S1/2002 - Bombardier Challenger CL-600-2B16, N90AG

AAIB Bulletin No: S1/2002	**Ref: EW/C2002/1/2**	**Category: 1.1**
Aircraft Type and Registration:	Bombardier Challenger CL-600-2B16, N90AG	
Serial Number:	5414	
Year of Manufacture:	1999	
Date & Time (UTC):	4 January 2002 at 1207 hrs	
Location:	Birmingham International Airport	
Type of Flight:	Private (FAR Part 91)	
Persons on Board:	Crew - 2	Passengers - 3
Injuries:	Crew - 2 Fatal	Passengers 3 Fatal
Nature of damage:	Aircraft destroyed	
Commander's Licence:	FAA Airline Transport Pilot's Certificate	
Commander's Flying Experience:	Approximately 10,000 hours (of which about 500 were on type)	
Information Source:	AAIB Inspector's Investigation	

History of the flight

The aircraft arrived at Birmingham Airport on 3 January 2002 at 2039 hrs after a non-stop international flight from West Palm Beach Airport, Florida, USA. The Birmingham METAR for 2050 hrs indicated that the surface wind was from 120° at 6 kt, visibility 8 km, no significant weather, temperature minus 1°C, dew point minus 2°C, QNH 1026 mb.

On arrival, the commander stated that the refuelling could be done the following morning in time for the planned 1200 hrs departure to Bangor Airport, Maine, USA. The aircraft was parked overnight on the Western Apron. The same 2 pilots and 3 passengers were to board the aircraft for the accident flight the following day.

There was no precipitation while the aircraft was at Birmingham. The air temperature remained below zero with a minimum temperature of minus 9°C at 0550 hrs. Initially, the sky was clear but the amount of cloud increased to give variable cloud cover after midnight. The surface wind remained south-easterly at less than 5 kt.

The next morning, one of the crew, together with one of the passengers, arrived at the aircraft at approximately 1040 hrs. The commander arrived at approximately 1100 hrs. At different times,

each crew member was seen to carry out an independent external inspection of the aircraft. Aircraft refuelling commenced at about 1105 hrs and the aircraft fuel tanks were reported full (20,000 lb) at about 1140 hrs. Then, following the arrival of the remaining two passengers, the aircraft doors were closed. During the morning, other witnesses stated that they had seen frost or ice on the wing surfaces of N90AG prior to departure.

Other aircraft, which had been parked overnight, were de-iced during the morning, with associated reports of moderate to severe ice or frost accumulations. Neither crew member requested de-icing, so N90AG was not de-iced prior to departure. The Birmingham METAR at 1150 hrs indicated that the surface wind was from 150° at 6 kt, visibility 8 km, scattered cloud, base 700 feet agl and broken cloud, base 800 feet agl. The outside air temperature was minus 2°C with dew point minus 3°C. The QNH was 1027 mb.

There were no ATC flow restrictions to affect the flight and ATC start clearance was obtained immediately on request. The engines were started at 1156 hrs and N90AG was cleared to taxy at 1201 hrs.

The preceding aircraft movement on Runway 15 was a landing BAe 146 aircraft about one minute before N90AG's departure. The previous departing aircraft had been an Embraer 145 a few minutes before that.

At 1206 hrs, N90AG was cleared to line up on Runway 15 and at 1207 hrs take-off clearance was issued with a surface wind from 140° at 8 kt.

The pilot in the left seat was handling the controls and the commander was seated in the right seat. Flap 20 had been selected for take-off and the following speeds had been calculated and briefed by the pilots: V1 137 kt; VR 140 kt; V2 147 kt. Initial post-accident assessment has shown these speeds to be appropriate to the estimated weight of the aircraft.

Flight recorder information

The aircraft was fitted with a solid state Cockpit Voice Recorder (CVR), and a solid state Flight Data Recorder (FDR). All available data was successfully recovered from both recorders.

