

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division
Washington, D.C. 20594

March 9, 2021

Flight Data Recorder

Specialist's Factual Report
By Cassandra Johnson

1. EVENT SUMMARY

Location: Waynesville, North Carolina
Date: February 7, 2020
Aircraft: Bombardier CL-600-2D24
Registration: N610NN
Operator: PSA Airlines
NTSB Number: DCA20CA071

On February 7, 2020, about 0105 eastern standard time (EST), PSA Airlines flight 5634, Bombardier CL-600-2D24, N610NN, encountered turbulence during enroute descent to McGhee Tyson Airport (KTYN), Knoxville, Tennessee. There were 73 passengers and crew onboard. The airplane sustained minor damage. The regularly scheduled domestic passenger flight was operating under the provisions of Title 14 *Code of Federal Regulations* Part 121 from Charlotte Douglas International Airport (KCLT), Charlotte, North Carolina, to KTYN.

2. FLIGHT DATA RECORDER GROUP

A flight data recorder (FDR) group was not convened.

3. FDR CARRIAGE REQUIREMENTS

The event aircraft, N610NN, was manufactured in 2019, and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 88 parameters, as cited in 14 CFR Part 121.344(f). Only parameters relevant to this event are provided in this report.

4. DETAILS OF FDR INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received an electronic file containing the FDR data from the N610NN aircraft.

4.1. FDR Data File Description

The FDR data in the electronic file was configured such that 512 12-bit words of digital information were recorded every second. Each grouping of 512 words (each second) is called a subframe. Each subframe has a unique 12-bit synchronization (sync) word identifying it as subframe 1, 2, 3, or 4. The sync word is the first word in each subframe. The data stream is "in sync" when successive sync words appear at proper 512-word intervals.

Each data parameter (for example, pressure altitude, pitch angle, roll angle, and magnetic heading) has a specifically assigned word number within the subframe.

4.1.1. Recording Description

The FDR recording contained approximately 158 hours of data. Timing of the FDR data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. The event flight was the second to last flight of the recording and its duration was approximately 38 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

4.1.2. Engineering Unit Conversions

The engineering unit conversions used for the data contained in this report are based on documentation from the aircraft manufacturer. Where applicable, the conversions have been changed to ensure that the parameters conform to the NTSB's standard sign convention that climbing right turns are positive (CRT=+).¹

Table A-1 lists the FDR parameters verified and provided in this report. Additionally, table A-2 describes the unit abbreviations used in this report.

4.2. Time Correlation

Correlation of the FDR data from SRN to the event local time, EST, was established by using the recorded GMT hours, GMT minutes, and GMT seconds and then applying an additional 5 hours offset to change GMT to EST.²

Accordingly, the time offset for the event flight data from SRN to EST is the following: $EST = SRN - 554,687$. Therefore, for the rest of this report, all times are referenced as EST, not SRN.

4.3. FDR Plots and Corresponding Tabular Data

Figures 1 to 4 contain FDR data recorded during the event on February 7, 2020. All the parameters listed in table A-1 are plotted except GMT hours, GMT minutes, GMT seconds, latitude, and longitude. Figures 1 and 3 contain the basic parameters and select engine parameters. Figures 2 and 4 contain flight control parameters.

Figures 1 and 2 cover the entire flight from 00:34:00 EST to 01:15:00 EST. Figures 3 and 4 have an expanded scale from 00:55:00 EST to 00:56:30 EST focusing on the large vertical acceleration excursion.

