



Accident to the Robin - DR400 - 140B registered F-GJZT

on 10 August 2019

at Ceyszac (Haute-Loire)

⁽¹⁾Unless otherwise stated, all times given in this report are in local time.

Time	Around 15:30 ⁽¹⁾
Operator	Aéroclub du Puy
Type of flight	Introductory flight
Persons on board	Pilot and three passengers
Consequences and damage	Aircraft severely damaged
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in March 2020. As accurate as the translation may be, the original text in French is the work of reference.	

In-flight engine shutdown, forced landing

1 - HISTORY OF THE FLIGHT

The pilot, accompanied by three passengers, took off from Puy Loudes aerodrome (Haute-Loire) for an introductory flight. About seven minutes into the flight, with the aircraft at an altitude of 4,500 feet, the pilot noted a decrease in engine power and that the fuel pressure light was on. He turned on the electric pump. This action had no effect on the engine, which was no longer delivering power. The pilot selected a field to land in. During the landing, the aircraft touched down hard. The nose gear and the left main gear collapsed, the plane slid a few metres and then came to a stop.

2 - ADDITIONAL INFORMATION

2.1 Meteorological conditions

The estimated meteorological conditions at the accident site were as follows:

- calm wind;
- visibility greater than 10 km;
- broken sky with cloud base at 4,700 ft;
- temperature 24 °C,
- QNH 1021 hPa.

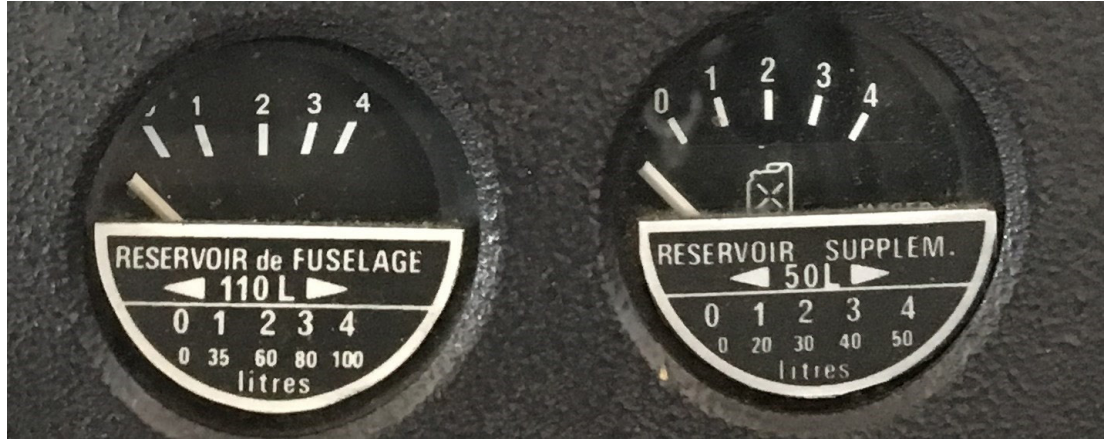
2.2 Pilot information

The pilot held a private pilot licence for aeroplanes (PPL(A)) and had logged approximately 2,000 flight hours.

2.3 Aircraft information

2.3.1 Description of the systems

The aircraft was equipped with a main tank (also called fuselage tank) with a capacity of 110 litres and a range extension tank with a capacity of 50 litres. The amount of fuel in these tanks cannot be checked visually. It can only be quantified based on the position of the needles on the fuel quantity indicator (one per tank).



