Fuel Starvation with Quarter Tanks?

The Incident

Some months ago, the pilot of a Cessna 180 experienced fuel management problems while engaged in parachute dropping at a provincial airport. The aeroplane was descending through 1500 feet on a high left base for the main runway, when the pilot made a MAYDAY call, reporting that the engine had failed. The pilot made a safe landing on the secondary cross runway, for which the aircraft was well placed. The engine was started and ran normally after landing. It was determined that the fuel tank outlet had become unported during the descent, causing fuel starvation to the engine.

The Reason

The aircraft involved is a Cessna 180B model, which has only one fuel outlet per tank, located about the mid-point on the inboard edge of each tank. Prolonged sideslip, or steep descent, with low fuel quantities can unport the fuel outlet and cause fuel starvation to the engine. C180E and subsequent models have two outlets per tank, one forward and one aft, and are not subject to the same problem. The two tank outlets on the C180E and subsequent models reduce the unusable fuel quantity to 18 litres compared with 36 litres for the earlier models.

Although no warning is published in the aeroplane Flight Manual, the CAA Safety Investigator was interested to find a 1961 CAIC/AIR during the course of the investigation, which referred to the problem. The CAIC stated that: "... a prolonged sideslip in the direction of the tank in use, or a prolonged steep descent, can cause engine fuel starvation if the fuel quantity is low, since the fuel tank outlet may become uncovered in these attitudes." The CAIC has long since been cancelled, but the situation lives on, particularly as there are still 45 affected models on the register.

A Further Incident

Since the incident featuring the Cessna 180, an accident involving a para-drop Cessna 206 has been reported to the CAA.

After the parachutists exited the aeroplane at 10,000 feet, the pilot began a descent, during which the engine failed somewhere in the region of 7000 feet. The pilot changed tanks but was unable to restore power so changed back to the originally selected left tank. Still unable to restore power, the pilot carried out a forced landing on the airfield. Unfortunately the result was a heavy landing that damaged the aeroplane.

Engineers later drained the fuel tanks, dismantled the aeroplane, and measured the quantities as 15 litres from the left tank and 25 from the right. The left fuel line to the fuel-metering unit was found to be empty.

The pilot indicated that the aircraft had been out of the air for some 10 months. During a ferry flight, after refurbishment and before the engine failure, he noted the need to have considerable rudder trim to maintain balanced flight with reference to the turn-and-slip indicator. He also noted that the aircraft symbol in the turn-and-slip indicator was rocking considerably. It is possible that the turn-and-slip indicator was providing an incorrect indication of balanced flight.

The aircraft Flight Manual contains the following note in the fuel system description section:

"Unusable fuel is at a minimum due to the design of the fuel system. However, with 1/4 tank or less, prolonged uncoordinated flight such as slips or skids can uncover the fuel tank outlets, causing fuel starvation and engine stoppage. Therefore, with low fuel reserves, do not allow the aeroplane to remain in uncoordinated flight for periods in excess of one minute."

The pilot was not aware of this note.

It is possible that, during the descent from 10,000 feet, the pilot may have been flying slightly out of balance, and the fuel tank outlets may have been uncovered.

Yet Another Incident

A further possible fuel starvation event occurred on another Cessna 206 shortly after takeoff. The pilot carried out a right turn onto the runway at a fairly high speed at a higher than usual power setting and began a rolling takeoff. At approximately 800 feet, a partial power loss occurred, followed by a complete power loss shortly thereafter. Trouble checks were carried out, and the fuel selector was changed from the left to the right tank. Engine power was restored approximately 20 seconds later, just prior to touchdown on the departure runway. Fuel tanks were dipped, and the aircraft was found to have 105 litres on board, 50 and 55 litres in respective tanks. A thorough engineering investigation was carried out on the aircraft, with no defect or contamination of any kind found.

Subsequent test flying was carried out with 55 litres of fuel in each tank in an effort to determine the cause of the power loss. It was found that, by placing the aircraft in an unbalanced situation, right rudder and left tank selected and vice-versa, a complete engine power loss occurred after about 50 seconds. Power was restored after about 12 seconds by returning the aircraft to balanced flight and carrying out the published flight manual procedures.

A Timely Reminder

All of these incidents serve as a timely reminder for pilots to consider how extensive is their knowledge on the type of aeroplane(s) they are currently flying. The fuel system description in an aircraft flight manual is very detailed, and it includes precautions and procedures for deliberately running a tank dry, including the restoration of power after engine stoppage for that reason. The importance of being familiar with the aircraft fuel system (and its associated procedures) cannot be stressed enough. Sometimes the differences between aircraft models can be greater than anticipated – all the more reason for receiving a comprehensive type rating from someone who really knows the aircraft. ■

Vector would like to acknowledge the efforts of Jim Lyver in preparing this article.