FDR data indicated that the turbulence event occurred from approximately 00:55:38 EST (about 17 minutes before touchdown) until about 00:55:58 EST and ranging in latitude longitude position from N35°21'32" W83°00'25" to N35°22'04" W83°02'37". During the event, there were vertical acceleration variations ranging in magnitude between 3.44 g's and

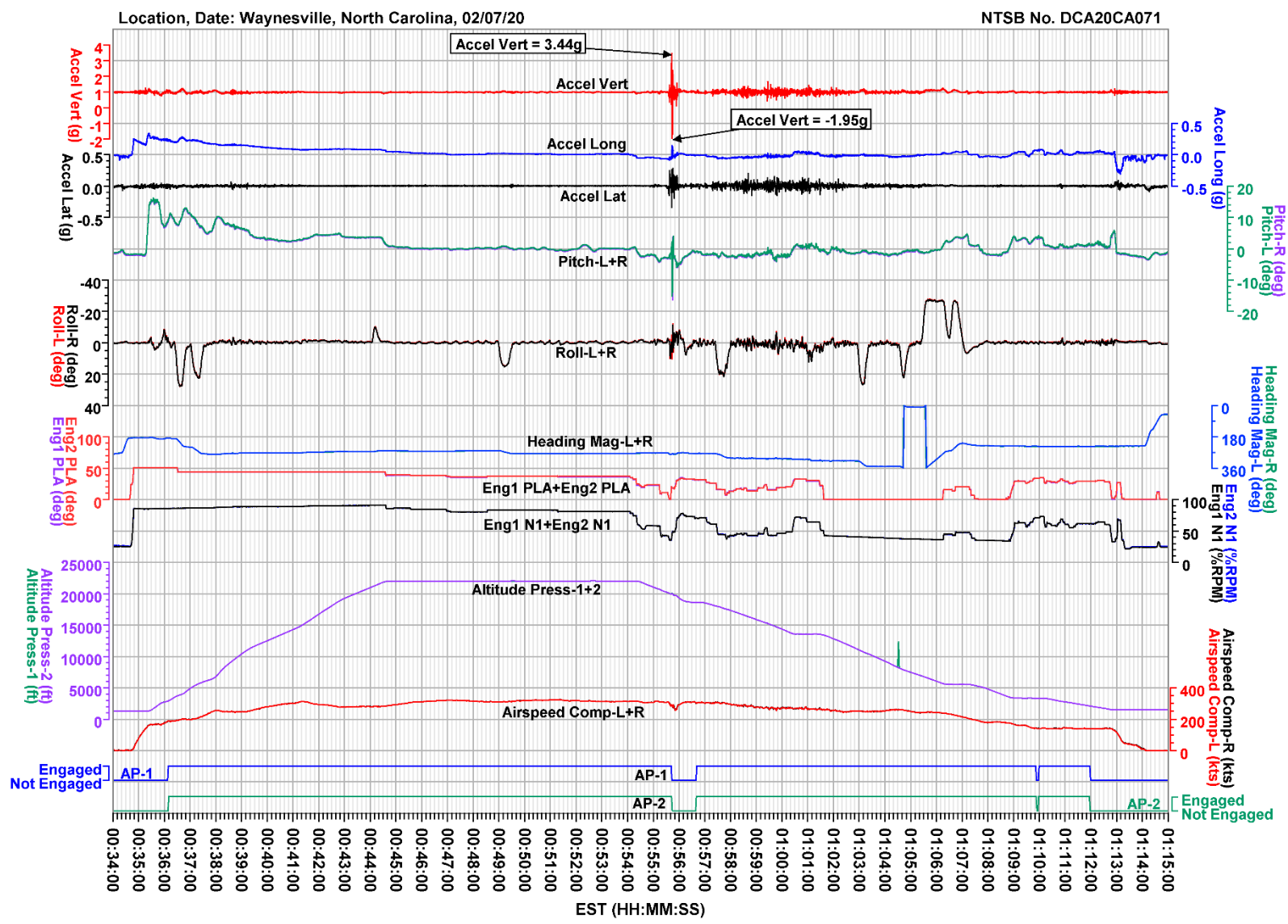
¹ CRT=+ means that for any parameter recorded that indicates a climb or a right turn, the sign for that value is positive. Also, for any parameter recorded that indicates an action or deflection, if it induces a climb or right turn, the value is positive. Examples: Right Roll = +, Pitch Up = +, Elevator Trailing Edge Up = +, Right Rudder = +.

