SERIOUS INCIDENT

Aircraft Type and Registration:	Reims Cessna F150M, G-CSBM	
No & Type of Engines:	1 Continental Motors Corp O-200-A	
Year of Manufacture:	1977 (Serial no: 1359)	
Date & Time (UTC):	10 July 2020 at 1438 hrs	
Location:	Winchfield, Hampshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	24 years	
Commander's Flying Experience:	215 hours (of which 103 were on type) Last 90 days - 23 hours Last 28 days - 17 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

Synopsis

As the aircraft approached Blackbushe Airport the engine lost power and the pilot made a precautionary landing in a field. There was no damage to the aircraft and neither occupant was injured.

The engine lost power due to fuel exhaustion. The pilot had used a fuel dipstick through a desire to measure the fuel onboard more accurately, but the dipstick used was not calibrated for the aircraft; this led him to overestimate the fuel onboard.

History of the flight

The pilot and a friend planned to fly a return trip from Blackbushe Airport (Blackbushe) in Hampshire to Sandown Airport (Sandown) on the Isle of Wight. He was aware that with the two people on board he could not completely fill the fuel tanks as this would put the aircraft above its maximum takeoff weight. He had calculated that he required 16 US gal of fuel for the return trip which included 5 US gal of reserve fuel. Prior to departing from Blackbushe the pilot checked the fuel quantity onboard with a dipstick. There was a wooden dipstick in the aircraft which was marked with a 0, ¼, ½, ¾ and full scale but the pilot found it difficult to see the fuel level on the stick and he wanted a more accurate measurement. Therefore, he found a dipstick which was marked with a more detailed scale, that was easier to read and was similar to one he had previously used on the Cessna 150. Using this he determined there was 9-10 US gal in each tank which he believed was sufficient for his intended trip.

The flight from Blackbushe to Sandown was uneventful. On the ground in Sandown the pilot re-measured the fuel quantity in each tank using the same dipstick. This showed there was 3-4 US gal in one tank and 9-10 US gal in the other. He was surprised that the tanks were not balanced so contacted another pilot who advised that this was not abnormal for this aircraft type. He was confident he had enough fuel for the return flight plus reserves, so did not refuel.

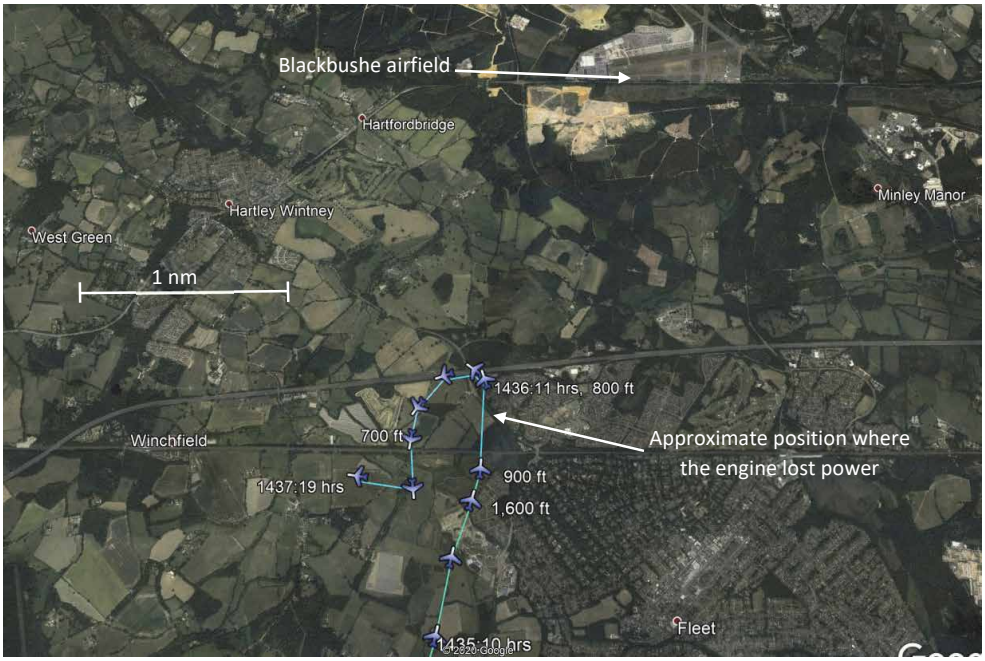

Figure 1

Aircraft track approaching Blackbushe Airport

The pilot had been trained that the fuel gauges on light aircraft are unreliable, and so did not use them.

