

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

September 23, 2020

Flight Data Recorder

Specialist's Factual Report
By Michael Portman

1. EVENT SUMMARY

Location: Disputanta, VA
Date: December 18, 2019
Aircraft: Embraer EMB-190
Registration: N959UW
Operator: American Airlines
NTSB Number: DCA20CA043

On December 18, 2019, at about 1109 eastern standard time (EST), an American Airlines Embraer EMB-190, N959UW, operating flight 2247, from LaGuardia Airport, New York (LGA) to Raleigh-Durham International Airport, North Carolina (RDU), encountered turbulence and the #1 flight attendant (FA) received a serious injury. Upon arrival in RDU, the #1 FA was transported to a local hospital for treatment of her injury. There were 2 flight crew, 2 flight attendants and 44 passengers on the Title 14 *Code of Federal Regulations* (CFR) part 121 domestic passenger flight.

2. FLIGHT DATA RECORDER GROUP

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

3. FDR CARRIAGE REQUIREMENTS

The event aircraft, N959UW, was manufactured in 2008, 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).

4. DETAILS OF FDR INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following FDRs:

Recorder Manufacturer/Model: **Honeywell 6025 DVDR**
Recorder Serial Number: **DVDR-01113**

Recorder Manufacturer/Model: **Honeywell 6025 DVDR**
Recorder Serial Number: **DVDR-02070**

4.1. Honeywell DVDR Description

The Honeywell Digital Voice-Data Recorder (DVDR) is a dual function recorder providing both FDR and cockpit voice recorder (CVR) functions. The FDR function records airplane flight information in a digital format using solid-state flash memory as the recording medium. The FDR can receive data in the ARINC 573/717/747 configurations and can record a minimum of 25 hours of flight data. It is configured to record 256 12-bit words of digital information every second. 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 (e.g. altitude, heading, airspeed) has a specifically assigned word number within the subframe. The DVDR is designed to meet the crash-survivability requirements of TSO-C123a and TSO-C124a.

4.1.1. Recorder Condition

The recorder was in good condition and the data were extracted normally from the recorder.

4.1.2. Recording Description

The FDR recording contained approximately 27 hours and 15 minutes 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 fourth to last flight of the recording and its duration was approximately one hour and 20 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

4.1.3. 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 Time GMT hours, Time GMT Minutes, and Time GMT Seconds and then applying an additional five hours offset to change GMT to EST.²

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 = +. However, due to the antithetical movement of the ailerons, a right roll is denoted by Right Aileron Up = +, Left Aileron Down = -.

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

Accordingly, the time offset for the event flight data from SRN to local EST is the following: $EST = SRN - 37,687$. 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 December 18, 2019. All the parameters listed in table A-1 are plotted except Latitude, Longitude, Time GMT Hours, Time GMT Minutes, and Time GMT Seconds.

Figure 1 shows an overview of basic parameters for the entire flight.