The take-off appeared normal up to the time of lift-off. Rotation was initiated at about 146 kt with an initial pitch rate of approximately 4°/second. Lift-off occurred 2 seconds later, at about 153 kt, with a pitch attitude of about 8° nose-up. Once airborne, the elevator position reduced from 8° to 3° (aircraft nose-up) whilst the pitch rate increased to about 5°/second.

Immediately after lift-off, the aircraft started to bank to the left. The rate of bank increased rapidly and 2 seconds after lift-off the aircraft had reached 50° left wing down. At that point, the aircraft heading had diverged about 10° to the left. Opposite aileron, followed closely by rudder, had been applied as the aircraft started banking; full right aileron and rudder had been applied within 1 second and were maintained until the end of the recording. As the bank angle continued to increase, progressively more aircraft nose-up elevator was applied. The last recorded aircraft attitude was approximately 111° left bank and 13° nose-down pitch.

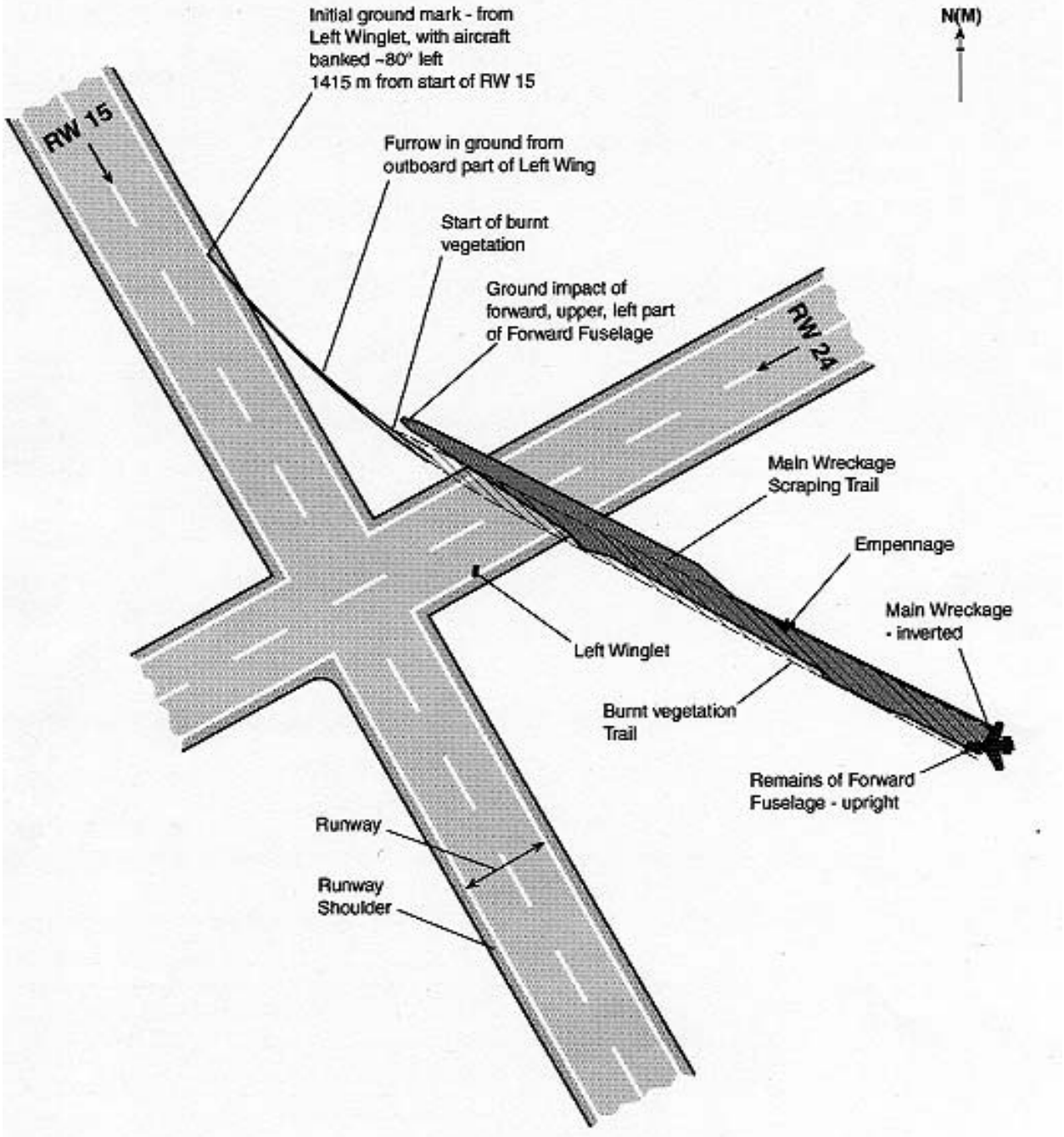
Initial analysis of the FDR parameters indicated that both engines were functioning normally from start-up until the end of the recording. There was no indication of any abnormality which could have accounted for the uncommanded left roll.