² GMT is Greenwich Mean Time which is also known as Coordinated Universal Time (UTC).

-1.95 g's before settling to about 1 g. Additionally, the aircraft descended from a pressure altitude of about 20,049 feet (ft) to 19,454 ft.

These figures are configured such that right turns are indicated by the trace moving toward the bottom of the page, left turns towards the top of the page, and nose up attitudes towards the top of the page.

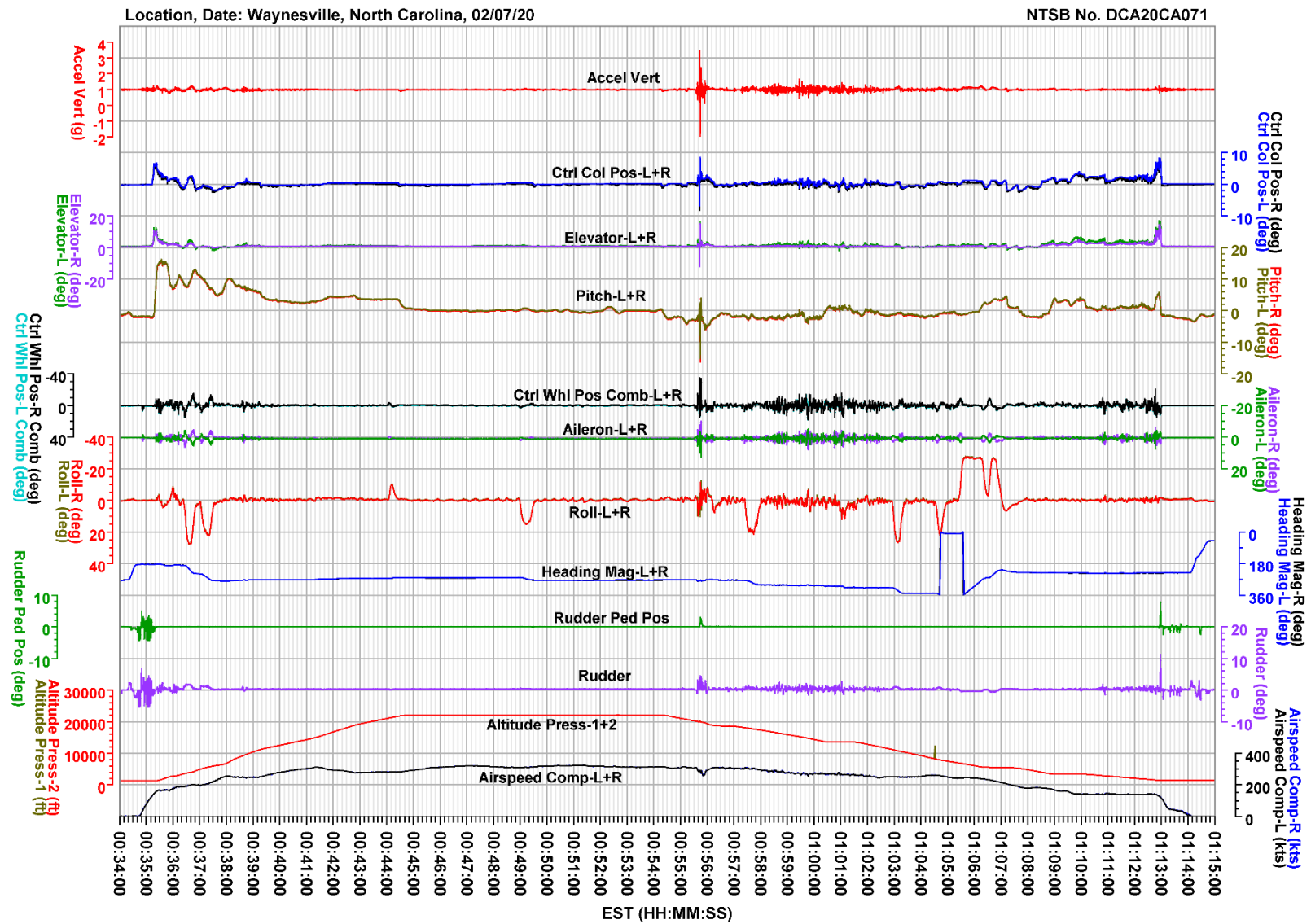
The corresponding tabular data used to create figures 1 to 4, including GMT hours, GMT minutes, GMT seconds, latitude, and longitude, are provided in electronic comma separated value (.csv) format as attachment 1 to this report.



