SERIOUS INCIDENT

Aircraft Type and Registration:	Cessna Citation 680 Sovereign, G-CJCC
No & Type of Engines:	2 Pratt and Whitney Canada PW306C turbofan engines
Year of Manufacture:	2008
Location:	During climb after departure from London Luton Airport
Date & Time (UTC):	30 September 2010 at 0825 hrs UTC
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 3 Passengers - 5
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	51 years
Commander's Flying Experience:	6,500 hrs of which 350 hrs were on type
Information Source:	AAIB Field Investigation

The investigation

The Air Accidents Investigation Branch (AAIB) was informed of the serious incident involving this aircraft at 1130 hrs on 1 October 2010 and an investigation was commenced immediately under the provisions of the *Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996.* In accordance with established international arrangements, the National Transportation Safety Board (NTSB) of the USA, representing the State of Design and Manufacture of the aircraft, appointed an Accredited Representative to participate in the investigation. The investigation is also being fully supported by all parties involved.

This Special Bulletin contains facts which have been determined up to the time of issue. It is published to inform the aviation industry and the public of the general circumstances of accidents and serious incidents and should be regarded as tentative and subject to alteration or correction if additional evidence becomes available.

The investigation is being carried out in accordance with The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996, Annex 13 to the ICAO Convention on International Civil Aviation and EU Directive 94/56/EC.

The sole objective of the investigation shall be the prevention of accidents and incidents. It shall not be the purpose of such an investigation to apportion blame or liability.

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History of the flight

The aircraft was operating a commercial passenger flight from London Luton Airport, United Kingdom, to Milas-Bodrum Airport, Turkey. It departed with a full fuel load of approximately 11,000 lbs. As it passed FL300 for FL320 in the climb, the DC EMER BUS L amber Crew Alerting System (CAS) message appeared. The crew referred to the Emergency/ Abnormal Procedures checklist and, from the observed indications, concluded that there was a fault on the left main electrical bus. They completed the required action items, which included selecting the left generator to OFF. They elected to return to Luton as the weather there was favourable and it was only 20 minutes flying time.

When the left generator was selected OFF, a number of systems lost power, including the flaps, the left fuel quantity indication and the commander's Primary Flight Display (PFD). The commander handed control to the co-pilot, who remained the handling pilot for the rest of the flight. As the flight progressed, the co-pilot became aware that an increasing amount of right aileron control input was required to maintain a wings-level attitude. A flapless landing was completed at Luton Airport without further incident.

When the aircraft was powered up again, all systems appeared to operate normally, including the left fuel quantity indication. The left tank fuel quantity indication was approximately 5,500 lbs (corresponding to full) and the right tank indication was approximately 3,300 lbs. The crew confirmed that they had not selected the fuel cross-feed during the flight.

Fuel system

Two separate integral wing fuel tanks, each with a capacity of 5,500 lbs, provide fuel for the engines and auxiliary power unit. Each engine is normally supplied from its on-side fuel tank. An electrically-driven boost pump supplies fuel pressure for engine starting. A motive-flow pump provides fuel to the engine once it is running and the boost pump is then switched off. The engine-driven fuel pump provides excess fuel flow capacity, with the excess fuel being returned to the on-side tank. The excess flow is used to operate the motive-flow pump.

A selectable fuel cross-feed facility allows either fuel tank to supply the opposite engine. When selected, the cross-feed valve is commanded open and the electric boost pump in the selected tank operates. A signal is sent to the cross-fed engine to close the motive-flow shutoff valve to the tank not in use, so that any excess fuel flow is returned to the selected tank.

The maximum permissible lateral fuel imbalance is 400 lbs, but this can be increased to a maximum of 800 lbs in an emergency.

Post-incident testing

During ground testing under AAIB supervision, it was established that removing power from the left main electrical bus caused the fuel cross-feed valve to open and the right fuel boost pump to operate, with the cross-feed selector switch in the OFF position. FUEL CROSS FEED and R BOOST PUMP messages were also displayed on the CAS. Tests on another, similar aircraft produced the same result.

Recorded data indicate that the motive-flow shutoff valves on both engines did not move during the incident.

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Discussion

This incident and subsequent ground testing showed that removal of power from the left main bus will cause the fuel cross-feed valve to open and the right boost pump to operate without any crew selection, and the motive-flow shutoff valves will remain open. This allows motive-flow fuel to be returned to both tanks, resulting in uncommanded fuel transfer from the right to the left tank. During the 20 minutes that elapsed between selecting the left generator OFF and landing at Luton, sufficient fuel was transferred from the right to the left tank, via the left engine motive-flow system, to create a fuel imbalance of 2,200 lbs. The crew were not aware that this was occurring, as only the right fuel quantity indication was available.

It is apparent that if the left main bus is not powered during aircraft operation, uncommanded fuel transfer from the right to the left tank will occur. This will cause an increasing lateral fuel imbalance, with associated roll control difficulties. For this reason, the following Safety Recommendations are made:

Safety Recommendation 2010-090

It is recommended that the Cessna Aircraft Company immediately informs all operators of Cessna Citation 680 Sovereign aircraft that uncommanded fuel transfer will occur during aircraft operation if the left main electrical bus is not powered.

Safety Recommendation 2010-091

It is recommended that the Federal Aviation Administration (FAA) require the Cessna Aircraft Company to take suitable actions for the Cessna Citation 680 Sovereign, to prevent uncommanded fuel transfer during aircraft operation when the left main electrical bus is not powered.

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