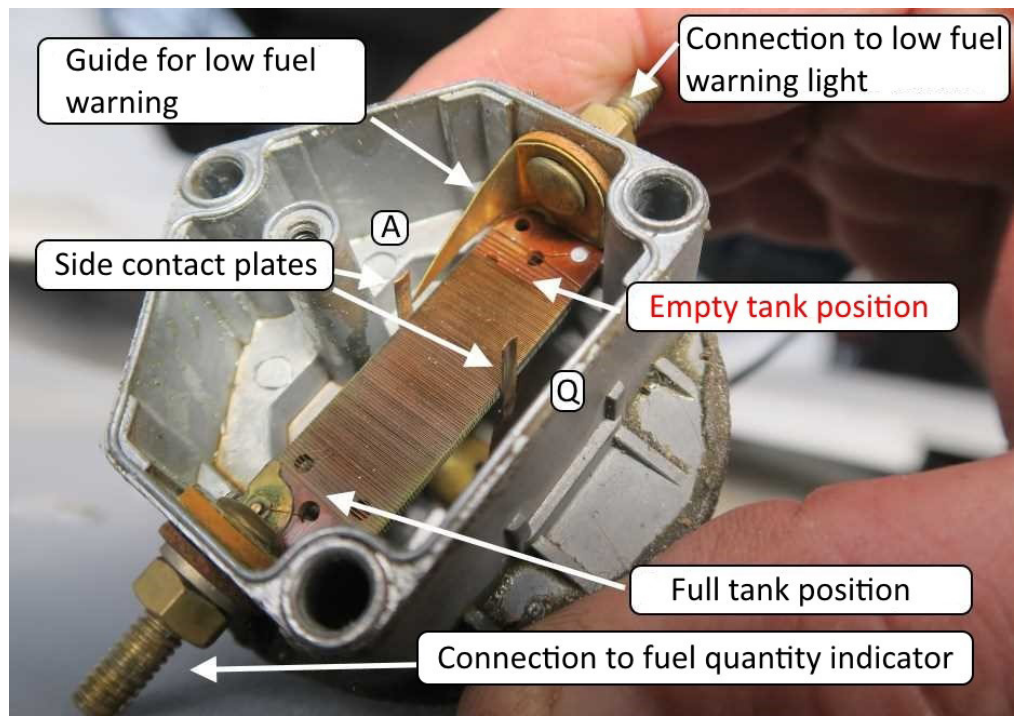
Source: BEA

Figure 1: fuel quantity indicators for both tanks

The average fuel consumption according to the aircraft flight manual is about 30 l/h (at 65% power between 0 and 4,000 ft).

The fuel gauge system for each tank consists of a fuel quantity indicator and a fuel gauge mounted on the tank. A low fuel warning light located in the cockpit is fitted to the main tank fuel gauge system. The fuel gauge consists of a movable arm fitted with a float and a transmitter that converts the physical position of the float arm into an electrical signal that is sent to the indicator.

The operating principle of the transmitter is based on the measurement of a variable resistance. The resistance value depends on the position of the contact between a copper wire wound round a plate and two side contact plates that slide along the side of this plate. These two side contact plates are connected to the float arm rotation mechanism. Over the last quarter of the stroke of the arm, one of the two side contact plates (A) slides along the outside of a guide, ensuring a continuous electric contact that lights up the low fuel warning light, while the other side contact plate (Q) continues to slide along the plate and transmits the fuel quantity indication.



Source: BEA

Figure 2: inside of the fuel quantity transmitter

2.3.2 1,000-hour maintenance programme

The accident flight was the first flight after the aircraft's 1000-hour maintenance inspection.

The maintenance was performed by a licensed mechanic. The maintenance operations carried out were noted in the maintenance operations logbook. In the "Fuel (ATA73)" section, inspection of the calibration of the transmitter (at 500-hour intervals) is noted as having been carried out.

This operation is listed in section 9, paragraph 9.6 "GAUGE SYSTEM" of the maintenance manual (ME1001606). This paragraph⁽²⁾ describes the procedure for removing and installing the tank transmitter and provides an equivalence table for the values indicated by the needle on the aircraft fuel quantity indicator and the corresponding quantity in the tank.

The "gauge calibration verification" methodology is not described in this section.

Note: in some maintenance workshops, as there is no defined procedure, the methodology used consists of draining the tank, then gradually filling it and comparing the position of the needle on the fuel quantity indicator with the quantity of fuel added. This equivalence can be checked by comparing the values indicated in the table in section 9 paragraph 9.6 of the maintenance manual with the values on the fuel quantity indicator (see figure 1). This operation not only serves to check the accuracy of the fuel indicator over the whole measuring range but also checks for correct operation of the low fuel warning light.

⁽²⁾ This paragraph deals with the different types of tanks on the various DR400 models (wing tanks, range extension tank, main tank depending on the aircraft serial number).

2.4 Examinations

2.4.1 Site and aircraft examination

The accident site was located in a recently harvested wheat field at an altitude of 2,800 ft. The marks left by the aircraft in the loose soil when it landed were facing the north-east. The distance from the initial point of impact to the aircraft's final position was approximately 20 m.



Source: BEA

Figure 3: aircraft at the accident site

An examination of the aircraft showed that the engine was not delivering power on landing and that the main and range extension fuel tanks were both empty. The needle on the fuel quantity indicator for the main tank was just below "1" and the needle on the indicator for the range extension tank was pointing to "0".



Source: BEA

Figure 4: position of the needles on power-up with both tanks empty

The light test showed that the low fuel warning light was working.

