

ACCIDENT

Aircraft Type and Registration:	Reims Cessna F182Q, G-BGFH	
No & Type of Engines:	1 Continental O-470U piston engine	
Year of Manufacture:	1979	
Date & Time (UTC):	23 May 2007 at 1355 hrs	
Location:	2.5 nm north-west of Burntisland, Fife, Scotland	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Nosewheel sheared off, propeller bent, engine cowling crushed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	66 years	
Commander's Flying Experience:	529 hours (of which 430 were on type) Last 90 days - 17 hours Last 28 days - 9 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and AAIB enquiries	

Synopsis

The engine stopped, possibly due to fuel starvation, and during the subsequent forced landing the aircraft touched down heavily causing the nosewheel to break and the propeller and engine to strike the ground.

History of the flight

The pilot planned to fly from Eddsfield in Yorkshire to Cumbernauld and back in the same day. He was familiar with the route and he estimated that it would take approximately 1 hour and 20 minutes to fly to Cumbernauld. The pilot filled both fuel tanks to within 20 mm of the top of the tank, which gave him approximately 300 litres of useable fuel. The aircraft departed Eddsfield at 0815 hours and routed to

Cumbernauld via Boulmer and the Talla VOR beacon. For most of the route the aircraft was flown at 1,500 to 2,000 feet agl. However the weather was worse than predicted and at one point he experienced 40 kt headwinds and the cloud base lowered to 800 feet agl during the last few miles to Cumbernauld. The aircraft arrived at Cumbernauld at 1016 hours, a journey that had taken approximately 40 minutes longer than planned.

With light rain and a cloud base of 800 feet in the local area, the pilot, after checking the forecast with the CFI at Cumbernauld, decided to return south by following the coast. As this would require him to transit through the Edinburgh control zone he telephoned Edinburgh

Operations and was advised to contact Edinburgh Approach once he was airborne.

The pilot stated that once airborne, he contacted Edinburgh Approach and was instructed to route via Philipstoun, the Bridges and Dalkeith. He was also instructed to contact Edinburgh Tower when he reached the Bridges. When he contacted Edinburgh Tower he was instructed to hold and so began orbiting to the left. He said that he orbited for over 30 minutes, at a height between 1,000 and 1,400 feet and a bank angle of approximately 30°, during which at least six aircraft landed and two or three departed from Edinburgh Airport. Towards the end of this period he checked the fuel contents gauges and noted that the left gauge read $\frac{3}{4}$ full and the right gauge was in the red, which he stated he thought to be normal. Shortly afterwards the engine misfired and at the same time the controller cleared the pilot to cross Runway 24. The pilot informed the controller that he had an engine problem and after being given details of local airfields, advised the controller that he would not be able to make any of them. The pilot applied carburettor heat, which had no effect, and pumped the fuel primer three times, but could feel no resistance. He advised the controller that because of the circling, all the fuel had gone to the left tank and that he would try orbiting to the right. After turning through approximately 90 degrees to the right he realised that given his height, he had no option but to make a forced landing into a field directly ahead of the aircraft. At a height of 150 to 200 feet he realised that the aircraft was going to collide with a dry stone wall and in an attempt to clear the wall the aircraft stalled and touched down heavily on its landing gear.

The pilot and passenger were uninjured and reported that approximately two minutes after they vacated their aircraft, another aircraft arrived and began circling above the accident site. After a further five minutes a helicopter

arrived, landed at the site and checked that the occupants were safe. Given the remote location of the accident site it was decided to leave the aircraft in the field until it could be recovered the next day. However, details of the accident were broadcast on the local radio and that evening vandals set it on fire. The aircraft cabin, the majority of the wings and the fuel system were totally destroyed by the fire.

Report from Edinburgh Tower Controller

The Tower Controller reported that G-BGFH had been given clearance to transit the Edinburgh CTR and was instructed to route as far as the Bridges and then transfer to Edinburgh Tower frequency for onward clearance across the Runway 24 extended centre line. The Controller said that the pilot made contact after passing the Bridges eastbound. He advised the pilot to hold at the Bridges, but the aircraft continued to fly on an easterly track in conflict with a number of aircraft on the approach to Edinburgh. On passing traffic information, the pilot of G-BGFH said he had an Airbus in sight. The controller suggested he pass behind the Airbus as there was further IFR traffic at 9 nm DME. However G-BGFH continued to fly to the east towards the traffic, so the controller instructed him to turn to the north. The controller reported that as this was the first instruction that the pilot had acted on he planned to direct G-BGFH back to the Bridges and to hold until he could clear him to cross the extended centre line.

G-BGFH was observed on radar manoeuvring towards the Bridges at an altitude varying between 1,200 and 1,900 feet. After loosely holding at the north tower of the Forth Road Bridge, G-BGFH was cleared to cross Runway 24 and report south-side. Almost immediately the pilot reported an engine problem and asked to orbit in the opposite direction as he felt that the prolonged orbit had emptied one of his fuel tanks.

