

DATA SUMMARY

LOCATION

Date and time	Monday, 2001 October 1st; 12:40 hours
Site	Cala Marsal – Porto Colom (Palma de Mallorca)

AIRCRAFT

Registration	D-EJUS
Type and model	CESSNA F172G

Engines

Type and model	ROLLS ROYCE O-300-D
Number	1

CREW

Pilot in command

Age	46 years
Licence	Airplane private pilot
Total flight hours	582:20 hours
Flight hours on the type	582:20 hours

INJURIES

	Fatal	Serious	Minor
Crew			1
Passengers			2
Third persons			

DAMAGES

Aircraft	Important
Third parties	Stone wall and concrete post

FLIGHT DATA

Operation	General aviation – Pleasure
Phase of flight	En route – Cruising level

1.- FACTUAL INFORMATION

1.1. Flight report

The aircraft took off from Son Bonet's aerodrome at 10:00 UTC bound for Palma de Mallorca airport. It was a transit flight within the island of Mallorca with two other aircraft.

After 35 min. of flight time and at some altitude between 700 and 900 feet, the pilot noticed an increase in the engine temperature indication and a decrease in the engine revolutions with an abnormal engine running. The pilot asked for help to the aircraft flying with him and was told that there was smoke coming out of the engine. He then decided to make an emergency landing and after searching the area, he chose a road with no traffic or people whatsoever.

The landing was slightly left deviated which resulted in the lift strut hitting a wall close to the road. Following this, the right wing tip hit a concrete post making the aircraft turn right and finally crashing with a wall on the left hand side of the road and stopping.

The three people on board were able to leave the aircraft on their own feet. The estimated flight time was 1 hour and the aircraft's endurance was 4 hours.

1.2. Injuries to people

Of the three on board, two were unhurt and the third one was slightly injured; a cut in a finger and another cut in the head.

1.3. Aircraft damage

The aircraft suffered important damage.

1.4. Other damage

Both the stone wall against which the aircraft crashed and the telephone concrete post hit by the right wing were damaged.

1.5. Crew information

1.5.1. Pilot

Licence: Airplane private pilot's

Flight hours: 582 hours

Type hours: 582 hours
Ratings: Single engine - land
Date of issue: 07-31-2001
Valid until: 06-30-2003

1.6. Aircraft information

1.6.1. *Airframe*

Make: Cessna Reims Aviation
Model: F 172 G
Serial number: 0317
Year of manufacture: 1966
Registration: D-EJUS
M.T.O.W.: 1045 kg

1.6.2. *Certificate of airworthiness*

Number: 2900
Type: Private
Date of issue: 07-22-1966

1.6.3. *Maintenance log*

Total flight hours: N/A
Last 100 h service: 6-01-2001
Hours since last 100
hours service: 4312 hours

It was not possible to contact the aircraft's owner in order to get some information about the aircraft maintenance, both airframe and engine.

1.6.4. *Engine*

Make: Rolls Royce
Model: O-300-D

Horse power:	145 HP
Serial number:	30R588
Total flight hours:	N/A
Last 100 h inspection:	N/A
Hours since last 100 hours inspection:	N/A

1.7. Meteorological information

The weather conditions as measured by the Meteo Office at Palma airport from 9:30 UTC to 11:30 UTC registered winds from 6 to 9 knots from the 3rd. quadrant, visibility above 10 km. Clouds 1 to 2 octas. Clouds base between 1600 and 2500 feet. Temperature 25 °C and dew point 23°, both with an oscillation of 1 °C. QNH was 1021 mb.

1.8. Communications

The aircraft left Son Bonet maintaining contact with Palma Airport Control to request permission to cross the air field. It was authorized to do it. Later on, it requested permission to fly along the coast line which was also granted.

When the engine problem arose, the aircraft contacted the two others with which it was flying to inform them of the problem. The other aircraft advised that some smoke was coming out of the engine.

As soon as they landed, the aircrafts accompanying the one involved in the accident alerted the Control Tower of Palma airport that the D-EJUS had made a safe emergency landing in an area close to PTC NDB and they requested to close their flight plan.

1.9. Wreckage and impact information

The aircraft made an emergency landing on a road bordered by two stone walls of about 1.20 metres high. The road was 10.60 metres wide and the span of the aircraft was 11 metres. The wings, with a height of 2 meters, were high enough to avoid contact with the stone walls.

