NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
WASHINGTON, D.C. 20594

October 11, 2006

POWERPLANTS GROUP CHAIRMAN'S FACTUAL REPORT

NTSB ID No.: DCA-06-MA-064

A. ACCIDENT

Location:	Lexington, Kentucky
Date:	August 27, 2006
Time:	0607 eastern daylight time
Aircraft:	Bombardier CL-600-2B19 (CRJ-100) Registration N431CA

B. POWERPLANTS GROUP

Group Chairman:	Harald Reichel National Transportation Safety Board Washington, DC
Member:	Gordon J. Hookey National Transportation Safety Board Washington, DC
Member:	Les McVey General Electric Aviation Cincinnati, Ohio
Member:	Michael Dages Comair – Delta Connection Erlanger, Kentucky
Member:	David M. Robles Air Line Pilots Association Greenville, South Carolina

C. SUMMARY

On August 27, 2006, about 0607 eastern daylight time, Comair flight 5191, a Bombardier CL-600-2B19 (CRJ-100), N431CA, crashed during takeoff from Blue Grass Airport, Lexington, Kentucky (LEX). The airplane, which had been cleared for runway 22, taxied onto runway 26 instead and ran off the end of runway 26. Of the 47 passengers and 3 crewmembers on board the airplane, 49 were killed, and 1 received serious injuries. The airplane was destroyed by impact forces and postcrash fire. The flight was operating under the provisions of 14 *Code of Federal Regulations* Part 121 and was en route to Hartsfield-Jackson Atlanta International Airport, Atlanta, Georgia (ATL).

D. DETAILS OF INVESTIGATION

D.1 Powerplant Information

D.1.1 Engines Description

The two engines installed in N431CA were General Electric Aircraft Engines (GEAE) models CF34-3A1. The left engine (No. 1) was serial number (S/N) 807567 and the right engine (No. 2) was S/N 807160[1].

The GEAE CF34-3A1 (Figure 1) engine is a dual rotor, high-bypass, turbofan engine incorporating an axial flow turbofan that features a 1-stage fan driven by a 4-stage LPT, a 14-stage high pressure compressor (HPC) with variable stator vanes driven by a 2-stage high pressure turbine (HPT), an annular combustor, and an accessory gearbox to extract energy from the engine to operate accessories. The CF34-3A1 engine has a normal thrust rating of 8,729 pounds and a maximum takeoff thrust rating of 9,220 pounds flat rated at 21°C (70°F).

[1] All orientation and directional references such as top and bottom, front and rear, right and left, and clockwise and counter clockwise are made aft looking forward unless noted otherwise. ALF indicates 'aft looking forward'. FLA indicates 'forward looking aft'.

D.1.2 Engines History

At the time of the accident the left-hand engine had accumulated the following times and cycles:

General Electric CF34-3A1 Engine S/N 807567	
Time Since New	17,265 hours
Cycles Since New	14,850 cycles
Time Since Last Major Shop Visit	145.2 hours
Cycles Since Last Major Shop Visit	118 cycles

The engine was delivered on December 1, 1998. The last major shop visit was performed by Delta Airlines on June 29, 2006 where the engine underwent 15,000-hour Life Limited Part (LLP) scheduled maintenance. The engine was subsequently installed into the accident aircraft on August 3, 2006 at the Comair Cincinnati facility.

At the time of the accident the right-hand engine had accumulated the following times and cycles:

General Electric CF34-3A1 Engine S/N 807160	
Time Since New	27,327 hours
Cycles Since New	25,373 cycles
Time Since Last Major Shop Visit	1746.3 hours
Cycles Since Last Major Shop Visit	1,424 cycles

The engine was delivered on September 1, 1994. The last major shop visit was performed by GE Strother on January 26, 2004 where the engine underwent 21,000-hour Life Limited Part (LLP) scheduled maintenance. The engine was subsequently installed into the accident aircraft on November 27, 2005 at the Comair Cincinnati facility. A partial “A” check was performed on this engine on July 24, 2006 on wing. This check consisted of a general visual inspection of the engine, a lube of the thrust reverser, a special detailed inspection of the C- sump drain, and an oil filter change.