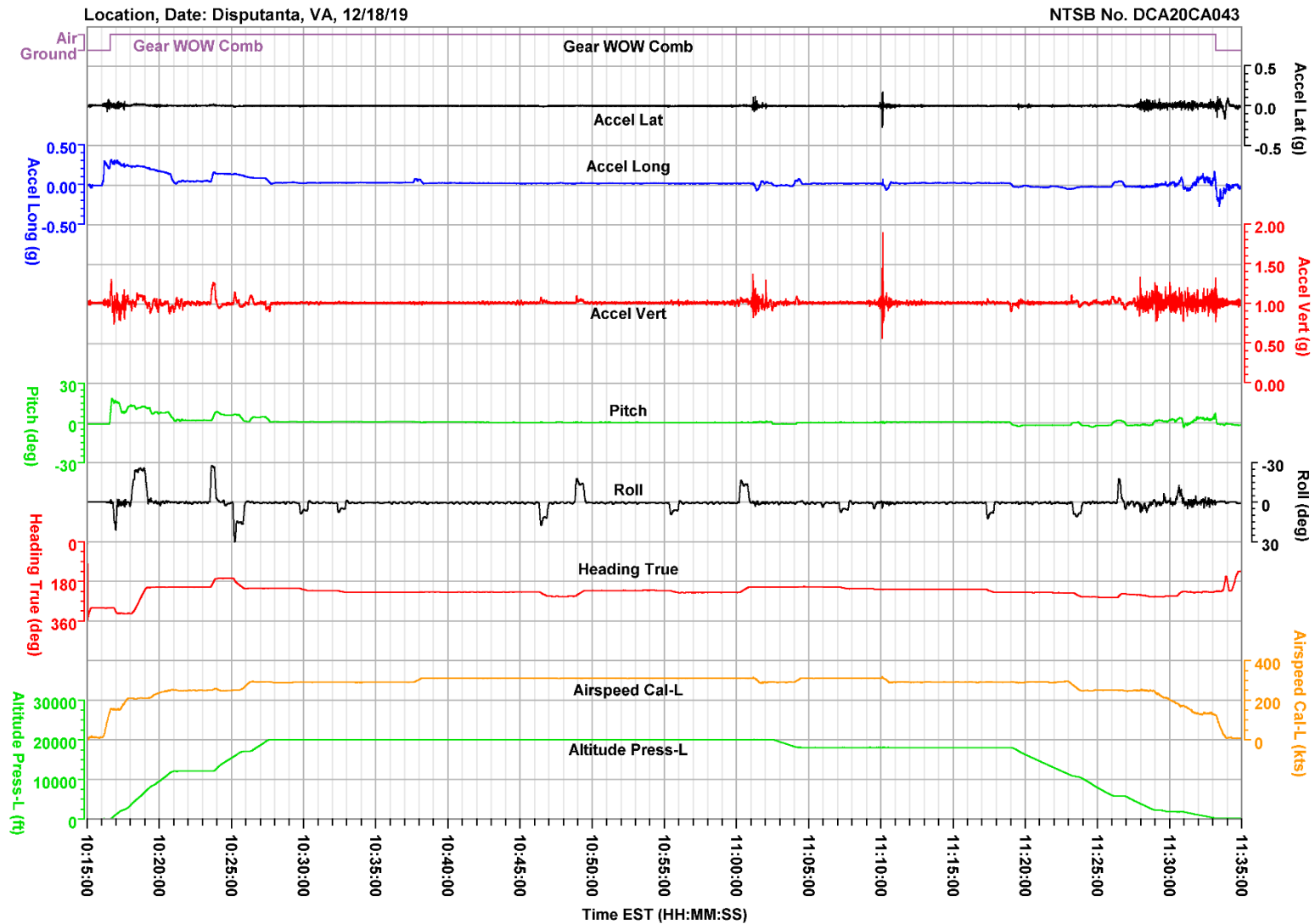
Figure 2 shows select engine, autopilot, and control related parameters for the entire flight.

Figure 3 shows basic parameters during the turbulence event.

Figure 4 shows select engine, autopilot, and control related parameters during the turbulence event.

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.

