhaul and the accident, the aircraft had flown 12:30 hours in eight months, therefore, not to many hours, but nevertheless it made many cycles, in total forty take-offs and landings.

The breakage of the oscillating arms, which occurred in the weakest area of the component, on a level with the holes for the shock absorber bolts, was probably caused by material fatigue, as demonstrated by the type of fracture seen in the fork fragments. The inspection of the fragment that remained attached to the leg for a few more seconds before it also fractured due to deformation, revealed that its broken edges impacted the runway, slightly wearing away the rough area around the break.

Proper preventative maintenance of the cracks in the oscillating arms would have detected the problem before the fracture occurred. The landing gear system is subjected to fatigue by its own function and operation, but fatal failures can be avoided with proper maintenance.

The internal corrosion revealed after the leg broke, while not considered to be a determining factor in the breakage, may have weakened the material and, therefore, contributed to the accident. The corrosion finding highlights the need for proper preventative maintenance.

The landing gear maintenance was, therefore, inadequate, probably due to an insufficient knowledge of the type of failures a surface crack may imply in the paintwork of critical components such as the oscillating arms of the nose gear fork.

3. CONCLUSIONS

3.1. Findings

- The pilot was the owner of the aircraft and held valid TULM (MAF) and PPL pilot licenses, as well as class 2 and LAPL medical certificates.
- His total flight experience was 280 hours, of which 146.67 hours were in the aircraft involved in the incident.
- The aircraft was an ultra-light, amateur-built aircraft, performing a private flight.
- There were no limiting meteorological conditions for visual flight.
- The aircraft had a valid restricted special airworthiness certificate.
- The aircraft was built in 2001 by the previous owner, and both the airframe and engine had 876:50 flight hours.
- The aircraft was first registered after its construction on 21/08/2001 and transferred to its current owner on 08/11/2013.
- The aircraft was maintained by the pilot/owner with brief annotations of the inspections in the aircraft and engine logbooks.
- The last general maintenance overhaul of the aircraft was carried out on 26/01/2020. Between that overhaul and the time of the accident, it flew 12:30 hours and performed forty cycles.
- Analysis of the aircraft wreckage has shown that the nose wheel's oscillating arms fractured from fatigue as the aircraft taxied after landing.
- The investigation has revealed that the preventative maintenance carried out on the aircraft was inadequate.
- The occupants were unharmed and able to exit the aircraft without assistance.

3.2. Causes/contributing factors

The investigation into the accident has determined it was caused by the breakage of the nose gear fork assembly, which occurred as the aircraft turned to taxi towards its parking stand.

Poor preventative maintenance of the aircraft is believed to have contributed to the accident.

4. OPERATIONAL SAFETY RECOMMENDATIONS

REC 16/21: It is recommended that AAE (Asociación de Aviación Experimental) disseminate the results of this report among its members in order to inform them of the need to regularly inspect and carry out preventative maintenance on amateur-built aircraft to lower the risk of fatal structural failures that could threaten the safety of the crew and the aircraft.