D.2 Observations at the Crash Site

D.2.1 Engine Locations and General Observations

The aircraft was found right side up just outside of the airport property. The aft fuselage had separated from the main fuselage and was resting against a fence and a tree. Both engines and pylons were still attached to the aft fuselage (Figure 2). The aft fuselage was rolled to the left and the left-hand (No. 1) engine was resting against the ground. The center line of the right-hand engine (No. 2) was approximately 8 feet above the ground. An external visual examination of both engines in-situ revealed no sign of un-containment or pre-impact fire.

D.2.2 Left-Hand Engine (No. 1)

The outboard of the nacelle was resting against an approximately 2-foot diameter tree (Figure 3) and the aft plane of the exhaust nozzle fairing rested against a wire fence (Figure 4).

The nose inlet cowl was separated from the engine and was missing. The anti-ice D-duct was found about 6 feet forward of the engine and slightly to the left (Figure 5). The composite upper access cowl was separated from the nacelle, the resin was not present and the fibers were loose and scorched (Figure 6 & Figure 7). The thrust reverser cascades were exposed and one cascade assembly at the 11 o'clock position was fractured (Figure 8). The thrust reverser blocker doors were in the stowed position (Figure 9). Three of the four thrust reverser ball jackscrews were found on the ground at the front of the engine and all were in the reverser stowed position. Most of the upper translating cowl door was missing. The core cowl doors and exhaust nozzle fairing were intact and dented between the 5 to 9 o'clock position (Figure 4). The aft lip of the exhaust nozzle fairing was buckled and folded inwards at the 6 o'clock position (Figure 15).

The fan could not be turned by hand (Figure 10). The spinner was missing and metal slag was found at its attachment studs (Figure 11). All fan blades were present, in place and had evidence of soft body impact on the leading edges (Figure 12 & Figure 13) with the displaced material bent in the direction opposite of rotation. There were several blades that also exhibited hard body damage or tears at the leading edges. The displaced material of one blade was in the direction of rotation, while all the others were displaced in the direction opposite of rotation. Five consecutive blades were bent just above the blade root platform: Three in the direction of rotation and 2 in the direction opposite of rotation. All fan outlet guide vanes (OGV) were present and in their locations. The fan case abradable strip was missing, and the honeycomb backing material was present, deformed and heat damaged. The fan containment Kevlar wrap was burned thru approximately 180 degrees at the bottom (Figure 14). The fan containment Kevlar wrap at the top 180 degrees was charred but in it's location. The epoxy impregnated Kevlar environmental protection barrier of the fan containment Kevlar wrap was missing. The 4th

low pressure turbine (LPT) stage blades that were visible through the exhaust nozzle appeared to be undamaged (Figure 15).

D.2.3 Right-Hand Engine (No. 2)

The entire inlet lipskin was covered with soot and was deformed and buckled between the 6 o'clock to the 9 o'clock location and at the 11 o'clock location (Figure 16 & Figure 17). The inlet inner barrel sound attenuation surface displayed impact marks through 360 degrees for its entire length (Figure 18). The inner diameter of the anti ice lip was still attached to the front edge of the inner barrel along the entire circumference and all the rivets were still in their location.

The entire length of the outer nacelle skin from the 12 to the 6 o'clock position (outboard section) exhibited paint blisters (Figure 17). There were random patches where the paint was burned away and the primer was exposed but there was no burn or soot indications along the axis of the engine. All fasteners were intact and all latches were secured from the leading edge of the inlet to the trailing edge of the translating cowl doors. The outer nacelle skin between the 6 and 12 o'clock position (inboard section) was heavily fire damaged, exposing the composite core from the inlet leading edge to approximately 4 feet aft (Figure 19). Aft of this location the remaining nacelle skin features were similar to the outboard skin. The translating cowl door and the blocker doors were in the stowed position (Figure 20).

The core cowl doors and the exhaust nozzle fairing were intact and covered with soot (Figure 21). The latches on the cowl doors were in place and secured. The exhaust nozzle fairing was dented at the trailing edge at the 3 o'clock position. The translating cowl door aft edge appeared to be concentric with the core cowling.

All fan blades were present and in place on the fan disk. Many of the fan blades had evidence of soft body impact on the leading edges (Figure 22). There were several blades that had tears at the leading edges (Figure 23). The displaced material was bent in the direction opposite of rotation. The fan case abradable strip was present and was circumferentially scored at the plane of the fan blades. The fan OGV appeared to be undamaged. The 4th stage low pressure turbine (LPT) rotor could be rotated freely and the fan rotated concurrently. The 4th stage LPT blades appeared to be undamaged (Figure 24). No metal spray was observed on the blades.

