BEA
Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile
www.bea.aero
@BEA_Aero

INVESTIGATION REPORT

Accident to the Cessna Reims-Aviation F152 registered F-GEMS

on 21 October 2018
at Lingreville (Manche)

Time	16:30[1]
Operator	Aéroclub de Cambrai
Type of flight	Cross country
Persons on board	Pilot and passenger
Consequences and damage	Aeroplane destroyed

This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in July 2021. As accurate as the translation may be, the original text in French is the work of reference.

[1] Except where otherwise indicated, the times in this report are in local time.

Engine failure in climb, off-airfield forced landing, collision with tree on short final

1 - HISTORY OF THE FLIGHT

Note: the following information is principally based on statements.

The pilot, accompanied by a passenger, took off from Granville - Mont-Saint-Michel aerodrome (Manche) bound for Cambrai-Niergnies aerodrome (Pas-de-Calais) where the aeroplane was based[2]. In climb at around 4,500 ft, the pilot felt strong vibrations accompanied by a sudden reduction in the engine rating. The pilot shut down the engine and reported that he was in distress on the Rennes Info frequency. Observing that he could not return to the departure aerodrome, he identified a large, obstacle-free field in order to carry out a forced landing. On short final, the tip of the right wing touched the branches of a tree situated at the edge of the field. During the landing, the left wing of the aeroplane struck the ground and the aircraft came to a sudden standstill.

[2] The same morning, the pilot had carried out the outward flight from Cambrai.

Source: BEA

Figure 1: Accident site

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

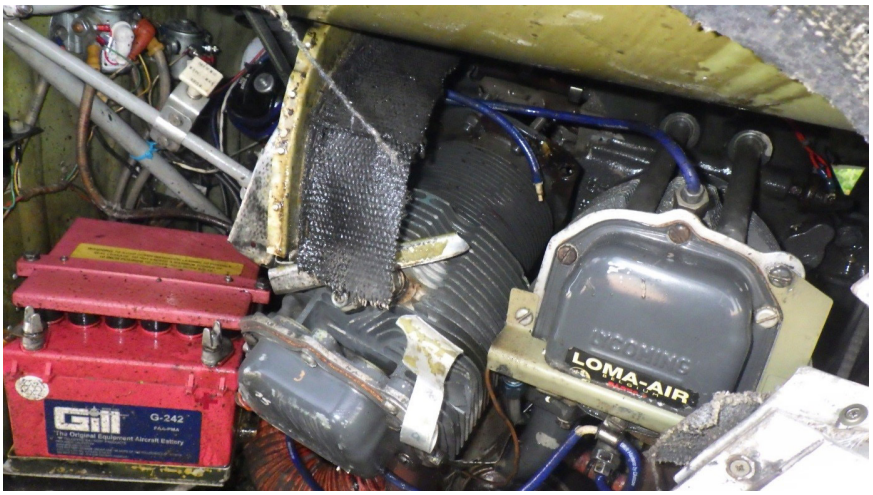
2 - ADDITIONAL INFORMATION

2.1 Pilot information

The 26-year-old pilot held an aeroplane private pilot licence issued in 2016. He had logged 116 flight hours of which 20 hours in the previous three months, all of the latter in the F-GEMS.

2.2 Aircraft information

The Cessna Reims-Aviation F152 registered F-GEMS was equipped with an air-cooled, flat-four Lycoming O-235-L2A engine. This direct-drive engine with a wet sump had a maximum power of 118 hp at 2,800 rpm. After the accident, a visual examination of the engine found that the right rear cylinder had separated from the crankcase.