The aircraft made the landing with some left deviation from the road centreline and for that reason the lift strut of the left wing slightly rubbed the wall. After going across some metres, it hit a concrete pole with the right wing. Then, the aircraft control was lost and started a skid turn until finally crashing into the stone wall.

Upon inspecting the remains of the aircraft some damages were observed in the leading edge of the right wing as a result of the hitting with the cement post. A part of this edge was cut away.

When the aircraft crashed into the stone wall, the frontal lower part of the aircraft absorbed the biggest part of the energy. Most of the underside of the aircraft from the propeller hub to approximately the fire wall was squeezed down because of the crash. The nose wheel was back bent.

The blade on the underside was completely worn and slightly back bent whereas the one on the upper side was practically intact.

1.10. Survival

The occupants left the plane by themselves.

1.11. Tests and investigations

1.11.1. *Inspection of the engine system*

According to the pilot report an engine inspection was carried out. The following points were inspected:

1.11.1.1. General visual inspection of the outside part of the engine

The aircraft had the blade of the propeller bent backwards due to the effect of the crash with the stone wall, the other blade just had scratches and scrapes. The bending of the blade showed that at the moment of impact the engine was stopped or turning at a low rpm. The screws of the propeller did not showed signs of bending from excess force.

The engine mount showed permanent deformations and breaking of essential bars due to the impact against the stone wall.

The carburator had come away from the engine and it was observed that the breakage of the support had been produced as a result of the crash.

The general condition of the crankcase and accessory gearbox was satisfactory and there was no evidence of any oil leakage previous to the accident. The oil sump was broken.

The silent blocks had the rubber split up.

The crankshaft rotated freely and no signs of seizing up or eccentricity were found.

1.11.1.2. Fuel system

Even though the carburetor was separated from the engine due to the crash, the fuel filter, just before the entrance to the engine, was inspected and found to be clean and without fuel leaks. The carburetor was taken apart and did not show signs of malfunction or foreign objects that could obstruct the flow of air or fuel. The feed pipes were checked and they did not show any fuel leak.

1.11.1.3. Intake and exhaust system

The exhaust system tubes and muffler were deformed and with breaks as a result of the crash of the aircraft with the stone wall. No signs of deterioration were found in joints or tubes.

1.11.1.4. Lubrication system

The oil sump was found to be open as a result of the crash into the stone wall. There was some remain of oil in the sump. The oil was of a blackish colour with deposits of soot.

The oil filter has metal splinters and a blackish appearance of oil due to the large quantity of carbon residues in suspension.

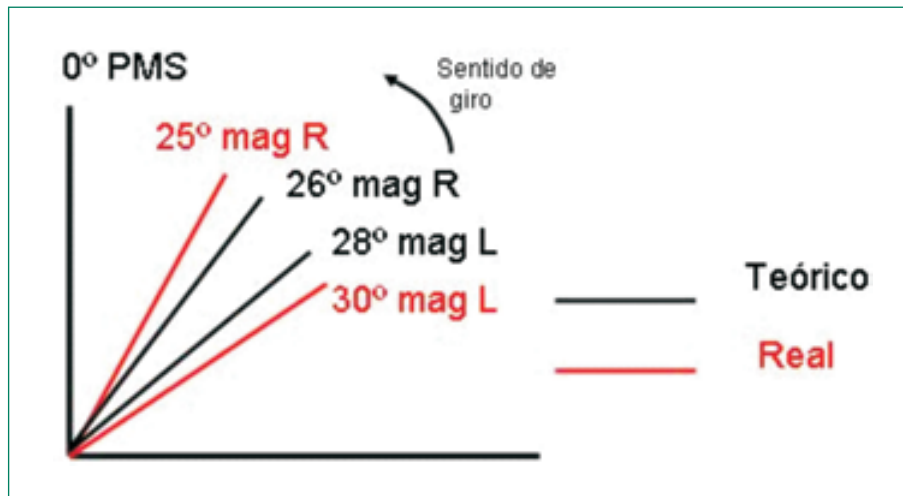
The analysis of the lubrication system could not be taken further as most of it was within the engine itself.

1.11.1.5. Ignition system

The setting of the magnetos was checked on the engine. It was observed that the right magneto, the one to feed the upper spark plugs, was set at 25 degrees, one degree below the 26¹ degrees established in the aircraft maintenance Manual. The left magneto, the one to energize the lower spark plugs, was set at 30 degrees, two more than the 28 degrees as established in same Manual.

