

AIRCRAFT ACCIDENT REPORT No 1/2008

This report was published on 10 January 2008 and is available on the AAIB Website www.aaib.gov.uk

REPORT ON THE SERIOUS INCIDENT TO BOMBARDIER CL600-2B16 CHALLENGER 604, VP-BJM 8 NM WEST OF MIDHURST VOR, WEST SUSSEX ON 11 NOVEMBER 2005

Registered Owner and Operator:	Southern Air - Nigeria
Aircraft Type and Model:	Bombardier CL600-2B16 Challenger 604
Nationality:	Bermuda register
Registration:	VP-BJM
Location:	8 nm west of Midhurst VOR, West Sussex
Date and Time:	11 November 2005 at 1522 hrs

Synopsis

This serious incident was notified to the Air Accidents Investigation Branch (AAIB) by the London Terminal Control Centre (LTCC) on 11 November 2005, the day of the occurrence, and the investigation began that day. The following Inspectors participated in the investigation:

Mr R D G Carter	Investigator-in-charge
Mr P Sleight	Engineering
Mr J Firth	Operations
Mr J R James	Flight Recorders

About four and half hours into a flight from Lagos, Nigeria, the autopilot pitch trim failed and subsequently the stabiliser trim system failed. Attempts were made to re-engage the stabiliser trim channels, resulting in channel 2 appearing to engage with no response to trim commands, and channel 1 engaging intermittently. During the flight the stabiliser occasionally trimmed nose

down, despite applications of nose-up trim commands. The trim eventually reached almost full nose down. To counteract this, both flight crew members had to apply prolonged aft pressure on the control column. The aircraft diverted to London Heathrow for a landing with flap retracted, although the QRH required 20° flap following a stabiliser trim failure. The commander made the decision as the crew considered that applying flap would substantially increase the control column load required to maintain level flight.

Subsequent investigation found contamination, formed by electro-migration in the presence of moisture, within the Horizontal Stabiliser Trim Control Unit (HSTCU). The moisture was probably created by humid air condensing on the cooling motherboard during prolonged flight at altitude.

The investigation identified the following causal factors:

1. In the absence of a mechanical backup system or sufficient physical separation of the control channels, there was insufficient protection within the design of the HSTCU against the effects of environmental contamination.
2. The airworthiness requirements relating to the design and installation of electronic components did not sufficiently address the specific effects of fluid and moisture contamination as a source of common cause failures.

One Safety Recommendation is made in this report and one was made earlier in the investigation.

Findings

1. The flight crew members were properly licensed to conduct the flight.
2. The flight was uneventful until the autopilot pitch trim failed about four and a half hours into the flight, followed by the stabiliser trim system.
3. Attempts by the crew to re-engage the stabiliser trim channels were not successful.
4. The stabiliser occasionally trimmed 'aircraft nose down', despite applications of nose-up trim commands, and reached almost full nose down.
5. To counteract the runaway trim, both flight crew members had to apply prolonged aft pressure on the control column.

6. The aircraft diverted to London Heathrow for a landing with flap retracted, although the QRH required 20° flap following a stabiliser trim failure.
7. The commander made the decision to land with flap retracted, as he was concerned that applying flap would substantially increase control loads required for level flight.
8. The runaway trim condition was caused by electrical shorting, in the presence of moisture, within the Horizontal Stabiliser Trim Control Unit (HSTCU).
9. The moisture was probably created by humid air condensing within the HSTCU during the prolonged flight at altitude.
10. The electrical shorting within the HSTCU affected both pitch trim control channels due to their physical and functional proximity in the unit.
11. With no separate mechanical backup system, there was insufficient system separation, and thus independence, between the control channels in the HSTCU.
12. The design of the HSTCU had insufficient environmental protection against moisture ingress.
13. There had been a number of previous occurrences of contamination within HSTCUs, of which the aircraft and component manufacturers were aware.

Safety Recommendations

The following Safety Recommendation was made shortly after the incident, in AAIB Special Bulletin S3/2005:

Safety Recommendation 2005-147

It is recommended that Transport Canada ensure that Bombardier Aerospace eliminate the risk of contamination affecting the operation of the horizontal stabiliser trim control system fitted in the Challenger 604 and other Bombardier aircraft with similar trim systems.

The Safety Recommendation was transmitted to Transport Canada through the Transportation Safety Board in Canada. The response is noted in the report under Section 5, Safety Actions Taken.

Safety Recommendation 2007-061

It is recommended that the EASA, in collaboration with other airworthiness authorities, including the FAA and Transport Canada, amend their requirements relating to the design and installation of electronic components in aircraft, so that fluid and moisture contamination, as a source of common cause failures, is specifically taken into account and adequate measures take place to minimise the risk.