

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

September 3, 2013

Flight Data Recorder - 10

Specialist's Factual Report
By Bill Tuccio

1. EVENT SUMMARY

Location: Atlanta, Georgia
Date: July 12, 2013
Aircraft: Boeing 777-200
Registration: N863DA
Operator: Delta Airlines
NTSB Number: DCA13CA128

On July 12, 2013 at approximately 0540 eastern daylight time (EDT), a Boeing 777, N863DA, operated by Delta Air Lines as flight 7 from Dubai, United Arab Emirates (DBX) to Atlanta, Georgia (ATL) encountered turbulence during descent into ATL. During the encounter, a flight attendant was seriously injured.

2. FLIGHT DATA RECORDER GROUP

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

3. FDR Carriage Requirements

The event aircraft, N863DA, was manufactured on December 21, 1999, and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 34 parameters, as cited in Title 14 *Code of Federal Regulations* Part 121.344(d).

4. DETAILS OF FLIGHT DATA RECORDER INVESTIGATION

The Safety Board's Vehicle Recorder Division received an FDR data file from Delta Air Lines.

4.1. FDR Data File 256 wps Description

The FDR data in the electronic file was configured such that 256 12-bit words of digital information every second was recorded. Each grouping of 256 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 256-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 56 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 last flight of the recording and its duration was approximately 14 hours and 45 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with the federal FDR carriage requirements.

4.1.2. Engineering Units Conversions

The engineering units 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

Appendix A lists the FDR parameters verified and provided in this report.

4.2. Time Correlation

Correlation of the FDR data from SRN to the event local time, EDT, was established by using the recorded Time GMT² hours, Time GMT Minutes, and Time GMT Seconds and then applying an additional 4 hours offset to change GMT to EDT.

Accordingly, the time offset for the event flight data from SRN to local EDT is the following: EDT = SRN - 180007. Therefore, for the rest of this report, all times are referenced as EDT, not SRN.

4.3. FDR Plots and Corresponding Tabular Data

The following three figures contain FDR data recorded during the July 12, 2013 event. The pressure altitude data exhibits "spikes" during climbs and descents. These spikes are an artifact of the numerical method used to record the parameters and do not represent actual altitude fluctuations.

Figure 1 shows a plot of the entire flight. The aircraft departed at about 1515 EDT and landed 14 hours and 45 minutes later, at about 0600 EDT.

Figure 2 shows a plot of the descent into ATL. The presumed turbulence encounter occurred between 0544:03 EDT and 0544:27 EDT.

Figure 3 focuses on the period surrounding 0544 EDT. In the 10-second period starting at 0544:10 EDT, as the aircraft was descending through 13,200 feet pressure altitude, the vertical acceleration fluctuated between a maximum of +1.56 g and a minimum of +0.24 g. During this period, the airspeed momentarily increased from 309 knots to 316 knots, the lateral acceleration fluctuated between +0.12 g and -0.19 g, and the roll fluctuated between 4 degrees left and 5 degrees right.

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).

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 these three plots are provided in electronic (*.csv³) format as Attachment 1 to this report.

