

INCIDENT

Aircraft Type and Registration:	Cessna 525 Citation Jet, D-IPCS	
No & Type of Engines:	2 Williams FJ44 turbofan engines	
Year of Manufacture:	1998 (serial no. 525-0264)	
Date & Time (UTC):	31 October 2013 at 1820 hrs	
Location:	South East England	
Type of Flight:	Commercial Air Transport (Passenger)	
Persons on Board:	Crew - 2	Passengers - 4
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	45 years	
Commander's Flying Experience:	4,900 hours (of which 400 were on type) Last 90 days - 71 hours Last 28 days - 10 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft diverted to London Gatwick Airport after both FUEL FLTR BYPASS warning lights illuminated during the cruise, indicating that the fuel filters were obstructed. The aircraft landed without further incident. The investigation concluded that the obstruction was probably caused by ice forming on the fuel filters due to insufficient anti-icing additive being added to the fuel during the previous refuelling.

History of the flight

The aircraft departed Barcelona at 1555 hrs for a flight to Manchester. On board were the two flight crew and four passengers. The flight proceeded normally until approaching the English Channel, cruising at FL 400, where the ram air temperature (RAT) was reported as -48°C. By this time a fuel imbalance of about 120 lb had developed, which the flight crew dealt with by transferring fuel from the right tank to the left.

About 10 minutes after completing the fuel transfer a RH FUEL FLTR BYPASS caption illuminated, indicating bypass of the right engine fuel filter. The flight crew consulted their Quick Reference Handbook (QRH), which advised that a landing should be made 'AS SOON AS PRACTICAL' and that the crew should consider the possibility of partial or total loss of the thrust from both engines. As the aircraft was nearing its destination, the crew elected to continue the flight to Manchester. However, after a further 10 to 12 minutes, the LH FUEL FLTR BYPASS caption also illuminated, indicating that both engines fuel filters were now affected.

The flight crew informed ATC of the situation and requested diversion to a suitable airport. London Gatwick was offered, which the crew accepted. The aircraft landed at Gatwick at 1841 hrs after an expeditious but uneventful arrival. There were no further abnormal cockpit indications and both engines continued to operate normally. Following an external inspection by the airport fire service, the aircraft was taxied to the parking area and shut down.

Fuel system description

Fuel is contained in two integral wing tanks, one in each wing, and is normally supplied to each engine by a primary ejector pump in each tank. These use fuel pressure returned from the engine-driven fuel pump and the venturi effect to produce a high volume flow at low pressure to the engine. Electric boost pumps are also fitted in each tank; these are used for engine starting, fuel transfer and as a backup to the primary ejector pumps.

The fuel supplied to each engine initially passes through an engine-driven fuel pump and then a filter, before being delivered to the engine fuel control unit. The fuel filter is fitted with a bypass valve to allow continued fuel flow should the filter become obstructed. The crew are alerted to an impending or actual bypass of the fuel filter by the relevant FUEL FLTR BYPASS annunciator panel light and the MASTER CAUTION RESET illuminating.

Fuel is not heated before it reaches the engine fuel filter and therefore an anti-icing additive must be mixed with the fuel to prevent fuel icing.

Refuelling prior to the flight

The commander reported that the aircraft was refuelled at Barcelona with 1,100 litres of Jet A-1 fuel, bringing the total fuel on board to 2,700 lb (approximately 1,500 litres). It was necessary to add a fuel system anti-icing additive during refuelling, cans of which were normally carried on the aircraft. The commander reported that he did so in Barcelona, but that on this occasion he did not realise that the can he used contained only half the amount of additive compared to the cans normally used. Consequently, the commander inadvertently added only half the required amount of additive.

Aircraft examination

The aircraft was inspected by the AAIB with an engineer from the operator's maintenance organisation present. Fuel samples were taken from each of the two wing tanks; no water or other contamination was visible. A test for micro-organisms in the fuel was negative. Each engine fuel filter was removed and inspected; both were clean. The fluid in each filter bowl was examined and in each case there was water present, as well as fuel. The fuel filters were replaced and the filter bowls were cleaned before being refitted. Engine ground runs were carried out and engine operation was normal.

Subsequent laboratory testing of the fuel samples showed that the fuel contained much less anti-icing additive than was required.

Conclusion

The obstruction of the fuel filters was most likely caused by ice forming on the filters due to insufficient anti-icing additive being added to the fuel during the previous refuelling.

Safety actions

Following this incident the operator undertook the following safety actions:

1. A new procedure was introduced requiring crews to record, in the flight log, the quantity of anti-icing additive used at each refuelling.
2. A safety message was issued to all crew highlighting the requirement for adding anti-icing additive to some aircraft, advising them of the new recording process and reminding commanders to check sufficient quantity of anti-icing additive is on board the aircraft before leaving home base.