

**SERIOUS INCIDENT**

<b>Aircraft Type and Registration:</b>	Bombardier CL600-2B16, N664D
<b>No &amp; Type of Engines:</b>	2 General Electric CF34-3B turbofan engines
<b>Year of Manufacture:</b>	2008 (Serial no: 5505)
<b>Date &amp; Time (UTC):</b>	26 March 2014 at 1354 hrs
<b>Location:</b>	Biggin Hill Airport, Kent
<b>Type of Flight:</b>	Commercial Air Transport (Non-Revenue)
<b>Persons on Board:</b>	Crew - 3                      Passengers - None
<b>Injuries:</b>	Crew - None                      Passengers - N/A
<b>Nature of Damage:</b>	Main wheel tyres blown, damage to main wheels and brake units
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence
<b>Commander's Age:</b>	45 years
<b>Commander's Flying Experience:</b>	7,695 hours (of which 410 were on type) Last 90 days - 100 hours Last 28 days - 28 hours
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot, investigation report submitted by the maintenance organisation, occurrence report submitted by ATC and recorded flight data.

**Synopsis**

A post-maintenance check flight, requiring an airborne check of the air-driven generator (ADG), involved placing the aircraft in an emergency electrical configuration. The check was completed successfully, but the pilots did not return the aircraft to the normal electrical configuration. Consequently, several aircraft systems remained inoperative, including flaps, ground spoilers, anti-skid and nosewheel steering. The aircraft landed in this configuration and the pilots experienced difficulty stopping it on the runway. All four main tyres deflated, causing damage to the main wheels and brake units.

**Background to the flight**

An airborne test of the aircraft's ADG was required<sup>1</sup> as part of its scheduled maintenance programme. This was to be carried out when the aircraft flew to Biggin Hill for maintenance but this had not been done prior to landing, necessitating the check flight.

A further single visual circuit at Biggin Hill was planned, during which the ADG would be tested. The incident occurred during the landing phase of this flight. An engineer from the

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**Footnote**

<sup>1</sup> In case of a failure of the aircraft's primary and auxiliary AC systems in flight, the ADG deploys automatically into the airflow and powers the AC essential busbar. Provision is also made for manual deployment.

maintenance organisation, who occupied the flight deck jump seat, accompanied the two pilots.

### History of the flight

The aircraft took off from Runway 03 in good weather conditions and with the commander as the handling pilot. After takeoff the pilots maintained the takeoff flap setting of 20° required for the ADG test. During the downwind leg, the flight crew took the main aircraft generators off-line, thus simulating the failure conditions which would cause the ADG to deploy. Correct deployment and functioning of the ADG was confirmed. The aircraft was not then reconfigured to its normal operating condition.

On base leg to land on Runway 03 the pilots selected wing flaps for landing but they remained at the takeoff setting of 20°. The commander continued the approach with the reduced flap setting and at a speed of 160 kt, which was appropriate for the configuration. The aircraft landed at an estimated 150 kt and the commander selected reverse thrust. Only the left thrust reverser deployed. The aircraft did not decelerate as expected and the commander applied maximum wheel braking, bringing the aircraft to a stop approximately 120 m from the runway end (Landing Distance Available was 1,550 m).

Biggin Hill ATC reported that, after what seemed like a fast landing, smoke was seen to come from the aircraft tyres and continued to do so for most of the landing roll. When the aircraft stopped the controller alerted the Airport Fire and Rescue Service, who attended the scene.

The pilots attempted to taxi the aircraft from the runway but were unable to do so. Subsequently it was established that all four main wheel tyres had ruptured, and the main wheels and the brake units on the left wheel had been damaged. The aircraft remained in position until the main wheels could be replaced, allowing it to be towed.