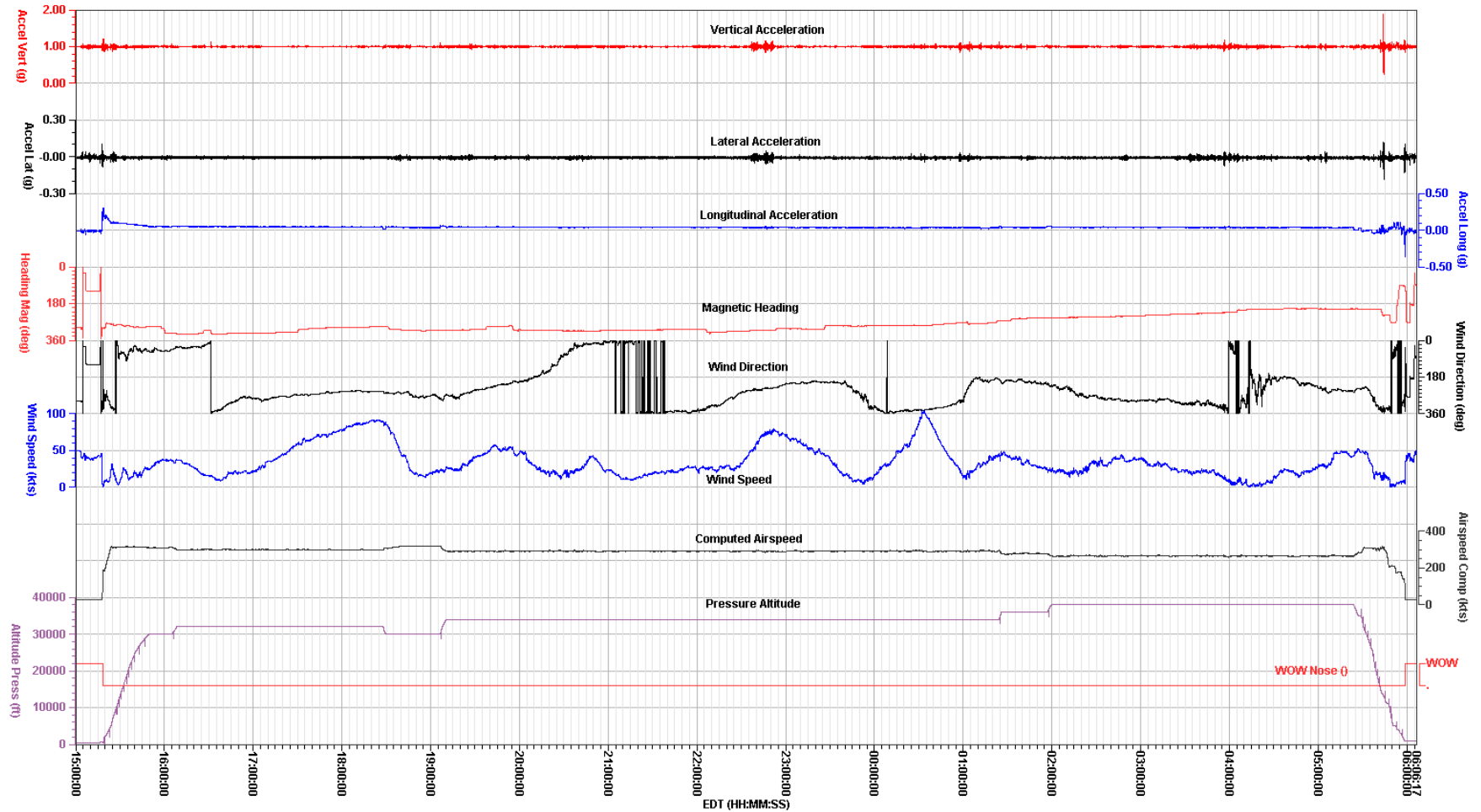
³ Comma Separated Value format.

Figure 1. Plot of basic parameters during entire flight.

