COURTESY TRANSLATION:

BEA

Bureau d'Enquêtes et d`Analyses REPORT

[Office of Investigations and Analyses] **SERIOUS INCIDENT**

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Failure of an autopilot control cable and stiffening of elevator control during flare

Aircraft	Bombardier CRJ700 registered F-GRZN
Date and time	12 July 2010 at around 18:30 UTC(1)
Operator	Brit Air
Place	Bilbao Airport (Spain)
Type of flight	Scheduled public transport of passengers
Persons on board	2 flight crew, 2 cabin crew, 63 passengers, 2 babies
Consequences and damage	None

(1) Except where otherwise stated, the times shown in this report are expressed in Coordinated Universal Time (UTC).

HISTORY OF THE FLIGHT

The crew was performing the first leg of its round trip, departing from Bilbao, bound for Paris Charles de Gaulle. During the climb, the crew noticed that the aircraft autopilot was unable to hold the engaged vertical mode. The caution message "AP PITCH TRIM" appeared. The crew ran the relevant checklist which, after another unsuccessful attempt at engaging the AP, led them to resume manual control. They then decided to makes several attempts at AP vertical mode engagement, which confirmed that the autopilot did not hold any of these modes. The flight continued on to its destination without any event of note.

At the stopover, the maintenance crew took a variety of steps relating to the problem encountered. No malfunctions were found. Specifically, they conducted three operational tests of the elevator servo control and checked the free clearance of the controls. The Certificate of Release to Service (CRS) was signed and the flight crew decided to fly the next leg, bound for Bilbao.

During this leg, the same problem occurred. The AP could not hold the vertical modes and the caution message "AP PITCH TERM" appeared. The flight continued under manual control.

During the flare at Bilbao, the crew had to exert greater effort than usual in order to flare. Touchdown, however, was normal. While taxiing, they noticed that the elevator control locked at half nose-up. The following flight was cancelled.

The maintenance performed after this incident revealed that the AP nose-up elevator control cable was broken and that the loose part of the cable had formed a loop, thereby jamming the AP servo.

CONCLUSION

The servo nose-up control cable broke at the aft quadrant of the elevator due to fatigue, as a result of the incorrect positioning of the end of the cable in the quadrant channel. This incorrect positioning most probably occurred during assembly of the elevator at the time of aircraft construction.

The failure had no significant consequences for the flight during which it occurred.

The failure had no significant consequences for the manual control of the aircraft up to the flare during the third landing after it occurred, either. However, the stiffening of the controls experienced during the flare could have occurred at any other moment during the flight, and the risk associated with a loss of effective inputs on the flight controls was real during the flight.

In addition, the autopilot exhibited considerable degradation. This phenomenon was observed and indicated in the aircraft technical logbook during the two flights following the flight during which the failure occurred.

After notes were made in the technical logbook at the end of the first flight subsequent to the flight during which the failure occurred, the maintenance performed did not bring the flight control problem to light. The problem was detected at the end of the second flight, during which the stiffening of the controls was observed during manual control.

The stiffening of the elevator was probably due to the cable becoming jammed in the servo mechanism, which led to the restriction of travel of the elevator aft quadrant.

LESSONS LEARNED

The checks performed during aircraft assembly generally make it possible to detect an incorrect assembly such as the one that led to this event. This assembly problem is not unique, but the fact that it was not detected appears to be exceptional. Nevertheless, the incident demonstrates that the quality control system does not guarantee that a failure to detect an incorrect assembly will not occur again.

The case of the incorrect assembly identified through this event could be used to increase the awareness of concerned persons with respect to the risk created by incorrect installation. This could be done via the skills upgrade courses taken by the operators, or using sheets that draw the operators' attention to certain specific points contained in the various documents used in the assembly process.

The application of maintenance task 22-11-24-710-801 should have made it possible to detect the problem in the flight control system. This was not the case. It was not possible to determine whether this failure was due to an error in the content of the Task Card or to incorrect application by the technician.

ACTION TAKEN BY THE MANUFACTURER

Following discussions with BEA, Bombardier took the following action in August 2011:

- ❒ Revision of the AMM Task 22-11-24-710-801

❒ Revision of the Bombardier “Functional Test Procedure”

❒ Revision of the Aeronova “Cahier de Montage” (Assembly Guide)

RECOMMENDATION

Note: In accordance with Article 17.3 of European Regulation (EU) 996/2010 of the European Parliament and Council dated 20 October 2010 on the investigation and prevention of civil aviation accidents and incidents, a safety recommendation shall in no case create the presumption of blame or liability for an accident, a serious incident or an incident. Addressees of safety recommendations shall inform the safety investigation authority which issued the recommendations of the actions taken or under consideration, under the conditions stipulated in Article 18 of the aforementioned Regulation.

The use of the video recorded by the crew turned out to be useful for the investigation in that it supplied information not readily obtainable elsewhere. Similarly, photos taken by the Pilatus crew during the incident flight on 2 June 2010 provided information not recorded elsewhere.

BEA had already recommended at the close of various investigations [(6)] that ICAO consider the installation of protected image recorders on aircraft used for the public transport of passengers. Investigation authorities from other countries have likewise made recommendations [(7)] to this effect.

ICAO is currently working with a view to adopting Standards and Recommended Practices concerning the installation of image recorders. This work, however, is not yet complete.

Consequently, BEA recommends:

❍ **that ICAO continue its efforts to ensure the installation of flight image recorders on aircraft used for the public transport of passengers. [Recommendation FRAN-2012-027]**

[(6)] Investigation of the accident on 20 January 1992 involving the Airbus A320 registered F-GGED, investigation of the serious incident on 23 November 1997 involving the McDonnell Douglas MD83 registered F-GRMC, investigation of the accident on 25 July 2000 involving the Concorde registered F-BTSC.

[(7)] The investigation authority of the United States, as part of two recommendations issued on 11 April 2000 following multiple investigations; the investigation authority of the United Arab Emirates, as part of the investigation of the accident on 10 February 2004 involving the Fokker F27 registered EP-LCA, the investigation authority of Greece, as part of the investigation of the accident on 14 August 2005 involving the Boeing B737 registered 5B-DBY; the investigation authority of the United Kingdom, as part of the investigation of the serious incident on 22 October 2005 involving the Airbus A319 registered G-EUOB; the investigation authority of Russia, as part of the investigation of the accident on 8 July 2006 involving the Airbus A310 registered F-OGYP.