The pilot then reported that the engine had failed and he was going down. The controller passed range and distance to Edinburgh and Glenrothes, but it quickly became apparent that the aircraft would not be able to make either of these airfields. The controller asked the pilot if he had anywhere visual to put down and he replied that he thought that he did. The controller passed the Edinburgh surface wind as the pilot passed altitude reports. At 300 feet the aircraft radar return disappeared and approximately one minute later the pilot reported that the aircraft was on the ground and both occupants were uninjured. During the emergency, the ATC assistant dispatched two aircraft, which were flying in the local area, to locate G-BGFH. Details of the position of the aircraft were passed to the local constabulary.

Description of fuel system

The Reims Cessna F182Q is a high-winged aircraft with an integral fuel tank mounted in each wing. Each fuel tank has a useable fuel capacity of approximately 166 litres and is equipped with its own fuel quantity transmitter and vented filler cap. A vent line is connected to each fuel tank.

Each fuel quantity transmitter is mounted on the inboard wall of its tank and the contents are measured by the use of a float. In a properly co-ordinated turn the fuel level will be the same as in straight and level flight. However if the aircraft skids in the turn then the fuel in the tanks will tend to slope in the direction of the skid with the result that the outboard tank will under read and the inboard tank will over read. If the aircraft slips in the turn then the inboard tank will under read and the outboard tank will over read.

An outlet pipe from each fuel tank is connected to a four-position selector valve that can be selected to

RIGHT, BOTH, LEFT or OFF positions. The fuel flows under gravity to a mechanical fuel pump connected to the engine, which delivers fuel to the carburettor. A mechanically operated engine primer, which is mounted on the instrument panel, takes fuel directly from the fuel line between the selector valve and mechanical pump.

Warnings in the Flight Manual

G-BGFH was manufactured by Reims Aviation who held the airworthiness responsibility for the Cessna F182Q. In March 2003 Reims Aviation was dissolved and airworthiness responsibility was passed to Cessna.

The flight manual¹ for G-BGFH was issued by Reims Aviation and in the section describing the fuel system there is no mention of fuel transferring between the wing tanks in flight. In contrast, the flight manual² issued by Cessna for the C182Q includes the following warning:

'When the fuel selector valve handle is in the BOTH position in cruising flight, unequal fuel flow from each tank may occur if the wings are not maintained exactly level. Resulting wing heaviness can be alleviated gradually by turning the selector valve handle to the tank in the "heavy" wing.'

Discussion

The pilot was familiar with the aircraft and confident that there was 300 litres of fuel on board prior to the flight. Whilst the aircraft flight manual gave a fuel consumption of 42 litres per hour (for the conditions on the day) the pilot had previously checked the fuel consumption and as a result used a figure of 52 litres per hour. The total flight time, since the aircraft was refuelled, was approximately 2 hour 45 minutes, which

Footnote

¹ Edition 3 dated October 1978.

² Dated 1 October 1978.

means that at the time of the accident the fuel tanks should have been between 52% and 61% full. The photographs taken by the police after the aircraft had been destroyed by vandals clearly show that the aircraft had been subject to an intense fire, which indicates that there was still a considerable amount of fuel on board the aircraft after it had crashed.

The pilot always flew with the fuel selector switch at BOTH, which balanced the fuel contents in both tanks. However there are no non-return valves between the fuel selector valve and the fuel tanks and therefore it is possible for fuel to transfer from the higher to lower fuel tank if it is flown in an unco-ordinated turn. Once the down-wing tank is full, fuel will discharge out of the tank through the vent pipe. The rate of transfer is dependent on a number of variables such as the fuel contents, bank angle and the amount of imbalance in the turn. The manufacturer confirmed that during the certification of the aircraft there was no requirement to establish the rate of fuel transfer during an unco-ordinated turn.

The pilot reported that towards the end of his period orbiting, the fuel gauges indicated that the left fuel tank was $\frac{3}{4}$ full and the right tank was in the red (less than 8 litres). However there is a warning in the Flight Manual that states:

'The indicators cannot be relied upon for accurate readings during skids, slips, or unusual flight attitudes.'

The manufacturer also confirmed that certification of the aircraft only requires the gauges to be accurate when the aircraft is level and the fuel tanks are empty. Unco-ordinated turns can also result in the fuel being pushed away from the fuel tank outlets which could, if the tank is nearly empty, cause fuel starvation and engine stoppage.

The pilot reported that his normal practice, once he was in the cruise, was to adjust the rudder trim and take his feet off the rudder pedals. He also felt that with the increased work load in flying across the Edinburgh control zone, and watching out for the numerous large aircraft in poor weather conditions, it is possible that during his prolonged period of orbiting he was flying out of balance.

Conclusion

The pilot's description of the engine misfiring and the lack of resistance when operating the fuel primer suggests that the engine stoppage was due to fuel starvation. The intensity of the fire indicates that there was still a considerable quantity of fuel in the aircraft; unfortunately the fuel system was destroyed by the fire and therefore it was not possible to rule out a fuel leak, blockage or contamination. The admission by the pilot that he might have been flying out of balance whilst orbiting at the Bridges raises the possibility that fuel starvation might have occurred due to a combination of fuel transferring from the right to the left fuel tank, and the remaining fuel in the right fuel tank being forced away from the tank outlet pipe.