

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

May 14, 2020

## **Flight Data Recorder**

**Specialist's Factual Report**  
**By Cassandra Johnson, assisted by Abigail McNally**

### **1. EVENT SUMMARY**

Location: St. Louis, Missouri  
Date: February 23, 2016  
Aircraft: Embraer EMB-145  
Registration: N856HK  
Operator: Trans States Airlines  
NTSB Number: DCA16LA100

On February 23, 2016, about 2323 central standard time (CST), Trans States Airlines flight 4615, an Embraer EMB-145, N856HK, encountered strong gusting crosswinds during its approach into Lambert-St. Louis International Airport (STL), St. Louis, Missouri, and struck both wingtips on the runway before performing a go-around. The flight crew made an uneventful landing on the second approach. The airplane was substantially damaged and there were no injuries to the 33 passengers and crew members onboard. The flight was operating under the provisions of Title 14 *Code of Federal Regulations (CFR)* Part 121 as a scheduled domestic passenger flight from Chicago O'Hare International Airport (ORD), Chicago, Illinois, to STL.

### **2. FLIGHT DATA RECORDER GROUP**

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

### **3. FDR Carriage Requirements**

The event aircraft, N856HK, was manufactured in 2001, and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 57 parameters, as cited in 14 CFR Part 121.344(e).

### **4. DETAILS OF FDR INVESTIGATION**

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

Recorder Manufacturer/Model: **Honeywell 4700**  
Recorder Serial Number: **07077**

#### **4.1. Honeywell 4700 Description**

The Honeywell solid state flight data recorder (SSFDR) records airplane flight information in a digital format using solid-state flash memory as the recording medium. The SSFDR 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 128 12-bit words of digital information every second. Each grouping of 128 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 128-word intervals. Each data parameter (for example, altitude, heading, and airspeed) has a specifically assigned word number within the subframe. The SSFDR is designed to meet the crash-survivability requirements of 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 55 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 56 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements, except elevator-2 and aileron-2. The Federal Aviation Administration was informed of these parameter deficiencies.<sup>1</sup>

#### **4.1.3. Engineering Units 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=+).<sup>2</sup>

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

#### **4.1.4. Parameters Recorded Invalid Data**

Throughout the entire event and FDR recording, elevator-2 recorded invalid data. Additionally, aileron-2 periodically recorded invalid data throughout the event and entire FDR recording.

### **4.2. Time Correlation**

Correlation of the FDR data from SRN to the event local time, CST, was established by using the recorded Time GMT hours, Time GMT Minutes, and Time GMT Seconds and then

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<sup>1</sup> Trans States Airlines ceased operations April 1, 2020.

<sup>2</sup> 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 = +.

applying an additional 6 hours offset to change GMT to CST.<sup>3</sup>

Accordingly, the time offset for the event flight data from SRN to local CST is the following: CST = SRN – 110,603. Therefore, for the rest of this report, all times are referenced as CST not SRN.

### 4.3. FDR Plots and Corresponding Tabular Data

Figures 1 to 5 contain FDR data recorded during the event on February 23, 2016. All the parameters listed in table A-1 are plotted except Stick Pusher, Stick Shaker, Time GMT Hours, Time GMT Minutes, and Time GMT Seconds. Stick Pusher and Stick Shaker remained off for the entire flight.

Figures 1, 2, and 4 contain basic parameters, as well as autopilot status, master caution, master warning, gear weight on wheels, and landing gear down and locked. Additionally, figures 2 and 4 contain radio altitude.

Figures 3 and 5 contain select flight control parameters, select basic parameters, select engine parameters, radio altitude, master warning, gear weight on wheels, and landing gear down and locked.

Figure 1 covers the entire flight from 22:30:00 CST to the end of the event flight data at 23:34:24 CST (the x-axis of the plot ends at 23:35:00 CST).

Figures 2 and 3 cover the descent starting at a pressure altitude of about 20,000 feet (ft) at 23:06:00 CST and end at 23:32:00 CST, about 1 minute and 28 seconds after final touchdown.<sup>4</sup>

Figures 4 and 5 focus on the missed approach from 23:22:15 CST to 23:23:30 CST.