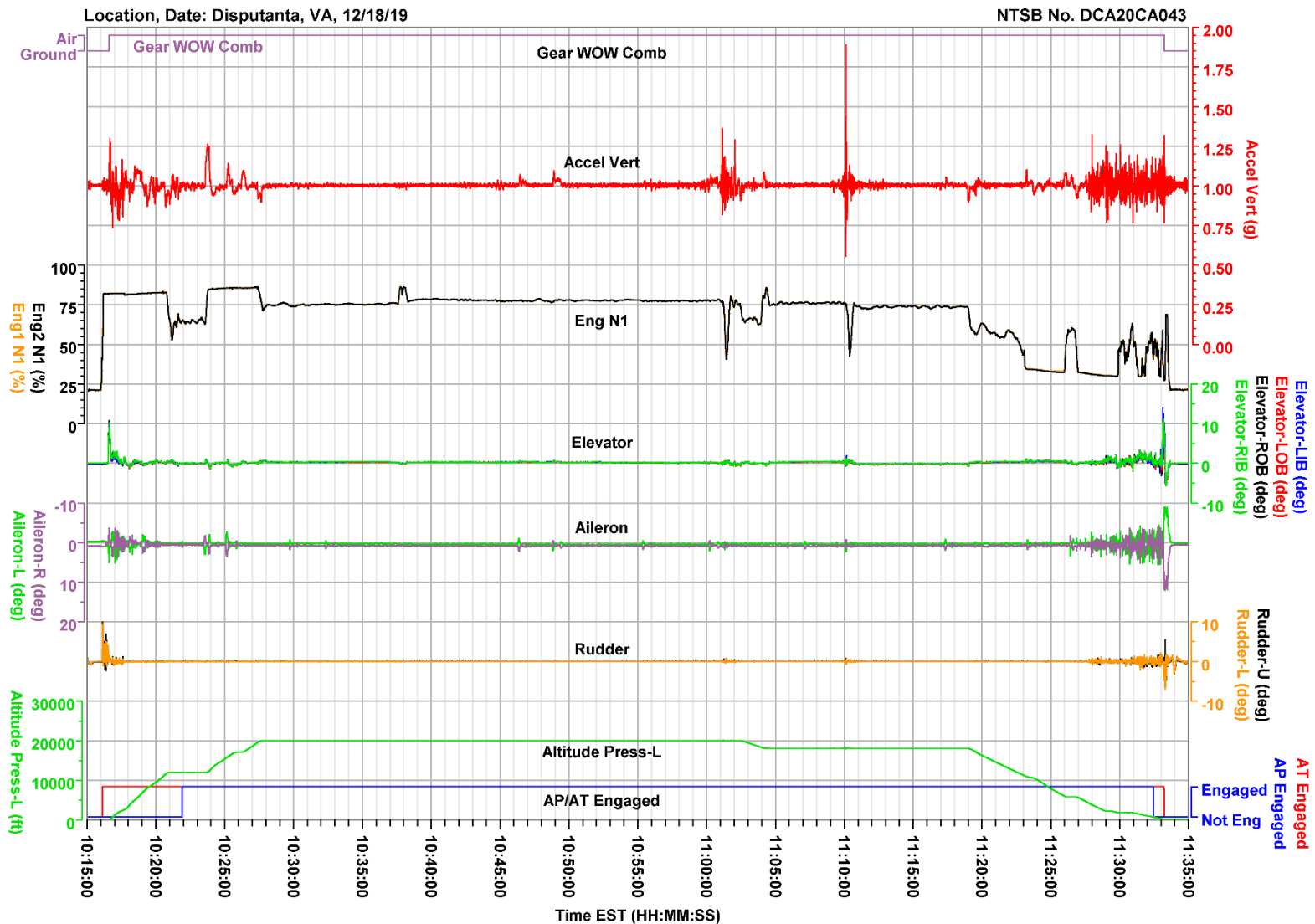
The corresponding tabular data used to create figures 1 to 4, including Latitude, Longitude, Time GMT Hours, Time GMT Minutes, and Time GMT Seconds, are provided in electronic comma separated value (*.csv) format as attachment 1 to this report.