PSA Airlines, Bombardier CL-600-2D24, N610NN

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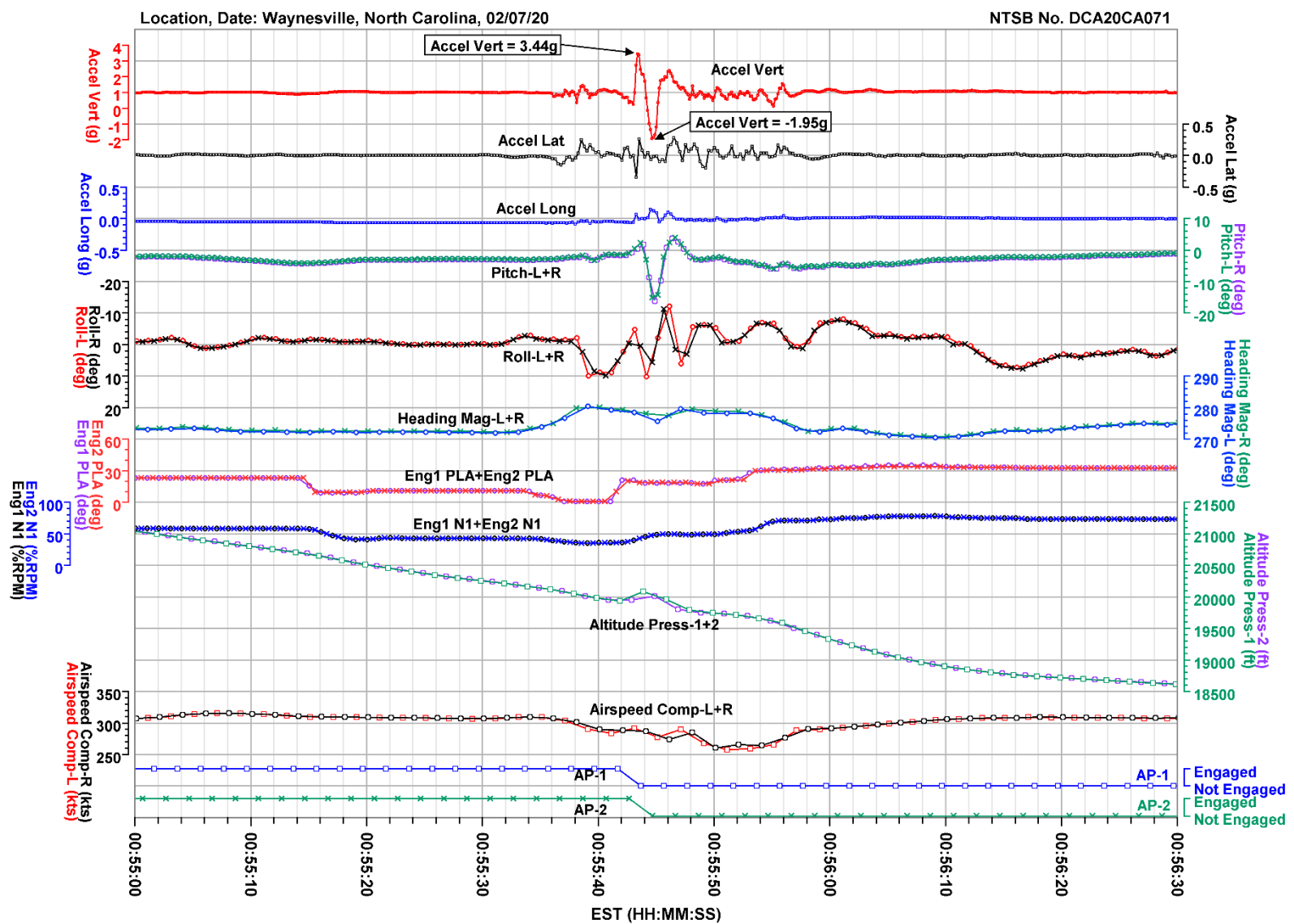
Figure 1. Plot of basic and select engine parameters during entire flight