The return flight was uneventful until the aircraft was approximately 2 nm from Blackbushe. The pilot had just descended to circuit height when the engine started to cough and lose power. He did not know what was wrong with the engine but, being aware that landing options close to the airport were limited if the engine failed completely, he decided the safest option was to make a precautionary landing in a field. He selected a large grass field on his left side and made an 180° turn to position the aircraft on a base leg for the field (Figure 1). The engine continued to run but was still losing power. He landed in the field using full flap and stopped the aircraft (Figure 2). There was no damage to the aircraft and both occupants were uninjured.

After landing no fuel could be seen visually in either fuel tank. It was subsequently discovered that the dipstick the pilot had used was calibrated for a Cessna 172 so showed a greater quantity of fuel than was actually present.

Figure 2

G-CSBM after the precautionary landing

Flying club comment

The owner of the flying club commented that whilst pilots are trained not to rely on the fuel gauges in light aircraft the gauges on G-CSBM are reasonably accurate.

After the incident he sent a message to all pilots at the club reminding them that the fuel dipsticks are different in each aircraft type and to ensure they use the one calibrated for the aircraft they are flying.

The flying club uses an electronic aircraft log, so it is not possible for pilots to see when the aircraft was last refuelled and how much flying the aircraft has done since. The owner reported that this was intentional to ensure pilots did not rely on this information and instead measured how much fuel was onboard before each flight.

Aircraft information

The Cessna 150 has two interconnected fuel tanks, one in each wing. Fuel is gravity fed to the engine (Figure 3). The tanks can hold 26 US gal of fuel but 3.5 US gal is unusable, giving a total usable capacity of 22.5 US gal.

Although the fuel tanks are interconnected, it was reported that it is not uncommon for the fuel to be imbalanced after flight. This can be caused by several banked turns in the same direction prior to landing causing the fuel to migrate to one side.

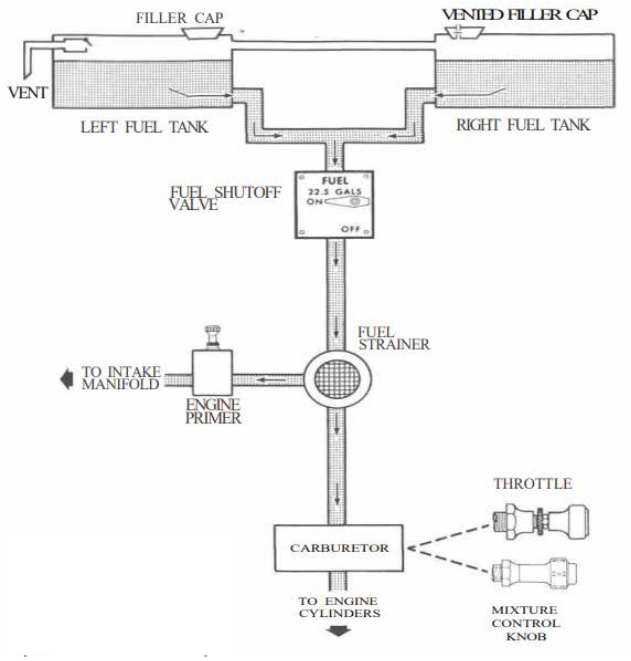

Figure 3

Cessna 150 fuel system

Weight and balance

The Cessna 150 maximum takeoff weight is 1,600 lbs (726 kg). G-CSBM basic weight was 526 kg. The pilot calculated that on takeoff from Blackbushe, with 54 kg of fuel and with a combined occupant weight 152 kg, the aircraft weighed 732 kg.