American Airlines, Embraer EMB-190, 2247, N959UW

National Transportation Safety Board

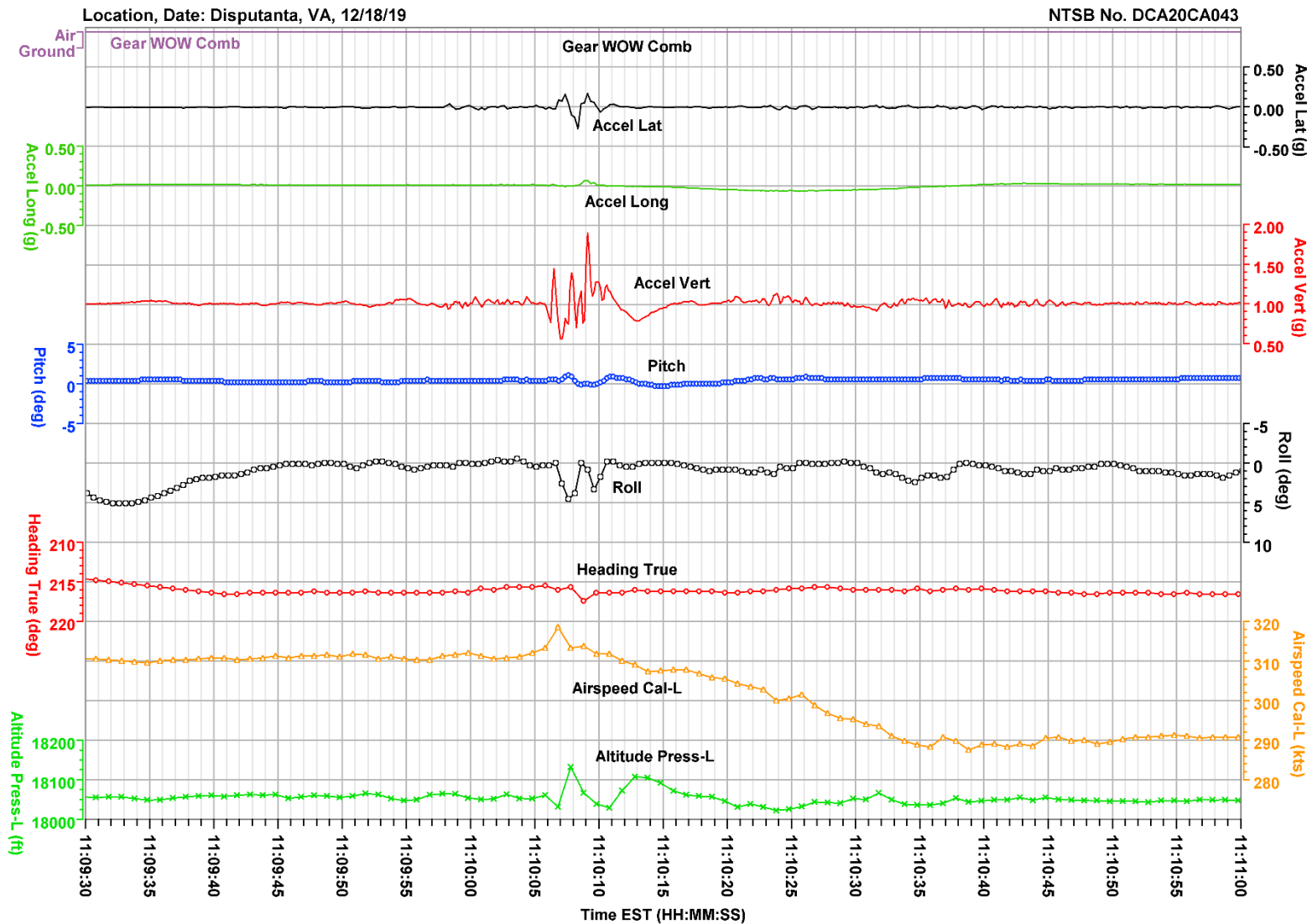
Figure 1. Overview of basic parameters for the entire flight.