Delta, Boeing 777-232, Flight 7, N863DA

Location, Date: Atlanta, Georgia, 07/12/13

NTSB No. DCA13CA128

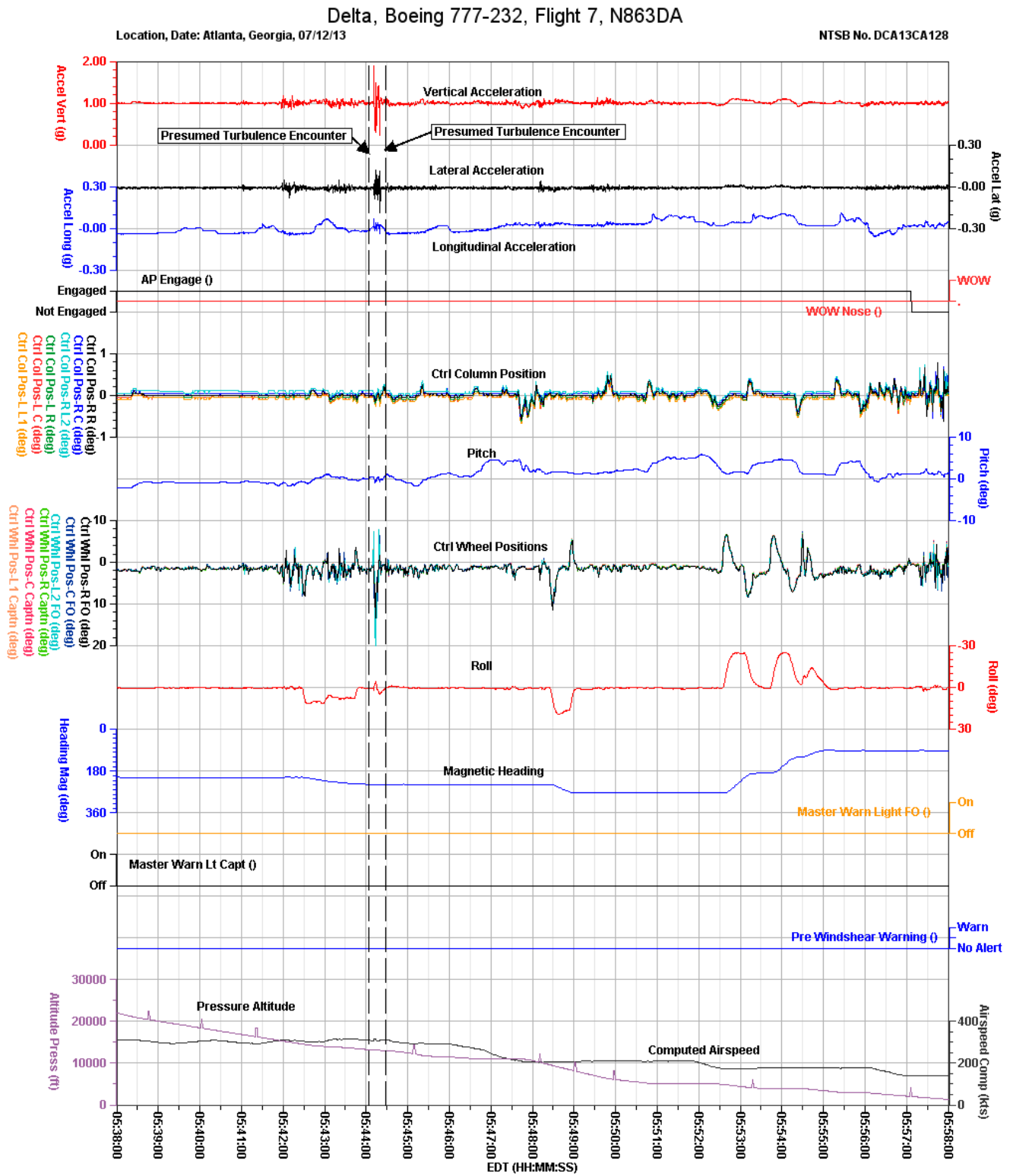


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Entire Event Flight

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Figure 2. Plot of flight controls and basic parameters during descent.