The spark plug showed to be normally gauged, brown coloured and with soot deposits.

¹ This figure is the angle that must rotate the crankshaft to make the piston reach the full advance firing position.



The magnetos were dismantled and it was found that the left magneto contact breaker points were abnormally separated.

1.11.1.6. Test carried out

A verification of the cylinder compression was conducted at a reference pressure of 80 psi obtaining the following results:

Cylinder	Compression ratio	Comments
1	80/68	Correct
2	80/10	Not correct
3	80/0	Not correct
4	80/65	Correct
5	80/65	Correct. Some leak in the piston rings
6	80/40	Not correct

1.11.1.7. Disassembly of the cylinders 2, 3 and 6

The cylinders 2, 3 and 6, which were those that showed a wrong pressure ratio, were disassembled.

- a) In cylinder 2 it was found that the inlet valve did not turn as one of its ends was burned.
- b) In cylinder 6 it was found that the piston rings were in good condition.

- c) In cylinder 3 the piston and piston rings were broken. It did not show any sign of continuous operation in the broken piston. The valves showed a condition that was appropriate to the engine life.

1.11.2. *Statement of witnesses*

1.11.2.1. *Pilot's statement*

In his statement the pilot claimed that after 35 or 40 minutes of flight time he noticed that the engine temperature gauges had risen and the engine rpm started to go down. The engine started to choke and to work irregularly so he got in touch with the two accompanying aircraft requesting help. These told him that they could see smoke coming out of the engine and they told him to go back to the departure aerodrome to land. The pilot decided to land in an area far away from urban build-up as he believed he wouldn't get back to the departure aerodrome.

He then circled the area twice to find an appropriate place to land and identified a track along which there were no people or vehicles. He carried out the landing manoeuvre and at some point the right wing hit the post, which made the aircraft to turn, losing control and crashing into the stone wall, producing important damages in the aircraft.

1.12. **Additional information**

1.12.1. *Problems produced by incorrect magneto timing*

A preignition may occur with an improper magneto setting if the spark fires before time, and a postignition if the spark fires after the correct time for the proper combustion of the mixture.

In both cases, the combustion is less efficient and the engine performance is deteriorated. In the case of the preignition, detonations may occur that could deteriorate the piston.

2. **ANALYSIS**

2.1. **Flight analysis**

The aircraft took off from Son Bonet bound for Palma de Mallorca Airport. After 35 minutes of flight time, the pilot noticed abnormal engine behaviour, which could have been caused by the failure of a piston at that moment. After that, he decided to make an emergency landing on a road that he found free of persons or traffic.

The landing took place correctly, but the road was too narrow and the aircraft hit the concrete post with the right wing. The impact made the plane turn to the right and crash into the stone wall which resulted in more damage to the aircraft with the breakage of the nose gear and various parts of the engine.

2.2. Analysis of the inspection carried out on the engine system

In the inspection that was carried out on the engine system two abnormalities were found:

1. The magneto timing. The right one was delayed 1° as related to the maintenance manual. This is not a big difference and in normal maintenance operations is easy to find deviations like that.

However, the right magneto was 2° ahead and that could produce some preignition that contributed to number 3 piston deterioration.

2. Cylinder 3 had the piston and the piston rings split, which certainly caused the engine to behave abnormally and resulted in the loss of power forcing the pilot to make an emergency landing. Without access to information about the maintenance of this engine or its life it is not possible to evaluate whether the deterioration was produced by bad maintenance.

3. CONCLUSIONS

3.1. Findings

- The aircraft had a valid airworthiness certificate in place.
- The pilot had a valid licence in place.
- The aircraft started the flight normally.
- The pilot noticed a loss of power and decided to make an emergency landing.
- In the inspection of the engine system it was observed that:
 - The timing of the right and left magnetos deviated from their nominal values, 1° and 2° respectively.
 - The piston and piston rings on cylinder 3 were broken.

3.2. Causes

The cause of the accident was a loss of power in the aircraft engine which forced the pilot to make an emergency landing in an unsuitable area causing major damage to the aircraft. The poor performance of the engine was probably due to the breakage of piston number 3 which could have had magneto timing outside the specified values.