The CVR indicated that the crew members were operating normally with no apparent time pressure. The left seat pilot was handling. There were no audio warnings activated until shortly after take-off when the automatic voice "Bank Angle" sounded; this occurred within 2 seconds of the end of the recording. From the CVR, there was no indication that the aircraft's Wing and Cowl Anti-ice systems were selected ON prior to take-off.

Initial engineering investigation

Witness marks indicated that, following lift-off, N90AG first made ground contact with its left winglet. Initial contact had been onto the tarmac-surfaced left shoulder of the runway, approximately 1,415 metre along the 2,605 metre runway (Figure 1). The runway marks and wreckage damage characteristics showed that the aircraft had been banked approximately 80° left at this point and had been descending at a comparatively low rate.

N90AG ACCIDENT SITE SCHEMATIC



Plan View

0 100 200 300 400

Approximate Scale - metre

Figure 1

After initially tracking 10-15° left of the runway heading, the winglet scraped across the left edge of the shoulder onto the grass-covered ground adjoining the runway. Ground contact became progressively heavier, causing the outboard part of the left wing to progressively deform and break-up, while the aircraft continued to roll to the left. After the left wing had scraped for a total of 120 metres, fuel released from the ruptured wing tank ignited. At the same time, the forward, upper, left part of the fuselage contacted the ground heavily. This caused severe damage to the upper portion of the forward fuselage, structural severance of the forward fuselage at the front of the wing centre section and localised rupture of the right and centre wing fuel tanks. Shortly thereafter, horizontal stabiliser ground contact caused detachment of the fin from the fuselage and thus separation of the whole empennage.

The main wreckage, consisting of the wings and the centre and aft fuselage, slid inverted for approximately 320 metres from the fuselage ground contact point before coming to rest. The remains of the forward fuselage remained attached by cables and pipelines to the main wreckage, in approximately its normal relative position, but came to rest upright.

The Airport Fire Service was in attendance less than 1 minute after the aircraft came to rest and within a short period extinguished a substantial fire centred in the forward fuselage area.

After on-site examination with the assistance of the aircraft manufacturer, the wreckage was moved to the Western Apron for further examination and to prepare it for onward transportation. The wreckage has now been moved to the AAIB at Farnborough for more detailed inspection.

Effect on airport operations

The airport was closed from the time of the accident until 1200 hrs on 6 January. Aircraft operations could not be recommenced until the crash site had been searched and examined in detail, as a large part of the wreckage trail was located within the runway cleared and graded area. This area was then required to be completely cleared of debris. This work had to be done primarily during daylight hours. The search and recovery operation was expedited using extensive resources from the West Midlands Police in co-operation with Birmingham International Airport Ltd and the Royal Air Force Aircraft Recovery and Transportation Flight.

Future investigation

The Chief Inspector of Air Accidents has ordered an Inspector's Investigation into the circumstances of this accident under the provision of the Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996. Investigation work will continue on engineering and operational aspects.