American Airlines, Embraer EMB-190, 2247, N959UW

National Transportation Safety Board

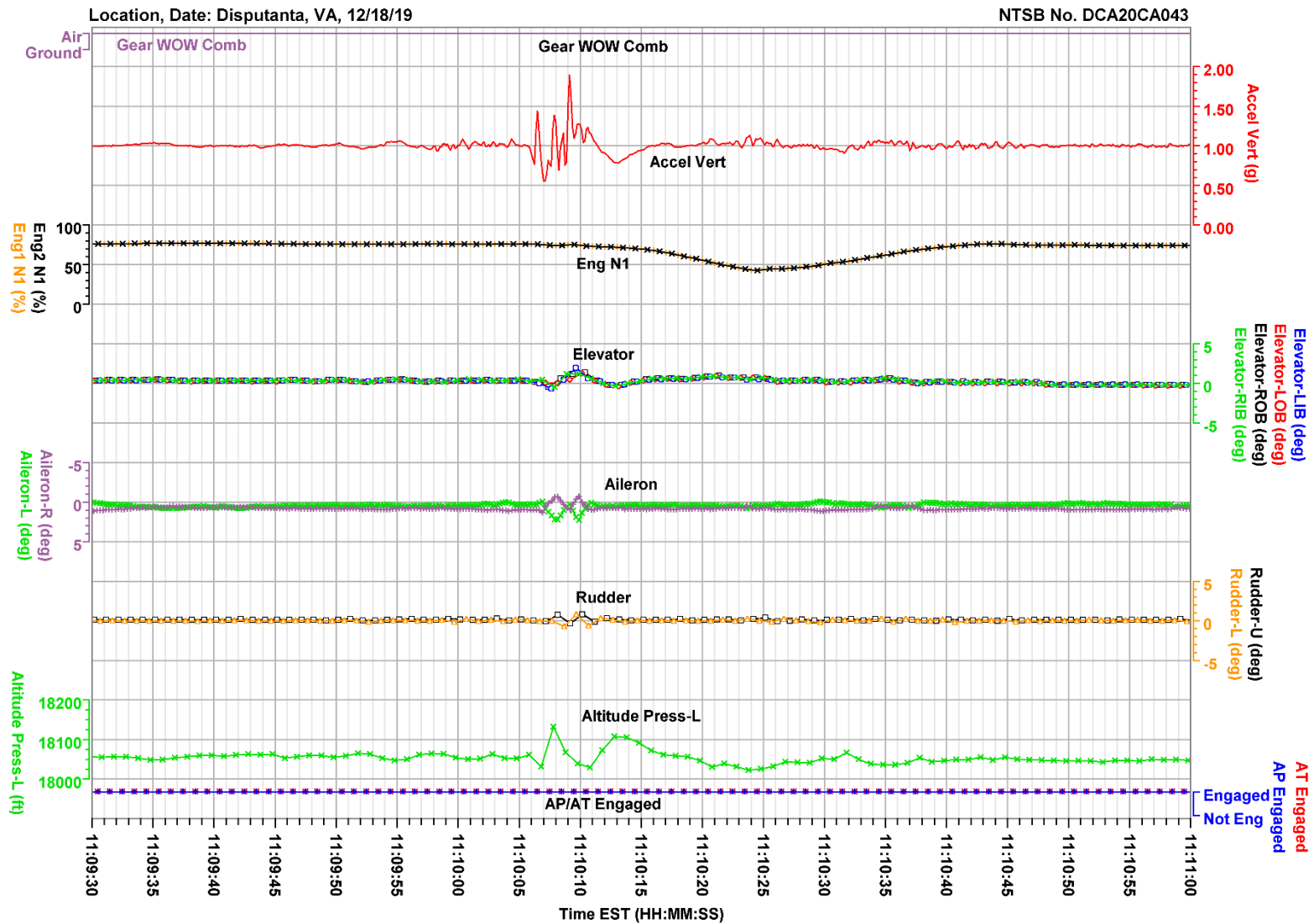
Figure 2. Select engine, autopilot, and control related parameters for the entire flight.



American Airlines, Embraer EMB-190, 2247, N959UW

National Transportation Safety Board

Figure 3. Detail view of basic parameters during the turbulence event.



American Airlines, Embraer EMB-190, 2247, N959UW

National Transportation Safety Board

Figure 4. Detail view of select engine, autopilot, and control related parameters during the turbulence event.

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	Vertical Acceleration	g
Aileron-L	Left Aileron Position	deg
Aileron-R	Right Aileron Position	deg
Airspeed Cal-L	Calibrated Airspeed	kts
Altitude Press-L	Pressure Altitude	ft
AP Engaged	Autopilot Status	
AT Engaged	Autothrottle Status	
Elevator-LIB	Left Inboard Elevator Position	deg
Elevator-LOB	Left Outboard Elevator Position	deg
Elevator-RIB	Right Inboard Elevator Position	deg
Elevator-ROB	Right Outboard Elevator Position	deg
Eng1 N1	Engine 1 N1 Speed	%
Eng2 N1	Engine 2 N1 Speed	%
Gear WOW Comb	Landing Gear Weight On Wheels	
Heading True	True Heading	deg
Latitude FMS	Latitude Position	deg
Longitude FMS	Longitude Position	deg
Pitch	Pitch Angle	deg
Roll	Roll Angle	deg
Rudder-L	Lower Rudder Position	deg
Rudder-U	Upper Rudder 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.

Table A-2. Unit abbreviations.

Unit Abbreviations	Descriptions
deg	degrees
kts	knots
g	acceleration (g's)
ft	feet
hrs	hours
min	minutes
sec	seconds