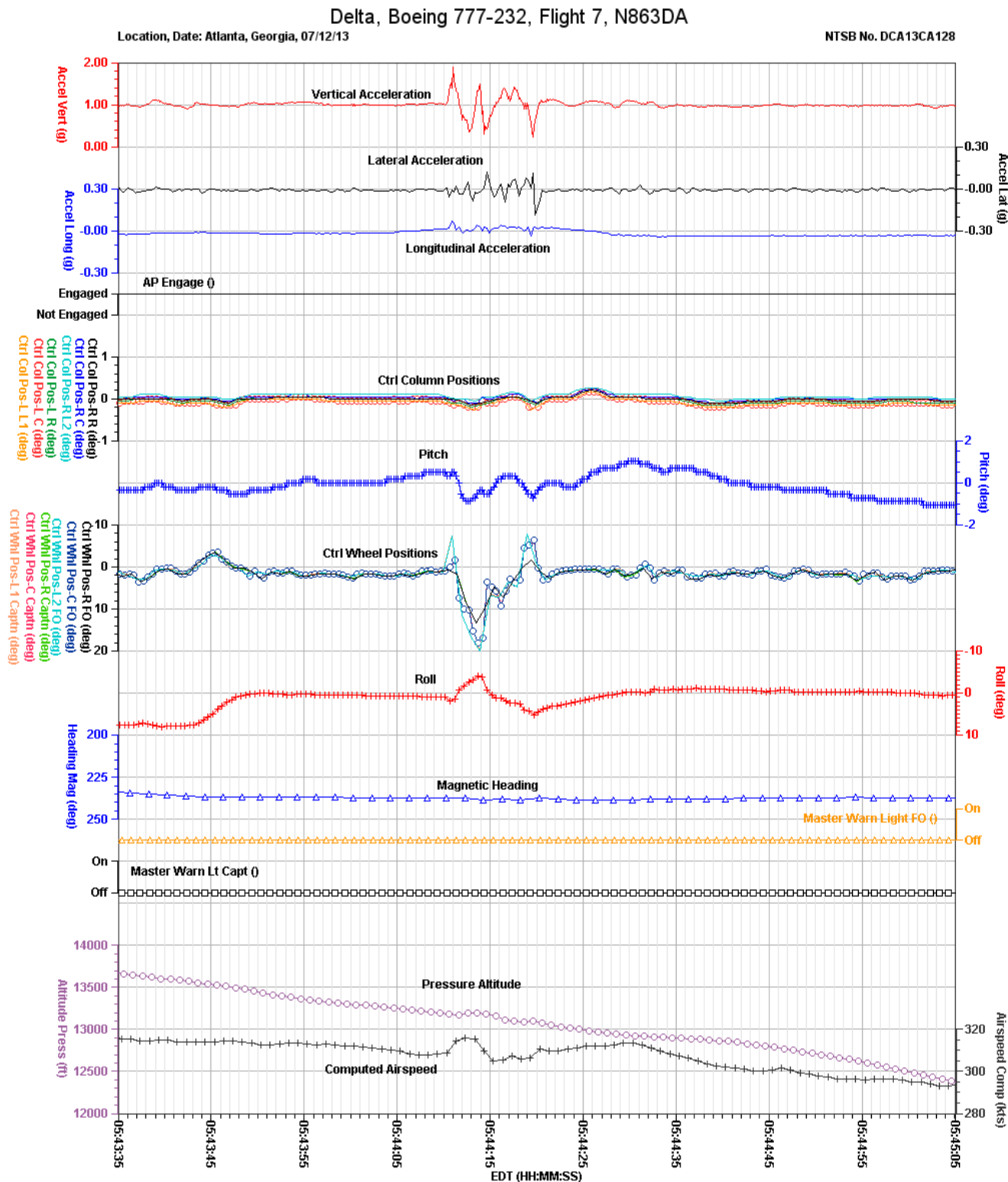


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Figure 3. Plot of flight controls and basic parameters during presumed turbulence encounter.



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APPENDIX A

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

Table A-1. Verified and provided FDR parameters.

Parameter Name	Parameter Description
1. Accel Lat (g)	Lateral Acceleration
2. Accel Long (g)	Longitudinal Acceleration
3. Accel Vert (g)	Vertical Acceleration
4. Airspeed Comp (kts)	Computed Airspeed
5. Altitude Press (ft)	Pressure Altitude
6. AP Engage (discrete)	Autopilot Engaged
7. Ctrl Col Pos-L C (deg)	Left Control Column Position L C
8. Ctrl Col Pos-L L1 (deg)	Left Control Column Position L L1
9. Ctrl Col Pos-L R (deg)	Left Control Column Position L R
10. Ctrl Col Pos-R C (deg)	Right Control Column Position R C
11. Ctrl Col Pos-R L2 (deg)	Right Control Column Position R L2
12. Ctrl Col Pos-R R (deg)	Right Control Column Position R R
13. Ctrl Whl Pos-L1 Captn (deg)	Left Control Wheel Position L1
14. Ctrl Whl Pos-L2 FO (deg)	Right Control Wheel Position L2
15. Ctrl Whl Pos-R Captn (deg)	Left Control Wheel Position R
16. Ctrl Whl Pos-R FO (deg)	Right Control Wheel Position R
17. Heading Mag (deg)	Magnetic Heading
18. Master Warning Lt Capt (discrete)	Captain Master Warning Light
19. Pitch (deg)	Pitch Angle
20. Pre Windshear Warning (discrete)	Pre Windshear Warning
21. Roll (deg)	Roll Angle
22. Time GMT Hrs (hrs)	GMT Hours
23. Time GMT Min (min)	GMT Minutes
24. Time GMT Sec (sec)	GMT Seconds
25. Wind Direction (deg)	Wind Direction
26. Wind Speed (kts)	Wind Speed
27. WOW Nose (discrete)	Nose Gear Weight On Wheel

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.

Table A-2. Unit abbreviations.

Units Abbreviation	Description
deg	degrees
kts	knots
g	g
discrete	discrete
ft	feet
hrs	hours

Units Abbreviation	Description
min	minutes
sec	seconds

NOTE: For parameters with a unit description of discrete, 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.