Harald Reichel
Aerospace Engineer

Figure 1 – GEAE CF34-3A1 engine cross section

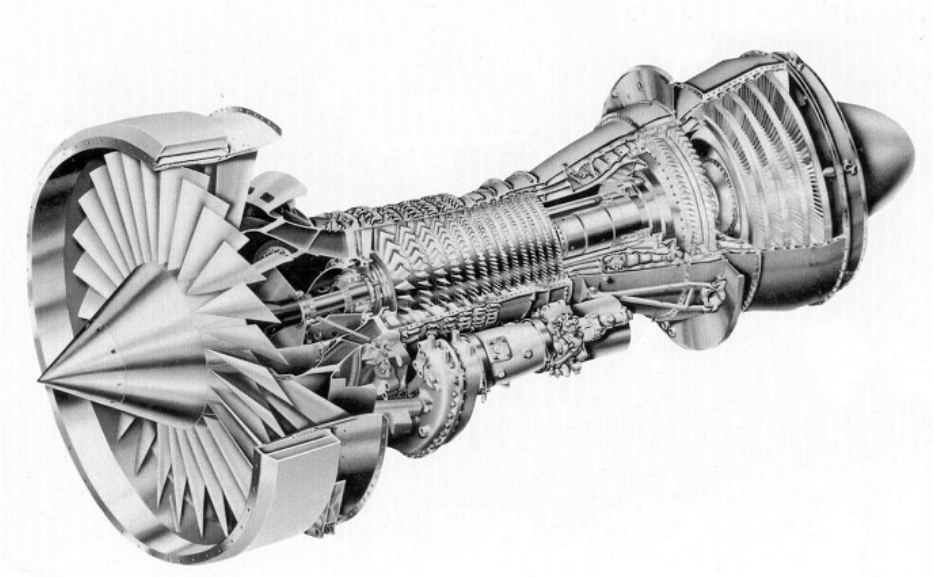

Figure 2 – Aft fuselage showing engines and pylons – Front view

Right-hand engine

Left-hand engine

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Figure 3 - Left-hand engine – Front View

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Figure 4 – Left-hand engine – Aft View

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Figure 5 – Left-hand engine – Anti-ice D-duct

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Figure 6 – Left-hand engine

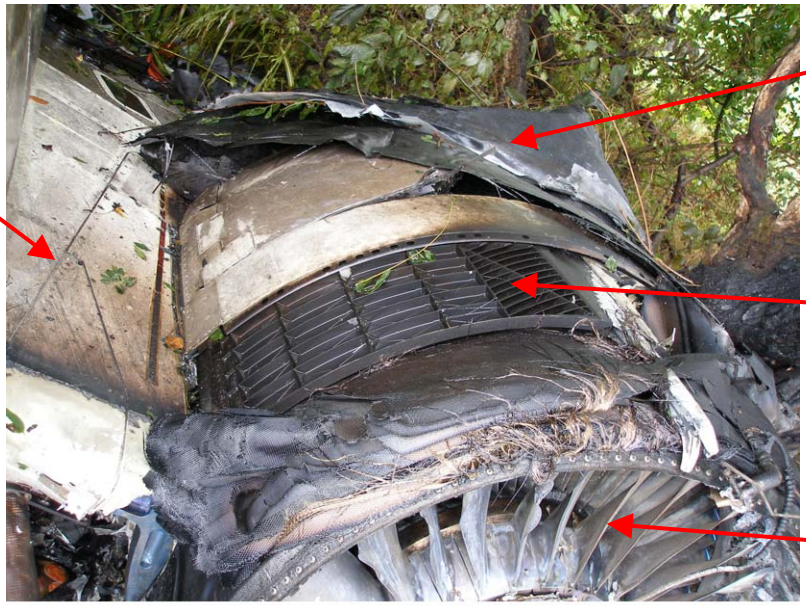

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Figure 7 – Left-hand engine – Aft view

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Figure 8 – Left-hand engine - Fractured thrust reverser cascades

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Figure 9 – Left-hand engine – Thrust reverser blocker doors stowed

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Figure 10 – Left-hand engine - Fan

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Figure 11 – Left-hand engine – Spinner mount location

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Figure 12 – Left-hand engine – Fan blades – soft body damage

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Figure 13 – Left-hand engine – Fan blades