### Technical information

The aircraft operating manual details a recommended procedure for an in-flight check of the ADG. A note at the beginning of the procedure states '*Normal electrical power must be restored before final landing approach is commenced.*' The procedure calls for deployment of the ADG using the manual deployment handle, after a number of preliminary steps and checks have been completed. Once deployed, the main generator switches are turned off, which should generate a red EMER PWR ONLY (emergency power only) warning and an amber caution message for each generator. Further checks are then made to confirm the functionality of the ADG. Finally, normal electrical power is restored by switching the generators back on, checking that the caution and warning lights extinguish, and pressing a power transfer override switch. This last action de-energises the AC emergency contactors and returns the electrical system to normal operation.

The operating manual lists aircraft systems that are not available when operating on emergency power. The list includes flaps, ground spoilers, nosewheel steering and the brake anti-skid system. A note also states that, if the ADG is the only source of electrical

power for landing, the manual deployment handle should be pulled. This ensures that the DC essential busbar remains powered by the aircraft batteries as airspeed (and thus ADG output) reduces on landing, otherwise damage to the aircraft's thrust reversers can result.

### **Aircraft commander's report**

The commander reported that when the aircraft was downwind it was agreed the aircraft's main generators would be taken off-line (producing conditions for ADG deployment). This was done, and correct deployment and functioning of the ADG was confirmed.

The commander observed that the roles of the pilots and the engineer had not been clearly established before takeoff, and the pilots assumed that the engineer would 'talk through' what he needed to see once airborne. The commander also observed that the crew should have referred to the Quick Reference Handbook (QRH) for the situation rather than rely on the engineer to guide them. The commander later discovered that the engineer was not expecting to make decisions or inputs during the flight, so a misunderstanding had existed.

### **Engineer's report**

The engineer described his role as primarily that of an observer, although with the intention of noting any defects or abnormalities that might arise during the flight test. He did not see the flight crew read or refer to the ADG test operational procedure. Once airborne, the crew initiated the ADG test by switching the generators off. They then checked to confirm that the ADG had deployed and was powering the AC essential bus.

The engineer was aware that the flaps had not moved when selected, and thought the co-pilot announced the abnormality twice without response from the commander. He was not aware of any attempt to bring the main generators back on-line. The approach continued and the engineer was expecting the pilots to discontinue the approach, but they did not. On the runway, it was evident that the aircraft was not decelerating as normal and that the pilots were having difficulty controlling it.

### **Maintenance organisation's report**

The maintenance organisation conducted an investigation into the occurrence and provided the AAIB with a copy of its report and findings. Among the internal recommendations made by the report was the requirement for a full briefing to be given to flight crews undertaking a maintenance check flight, irrespective of whether or not the crew declared themselves to be familiar with the procedure.

### **Recorded data**

The aircraft's Cockpit Voice Recorder (CVR) and Flight Data Recorder (FDR) were available for inspection. The CVR was not isolated immediately<sup>2</sup> after the incident and the recording was overwritten.

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#### **Footnote**

<sup>2</sup> The maintenance organisation stated that it was isolated "approximately 20 minutes after the incident".

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FDR data showed that the flight lasted 271 seconds from liftoff to touchdown. Airspeed on short final was 172 kt, reducing to about 159 kt at touchdown. The left thrust reverser first indicated unlocked at 153 kt; the right thrust reverser remained stowed during the landing roll.

### **Discussion**

Detailed advice on check flights may be found in the CAA's CAP 1038 '*Check Flight Handbook*'.

In this case, the flight crew embarked on a very short flight with no firm plan how to conduct the check, and a misunderstanding of the roles of the three people on board. A visual circuit at a busy airfield requires crew vigilance even in normal circumstances, so was not a suitable operating environment for the check.

A detailed procedure for the check was available but was not followed by the crew. Because of this, and the time pressure the crew imposed on themselves by attempting to do the check during one visual circuit, the aircraft was not returned to its normal electrical configuration prior to landing. There were several indications to the crew that the aircraft was not correctly configured, including warning and caution messages in the cockpit, and the inoperative flaps. Addressing these might have alerted the crew to the need to restore normal electrical power.