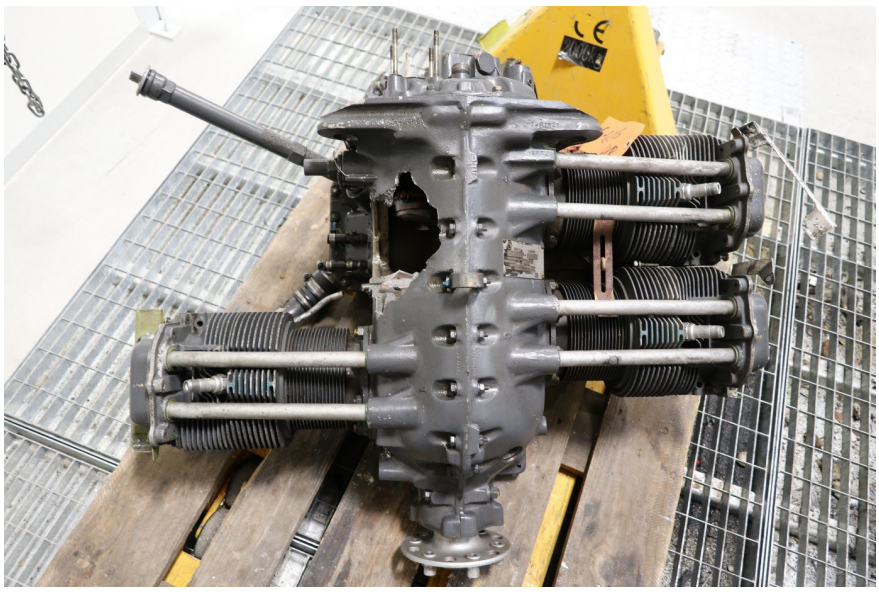


Source: GTA

Figure 2: Right rear cylinder separated from crankcase

2.3 Examination of engine

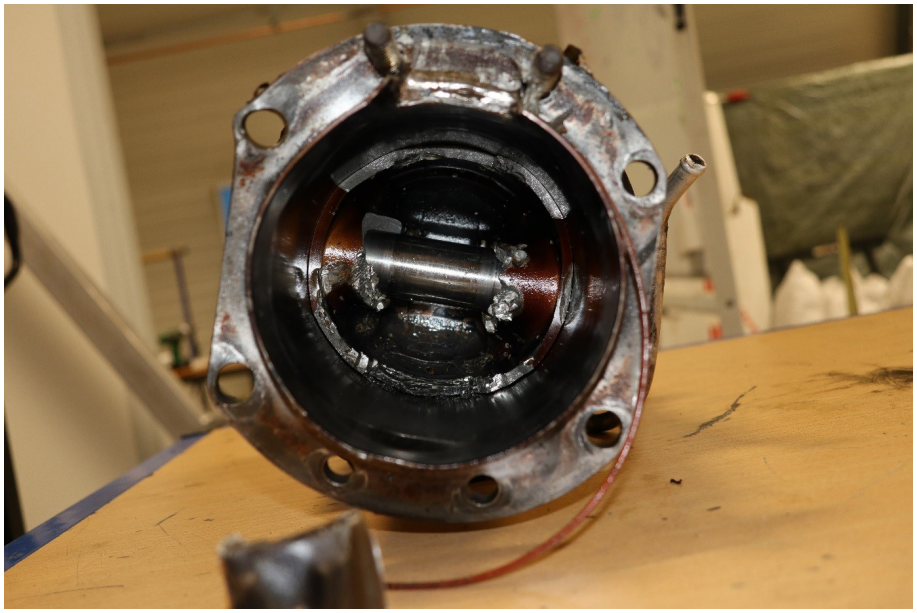
The engine was removed to be examined at the BEA. The crankcase had ruptured around the base plate of the right rear cylinder (cylinder No 3). The three other cylinders were in position without any visible damage.



Source: BEA

Figure 3: Engine at its arrival at the BEA

The piston was blocked inside cylinder No 3. The pin coupling the piston with the rod was present and in good condition. There were no marks or signs of overheating on it. The piston was partially destroyed.



Source: BEA

Figure 4: Piston blocked in cylinder No 3

The cylinder No 3 rod was substantially damaged. It had separated from the crankshaft and piston pin.

Source: BEA

Figure 5: Rod of cylinder 3

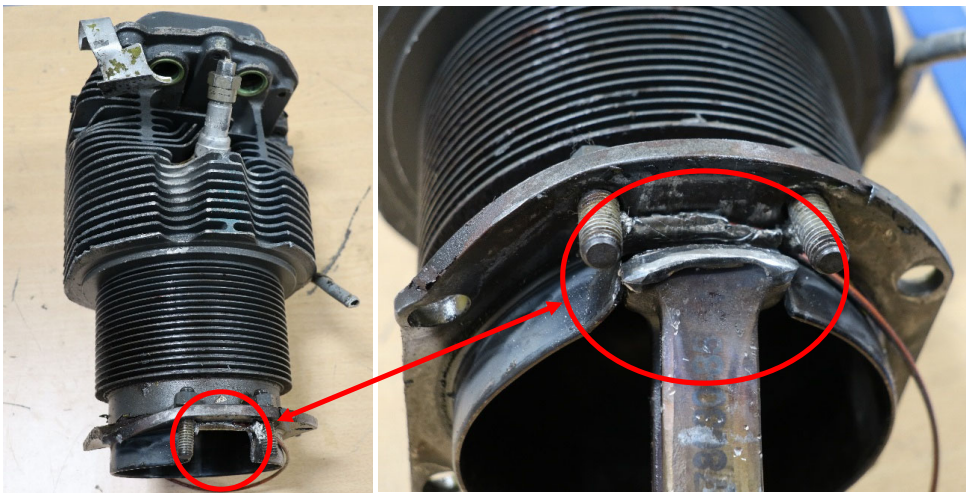
The rod big end (crankshaft side) had only slight damage; the two bolts holding the rod cap had broken. The examination of the fractures of these two bolts showed a sudden rupture due to an overload phenomenon following the failure.