PSA Airlines, Bombardier CL-600-2D24, N610NN

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Figure 2. Plot of flight control parameters during entire flight



PSA Airlines, Bombardier CL-600-2D24, N610NN

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Figure 3. Plot of basic and select engine parameters during vertical excursion

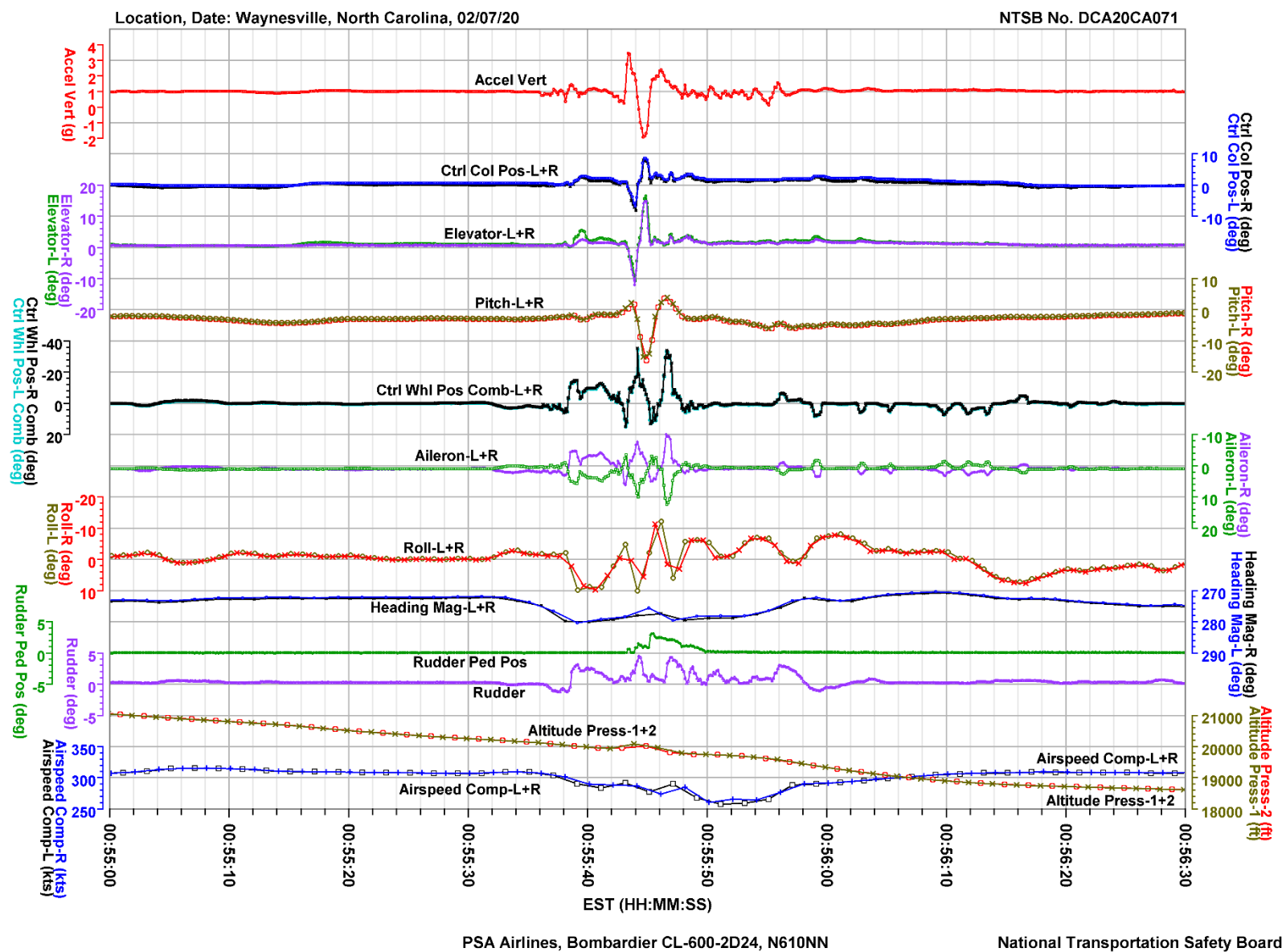


Figure 4. Plot of flight control parameters during vertical excursion

APPENDIX A

This appendix describes the parameters provided and verified in this report. Table A-1 lists the plot/table labels, parameter names, and units. Additionally, table A-2 describes the unit abbreviations used in this report.

Table A-1. Verified and provided FDR parameters.

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Acceleration	g
Accel Long	Longitudinal Acceleration	g
Accel Vert	Normal Acceleration	g
Aileron-L	Left Aileron Position	deg
Aileron-R	Right Aileron Position	deg
Airspeed Comp-L	Left Computed Airspeed	kts
Airspeed Comp-R	Right Computed Airspeed	kts
Altitude Press-1	Press Altitude-1	ft
Altitude Press-2	Press Altitude-2	ft
AP-1	Autopilot-1	
AP-2	Autopilot-2	
Ctrl Col Pos-L	Control Column Position-Pilot	deg
Ctrl Col Pos-R	Control Column Position-Copilot	deg
Ctrl Whl Pos-L Comb	Control Wheel Position- Pilot (Sources are SSCM1 and SSCM2)	deg
Ctrl Whl Pos-R Comb	Control Wheel Position- Copilot (Sources are SSCM1 and SSCM2)	deg
Elevator-L	Left Elevator Position	deg