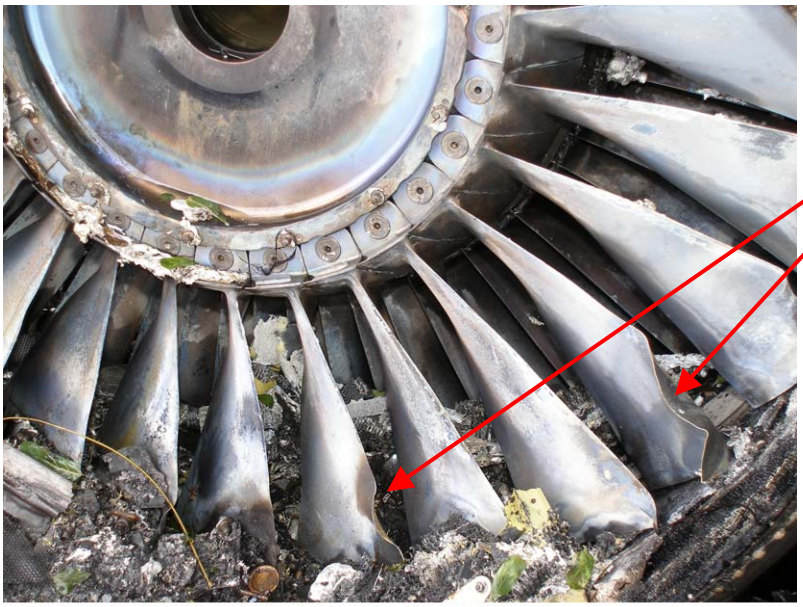

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Figure 14 - Left-hand engine - Fan containment Kevlar wrap

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Figure 15 – Left-hand engine - 4th Low pressure turbine (LPT) stage

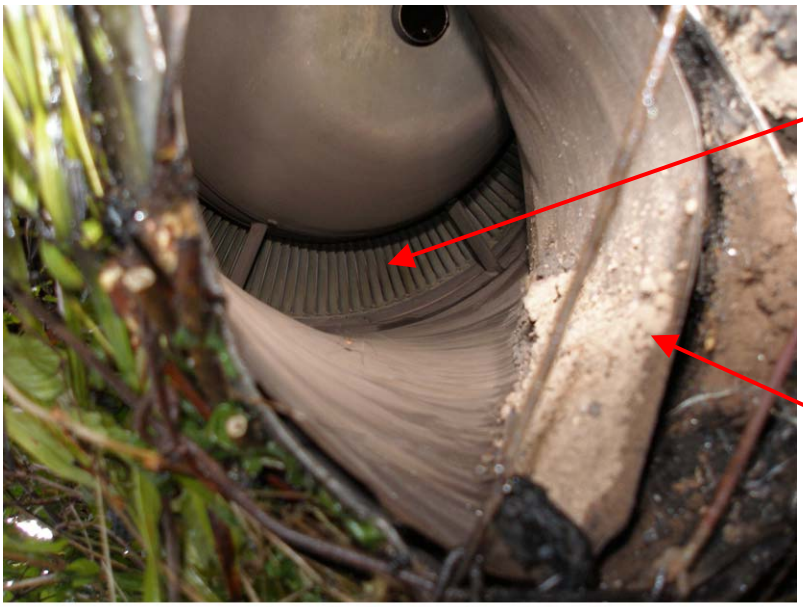

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Figure 16 – Right-hand engine – Front View

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Figure 17 – Right-hand engine – Nacelle outboard side

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Figure 18 – Right-hand engine – Inlet inner barrel surface

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Figure 19 – Right-hand engine – Nacelle inboard side

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Figure 20 - Right-hand engine – Thrust reverser blocker doors stowed