The rod cap and the half-bearings, normally positioned between the rod and the crankshaft, were not found. Prior damage to the half-bearings was unlikely due to the absence of signs of overheating or intense rubbing on the crankshaft.

The rod small end had broken and showed deformation and peening resulting from the hammering of the rod small end while the crankshaft was still being driven. The extent of the damage meant that it was not possible to determine the nature of this failure. The bushing, normally positioned between the rod small end and the piston pin was not found.

The cylinder is normally fixed to the crankcase by eight studs, two of which are through-studs. One of the studs was not found. Two other studs had been torn from the crankcase. The five other attaching parts had broken. The examination of the rupture areas showed sudden failure due to overload phenomena.

The base of cylinder No 3 showed local damage caused by the repeated hammering of the rod small end. The separation of cylinder No 3 from the crankcase was clearly the consequence of prior damage to the rod.



Source: BEA

Figures 6 and 7: Cylinder No 3 and rod small end opposite cylinder damage

All of the examinations carried out by the BEA indicated an initial failure at the small end of the cylinder No 3 rod. Due to the extent of damage on this rod, it was not possible to define the rupture scenario in more detail.

2.4 Aeroplane and engine maintenance

The last 100-hour inspection of the aeroplane dated back to 4 September 2018. At the time of this inspection, the engine had logged 2,769 operating hours since its last major overhaul. When the accident occurred, it had probably exceeded 2,800 operating hours.

The engine manufacturer specified that the TBO[3] for this type of engine is 2,400 hours with no possibility of extending this time.

[3] Time Between Overhaul.

2.4.1 Regulations regarding exceedance of TBO

At the time of the accident, the DGAC had established that it is acceptable to exceed TBOs under certain conditions specified in the G-41-11 guide regarding alternative inspections to TBO for piston engines, published by OSAC. This guide is applicable to aircraft which:

- hold an ICAO certificate of airworthiness;
- are equipped with air cooled only, opposed-cylinder, four-stroke, petrol engines;
- are recorded in the French registration register;
- are not operated by commercial air transport organizations holding an AIR OPS AOC (European AOC obtained in accordance with regulation (EC) 1008/2008 or A to A AOC) and national AOCs.

This guide specifies that the exceedance of the TBO recommended by the engine manufacturer is limited to 20% and subject to regular additional inspections being carried out. Moreover, it defines these additional inspections.

The aircraft maintenance programme must then be revised to take into account the instructions described in the guide. This revision must be approved by the authority or approved airworthiness management organization.

2.4.2 Changes to Part ML regulations

Since 24 March 2020, a new regulation[4] (Part-ML) gives the possibility of declaring the maintenance programme of numerous light aircraft subject to EASA rules. Since this date, the G-41-11 guide is no longer applicable for the maintenance of these aeroplanes.

Part-ML does not require the approval of the content of the maintenance programmes of the aircraft concerned, deviations included, by the competent authority. Henceforth, the maintenance programme for aircraft covered by part-ML is either approved by an approved Continuing Airworthiness Management Organisation or declared by the owner when the latter manages it himself.

The regulatory provisions adopted via regulation (EU) No 2015/1088[5] have also introduced a generic MIP[6][7]. This MIP can be chosen as the basis for a declared maintenance programme instead of the maintenance data defined by the manufacturer.

Any deviations must not make the maintenance programme less restrictive than the MIP and cannot concern compulsory information regarding continuing airworthiness. The MIP only contains basic elements: the extension of the engine TBO is not part of the compulsory maintenance information.

An airworthiness manager can thus choose to exceed the TBO and not to apply any compensating measure.

[4] https://eur-lex.europa.eu/legal-content/FR/TXT/PDF/?uri=CELEX:32020R0270&qid=1624986224899&from=fr

[5] Commission Regulation of 3 July 2015 amending Regulation (EU) No 1321/2014 as regards alleviations for maintenance procedures for general aviation aircraft

[6] Minimum Inspection Programme.

[7] https://www.osac.aero/actualites-Programme_d_entretien_le_canevas_EASA

3 - CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation. They are not intended to apportion blame or liability.

Scenario

While the pilot was climbing and at around 4,500 ft, he was confronted with a sudden failure of the engine. After shutting down the engine, he made an off-airfield forced landing. On short final, he was lower than planned and was not able to maintain sufficient clearance with the vegetation. The tip of the right wing struck a tree before the intended field.

Contributing factors

The investigation showed that the failure of the engine was caused by the rupture of the small end of one of the engine rods. It was not possible to determine what caused this rupture.

The exceedance of the TBO of the engine which had logged 2,800 operating hours whereas the TBO recommended by the manufacturer is 2,400 hours may have contributed to the in-flight failure of the engine.

It is possible that after shutting down the engine, the pilot misestimated the glide performance of the aeroplane with the engine shut down.