Elevator-R	Right Elevator Position	deg
Eng1 N1	Engine 1 Fan Speed	%RPM
Eng1 PLA	Engine 1 Power Lever Angle	deg
Eng2 N1	Engine 2 Fan Speed	%RPM
Eng2 PLA	Engine 2 Power Lever Angle	deg
Heading Mag-L	Left Magnetic Heading	deg
Heading Mag-R	Right Magnetic Heading	deg
Latitude	Latitude Position	deg
Longitude	Longitude Position	deg
Pitch-L	Left Pitch Angle	deg
Pitch-R	Right Pitch Angle	deg
Roll-L	Left Roll Angle	deg
Roll-R	Right Roll Angle	deg
Rudder	Rudder Position	deg
Rudder Ped Pos	Rudder Pedal Position	deg
Time GMT Hrs	Greenwich Mean Time Hours	hrs
Time GMT Min	Greenwich Mean Time Minutes	min
Time GMT Sec	Greenwich Mean Time Seconds	sec

NOTE: This FDR records pressure altitude, which is based on a standard altimeter setting of 29.92 inches of mercury (in Hg). The pressure altitude information presented in the FDR plots and in the electronic data has not been corrected for the local altimeter setting at the time of the event.

NOTE: Parameters with a blank unit description in table A-1 are discretes. A discrete is typically a 1-bit parameter that is either a 0 state or a 1 state where each state is uniquely defined for each parameter.

NOTE: SSCM stands for Spoiler and Stabilizer Control Module

Table A-2. Unit abbreviations.

Unit Abbreviations	Descriptions
%RPM	percent revolutions per minute
deg	degrees

APPENDIX A

Unit Abbreviations	Descriptions
ft	feet
g	unit of gravitation acceleration
hrs	hours
kts	knots
min	minutes
sec	seconds