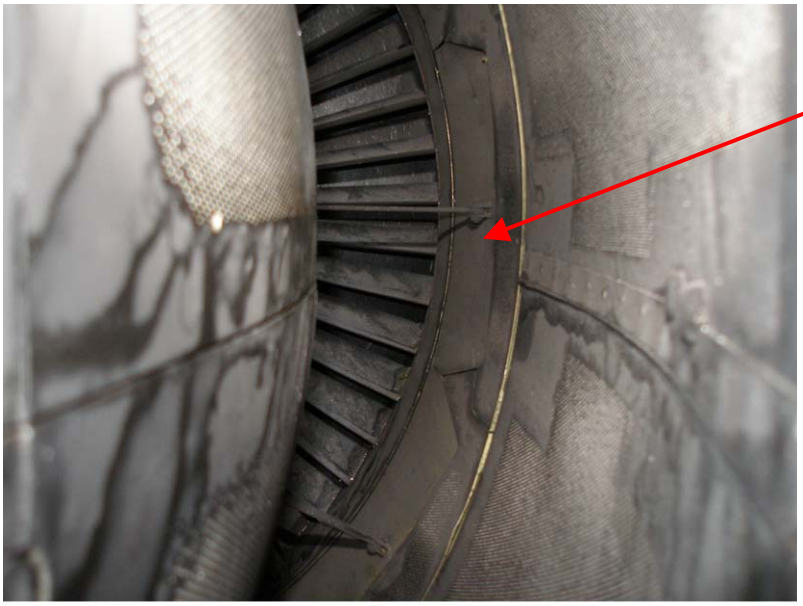

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Figure 21 – Right-hand engine - Core cowl doors and the exhaust nozzle fairing

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Figure 22 – Right-hand engine – Fan blades with ‘soft’ impact damage

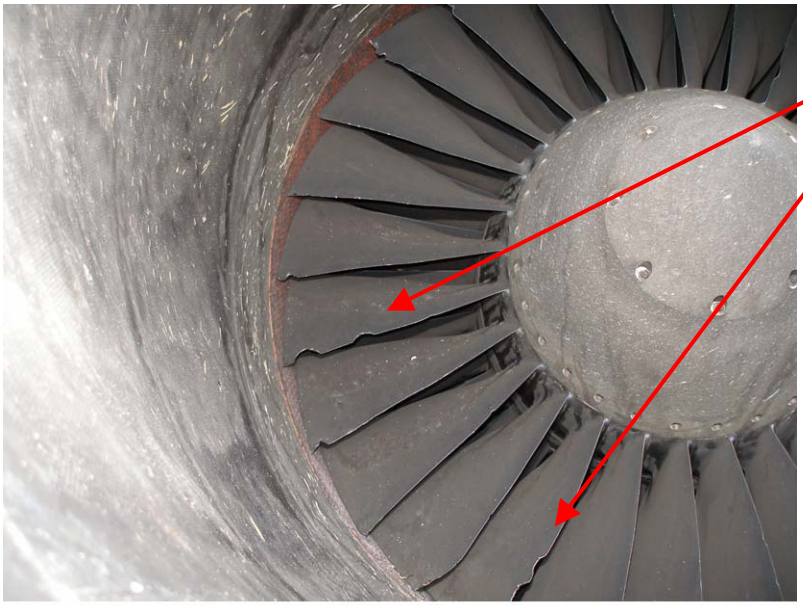

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Figure 23 – Right-hand engine – Fan blades with hard impact damage tears

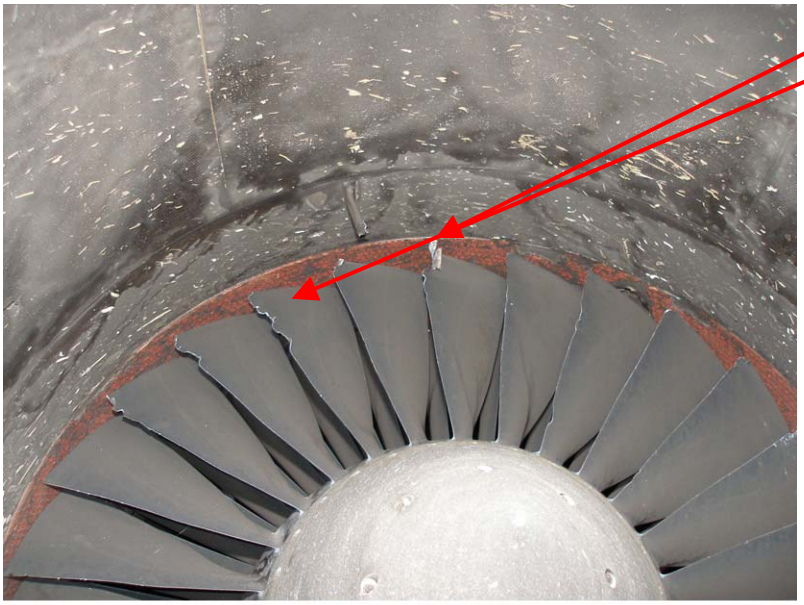

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Figure 24 – Right-hand engine – 4th Low pressure turbine (LPT) stage

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