Fuel planning and management guidance

The CAA skyway code (CAP 1535S[1]) states that:

> *'Fuel gauges in most general aviation aircraft are not very accurate and should not be considered a reliable indicator of fuel level. You should physically check fuel levels on the ground by dipping the fuel tanks.'*

Following several fuel starvation and fuel exhaustion accidents in New Zealand the Civil Aviation Authority of New Zealand published a guidance document titled '*Fuel Management*'[2]. The document contains the following guidance:

> *'It's good practice to check the fuel available before flight by at least two separate methods. We can do this by referring to the fuel gauge(s), loading a known quantity and, in many aircraft, by dipping the tanks.*

Footnote

1 CAA, '*The Skyway Code*' available at https://publicapps.caa.co.uk/modalapplication.aspx?appid=11&mode=detail&id=7920 (accessed 3 August 2020).

2 Civil Aviation Authority of New Zealand, '*Fuel Management*' available at https://www.aviation.govt.nz/assets/publications/gaps/Fuel_Management.pdf (accessed 3 August 2020).

Using a fuel dipstick is the most accurate way of determining the fuel on board. It's therefore important to ensure that you have the correct dipstick for your aircraft. Each dipstick has been specifically calibrated to the fuel tanks of a particular aircraft and is therefore not interchangeable with those of any other aircraft, even of the same type – which is why it should be clearly marked with the aircraft registration and also show whether the figures are total or usable fuel.

Keep an accurate fuel log. This, in combination with fuel gauge readings, is an important part of monitoring your fuel status in flight. The bottom line is that every method and aid you have for monitoring fuel quantity should be used. Remember to keep a close eye on the fuel gauge. Some pilots dismiss gauges as unreliable. That's possibly unwise, considering the number of fuel starvation or exhaustion incidents where pilots have pressed on with low gauge readings. Make regular reading of fuel gauges an integral part of your fuel management strategy.

If, despite doing this, your fuel situation becomes critical […] *then a precautionary landing is the best course of action. Too many accidents have occurred because pilots pressed on thinking that they could make it. The fact that the aircraft may be damaged in a precautionary landing should not influence the decision – aircraft can always be repaired. It's human nature that, when faced with marginal situations, we feel the pressure to reach our intended destination. "My passengers need to get to the destination today"; "the aircraft has to be back tomorrow"; "I don't want anyone to know that I stuffed up"; are the types of thoughts that usually run through our minds. Ignore them, and take decisive action to divert, or land.'*

Analysis

As the aircraft approached Blackbushe Airport the engine lost power due to fuel exhaustion. The pilot's decision to make a precautionary landing in a field produced a safe outcome.

The fuel exhaustion occurred because, before the flight, the pilot had measured the fuel with a dipstick which was calibrated for another aircraft type. Consequently, he thought there was more fuel onboard than was actually present. The pilot wanted to measure it as accurately as possible to ensure he had enough for his intended journey but also to remain below the aircraft's maximum takeoff weight. The desire for a more accurate reading led him to use a fuel dipstick which he thought was more accurate. The accident highlights the importance of checking the dipstick is calibrated for aircraft being flown.

The pilot did not use the fuel gauges on the aircraft in flight as he believed them to be unreliable. However, the aircraft owner reported that on this aircraft the gauges are accurate. Many guidance documents stated that fuel gauges on light aircraft can be unreliable, but, as highlighted in the New Zealand CAA guidance, this does not mean that they should not be used at all. Fuel gauges can be used as part of an overall fuel management strategy. In this event it is likely that the fuel gauges would have indicated the low fuel state.

The New Zealand CAA guidance recommends checking the fuel onboard by two independent means. One means of estimating the fuel onboard is checking the total flight time since the aircraft was last fuelled to a known state. This can usually be determined from the aircraft's log. The flying club which operated G-CSBM used an electronic log system that did not enable the pilot to see the previous flights. This removed one possible barrier which might have alerted the pilot to the incorrect fuel measurement.

When the engine began to lose power the pilot decided to make a precautionary landing. The pilot's decision to land before the engine stopped completely gave him time to position the aircraft into a suitable large field and focus on flying the aircraft to ensure a safe outcome.

Conclusion

The pilot made a safe precautionary landing in a field due to loss of engine power. The engine had lost power due to fuel exhaustion.

Through a desire to measure the fuel accurately the pilot had used the incorrect fuel dipstick leading him to overestimate the fuel onboard.

Safety action

The flying club have reminded pilots of the importance of only using the dipstick calibrated for the aircraft they are flying.