

Fuel starvation, forced landing in countryside during aerial work

Aircraft	Reims Aviation F172M registration F-GBFG.
Date and time	15 October 2012 at 16 h 20 ⁽¹⁾
Operator	Company
Place	Les Herbiers (85)
Type of flight	General aviation
Persons on board	Pilot; one passenger
Consequences and damage	None

⁽¹⁾The times in this report are local.

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

1 – HISTORY OF FLIGHT

The pilot, accompanied by a photographer, took off from Lyon Bron (69) airport at about 11h08 for an aerial photography flight. The planned flight represented a distance of 400 to 450 NM corresponding to the maximum flight in an F172M of about 4h30. The pilot had planned to land at Niort (79) aerodrome to refuel. The flight took place without any particular problem according to the following vertical profile as indicated by the pilot:



At about 16h15, after photographs had been taken of places in the commune of Herbiers, the pilot decided to refuel at Cholet (49), which was closer than Niort. He told the AFIS agent of his intention. A few minutes later, he noticed the engine misfiring, followed by loss of power. He undertook some fault-finding, and then looked for a field to land in. He explained that, during the descent, the engine was still running but was not delivering power. The landing took place after five hours and thirty minutes of flight, less than 15 NM from Cholet aerodrome. Once on the ground, the engine stopped.

2 - ADDITIONAL INFORMATION

2.1 Pilot's licence and experience

The pilot, holder of a CPL (A) licence since April 2012, had a total of 259 flying hours, of which 146 on type and 37 during the three months preceding the accident, of which 18 on type.

2.2 Pilot's statement

The pilot stated that he did not make a specific navigation log when he prepared the flight. To assess fuel autonomy he used the cruise performance table in the flight manual with engine rpm of 2,400 and with an altitude of 3,000 feet in standard atmosphere. According to this table, the average hourly consumption is about 29 l/h. Taking into account the capacity of the tanks he estimated fuel autonomy at 6 hours and 30 minutes. He stated that he planned to refuel after 5 hours and 30 minutes flight at the latest, thus giving himself a reserve of one hour's flight. Before departure he filled the tanks completely and visually checked the filling of the tanks. He explained that he "made a fuel check after each hour of flight" with the average hourly consumption that he had taken into account during flight preparation. He specified that the fuel/air mixture was adjusted during cruise at FL 65, 55 and 45. For the phase of flight between 1,200 and 3,000 feet altitude, he set the mixture control in the rich position. Until this flight, he had never made a flight longer than 4 hours.

2.3 Aircraft information

F-GBFG is an aircraft which has two long distance wing tanks. Its maximum capacity in fuel is 204 litres, of which 15 are unusable. It did not have a fuel flowmeter indicator. Its fuel gauges were not working and permanently showed that the tanks were full (the pilot knew this before departure). According to the flight manual the fuel autonomy of the F172M with full tanks is of the order of:

- 5 flying hours with 75% engine power + 45 minutes reserve with 45% engine power;
- 6 flying hours with 65% engine power + 45 minutes reserve with 45% engine power.

This fuel autonomy is estimated by taking into account:

- 189 litres usable fuel;
- a poor mixture;
- a standard temperature and zero wind;
- the maximum weight of the aircraft, that is to say 1,043 kg;
- the quantity of fuel required for starting the engine, taxiing, take-off and climb. The fuel autonomy given in the flight manual considers a stable cruise and does not take into account possible manoeuvres made by the pilot during a flight (turns, climbs, descents).

The 45 minutes reserve with 45% engine power correspond to a fuel quantity of about 15 litres, that is to say about 30 minutes flight with cruise power at 75%. In addition, when the richness of the mixture is not adjusted and the mixture is too rich, the consumption is higher than that indicated in the flight manual.

2.4 Regulatory aspects

According to airworthiness regulation CS-23⁽²⁾, aeroplanes included in this regulation need only have, as an aid to in-flight fuel management, an instrument allowing display to pilots of the quantity of fuel usable in flight.

⁽²⁾Applicable to aeroplanes with a maximum capacity of less than nine passenger seats and a maximum take-off weight (MTOW) 5,670 kg or to twin-engine aeroplanes with a maximum capacity of less than nineteen passenger seats and a maximum take-off weight of 8,618 kg.

It should be noted that for aeroplanes equipped with turbine engines the following instruments are also mandatory to help with in-flight fuel management:

- fuel flowmeter indicator;
- low fuel level warning device.

Note: Most recent fuel flow meter indicators include a total consumption function.

2.5 Fuel starvation in general aviation

From 2007 to 2012, the number of events in France linked to fuel starvation for certified aircraft was:

2007	2008	2009	2010	2011	2012	2013
9	19	2	9	2	5	1

Among these 47 events, 5 involved aeroplanes equipped with fuel flowmeter indicators.

3 - LESSONS LEARNED AND CONCLUSION

During flight preparation, the pilot estimated the aeroplane's fuel autonomy based on average hourly cruise consumption. He did not consider the influence of the various manoeuvres that are necessarily implied in an aerial photography mission. This incorrect assessment of consumption during flight preparation, associated with in-operational gauges, led to imprecise fuel management during flight.

Since this incident, the company's safety manual has been modified. It requires that those using its aircraft should "land with an onboard fuel quantity at least equal to an hour of flight in cruise". It also set a fixed rate for hourly consumption (35l/h for the F172) and some specific fuel quantities (taxiing, final reserve for example).

4 - RECOMMENDATIONS

Note: In accordance with Article 17.3 of European Regulation (EU) 996/2010 of the European Parliament and Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation shall in no case create a presumption of blame or liability for an accident, a serious incident or an incident. The addressee of a safety recommendation shall inform the safety investigation authority which issued the recommendation of the actions taken or under consideration, under the conditions described in Article 18 of the aforementioned Regulation.

Totalising fuel flow indicators and low fuel level warnings

A large majority of events in France linked to fuel starvation have involved aeroplanes only equipped with gauges as a means of managing fuel in flight. Furthermore, these gauges can be imprecise. An incorrect estimation of fuel consumption during flight preparation is difficult to detect in flight based only on these gauges.

Airworthiness regulation CS-23 does not make it mandatory to install fuel flowmeter indicators and low fuel level warnings on all aircraft included in this regulation, even though these instruments would make it possible to manage fuel in flight more precisely than with gauges. Installation of these instruments could also benefit aeroplanes covered by regulation CS-VLA, equipped with a maximum of two seats and having an MTOW lower than 750 kg. The BEA thus recommends that:

- **EASA modify airworthiness regulations CS-23 and CS-VLA to make mandatory the installation of totalising fuel flowmeter indicators or equivalents or low fuel level warnings independent of the main gauge systems in all relevant aircraft. [Recommendation FRAN-2014-013]**