2.4.2 Documentation review

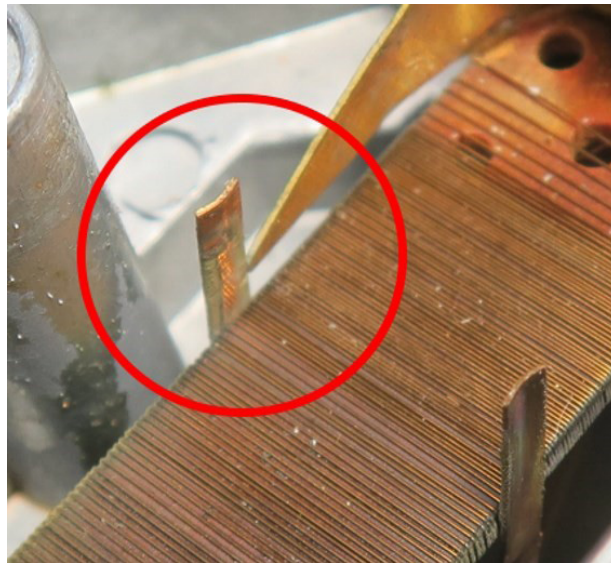
A review of the aircraft's journey logbook showed that the main tank had been filled at Mende Brenoux aerodrome (Lozère) on 4 August 2019 and that a 47-minute flight to Puy Loudes aerodrome had been made that same day. The aircraft was then grounded for its "1-000 hour" maintenance inspection.

2.4.3 Fuselage tank fuel gauge examination

An examination of the fuel gauge revealed a malfunction. The float arm was not travelling through its normal full travel range. The arm remained stuck during the last quarter of its stroke.

An internal examination of the transmitter showed that the contact plate (A) (see figure 2) abuts against the tip of the guide that provides the low fuel level contact instead of sliding along it. Since both contact plates are joined to the float arm, the position of the second contact plate (Q), which transmits the fuel quantity information, is also stuck. The information transmitted to the indicator was stuck at approximately one-quarter of the tank capacity even though the actual fuel quantity was lower.

Traces of oxidation were also visible on the edges of the contact plates and on the tip of the guide that provides the low fuel level warning signal. This oxidation probably prevented electrical conductivity and stopped the low fuel warning light from lighting up.



Source: BEA

Figure 5: detailed view of the malfunction

⁽³⁾ A NOTAM (D3500/19) indicated that 100 LL fuel was unavailable from 31 July 2019 to 13 September 2019.

⁽⁴⁾ Fuel quantity indicator needle.

2.5 Statements

2.5.1 President of the aero club

The president of the aero club said that the fuel pump at Puy Loudes aerodrome had been unavailable for several days⁽³⁾. He stated that, because F-GJZT was grounded for maintenance for an indefinite period, fuel had been taken from it and transferred to the aero club's second aircraft. He indicated that he had filled three 20-litre cans via the aircraft's drainage system and that, during the operation, an estimated 10 to 15 litres of fuel was spilled on the ground. He stated that he had noted the addition of the 60 litres of fuel in the logbook of the second aircraft, but that he did not note in F-GJZT's logbook that 70 to 75 litres had been drained from it.

2.5.2 Pilot of F-GJZT

The pilot indicated that during the pre-flight inspection, he had noted that the "gauge"⁽⁴⁾ of the main tank was on "1" and that of the range extension tank was on "0". He stated that the flight was due to last only 30 minutes and the amount of fuel indicated by the «gauge» corresponded to approximately one hour's flight time, so he decided to make the flight. He said that he did not notice that the entries in the aircraft journey logbook were not consistent with the fuel gauge reading.

Note: based on the journey logbook entries (last refuelling and time flown since refuelling), the pilot should have expected to see the needle on the main tank fuel quantity indicator on "3" rather than on "1".

2.5.3 Aircraft maintenance mechanic

The mechanic indicated that, for the purpose of the gauge calibration inspection, he only verified that the aircraft gauge reading was consistent with the entries in the journey logbook. This check was performed before the fuel drainage operation and the gauge needle was close to "3", which was consistent with the flight made after the last tank refuelling.

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

The accident occurred during a forced landing following a loss of engine power in-flight due to fuel starvation.

Contributing factors

The following factors may have contributed to this in-flight power loss:

- ❑ The pilot's failure to check that the information in the aircraft's journey logbook was consistent with the position of the aircraft's fuel quantity indicator needle.
- ❑ The failure by the president of the aero club to note the fuel drained from the aircraft in the aircraft's journey logbook.
- ❑ The failure of the fuel quantity transmitter, which indicated a quantity greater than the actual quantity in the tank and prevented the low fuel warning light from functioning properly.
- ❑ The methodology used by the mechanic to perform the gauge calibration check scheduled during the 1000-hour maintenance inspection which was insufficient to detect the gauge failure.

All of these factors led to the pilot undertaking a flight for which he did not have the minimum amount of fuel required.