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 FDR data indicated at 23:15:33 CST (about 41 minutes after takeoff) while descending through a pressure altitude of approximately 10,500 ft, the autopilot status transitioned from engaged to not engaged and remained not engaged for the remainder of the flight. At 23:19:39 CST while descending through a pressure altitude of approximately 3,387 ft, radio altitude decreased from its maximum value of 2,550 ft to 2,532 ft and continued to decrease.<sup>5</sup> At 23:22:52 CST while at a radio altitude of 4 ft, the gear weight on wheels changed from air to ground then switched back to air less than a second later while the master warning changed from off to on. Eleven seconds later at 23:23:03 CST, the master warning changed to off, 3 seconds later back to on, and then 4 seconds later at 23:23:10 CST back to off and remained off for the remainder of the flight. At this time, radio altitude had increased to 210 ft and at 23:24:16 CST had increased to approximately 2,400 ft. At 23:27:13 CST, the aircraft

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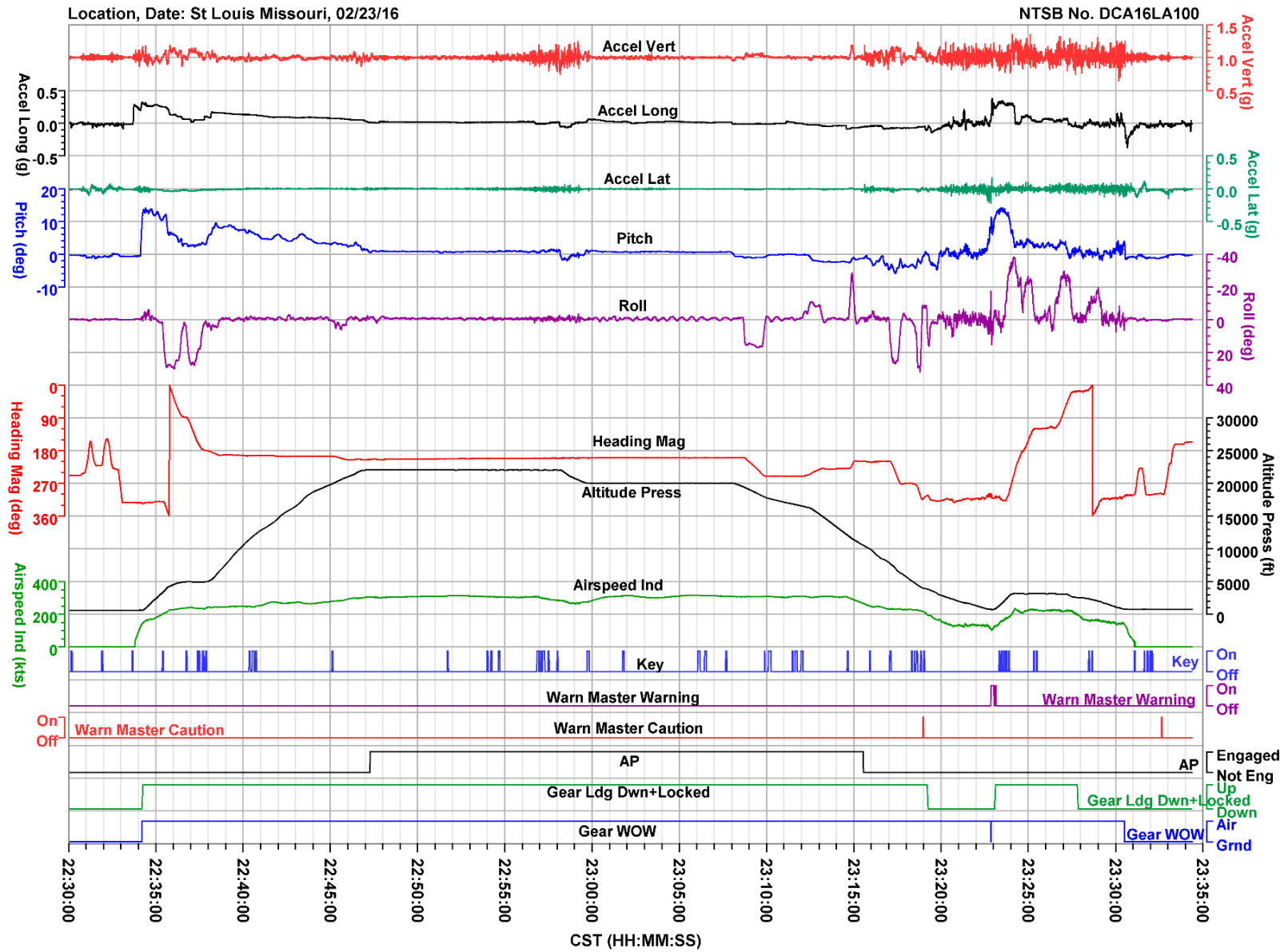
<sup>3</sup> GMT is Greenwich Mean Time which is also known as Coordinated Universal Time (UTC).

<sup>4</sup> This FDR records pressure altitude which is based on a standard altimeter setting of 29.92 inches of mercury (in Hg).

<sup>5</sup> Radio altitude is only valid below 2,550 ft.

began its final descent and at 23:30:32 CST the gear weight on wheels transitioned to ground.

The tabular data from 22:30:00 CST to 23:34:24 CST for all the parameters listed in table A-1 are provided in electronic comma separated value (.csv) format as attachment 1 to this factual report.



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Figure 1. Plot of basic parameters during entire flight.

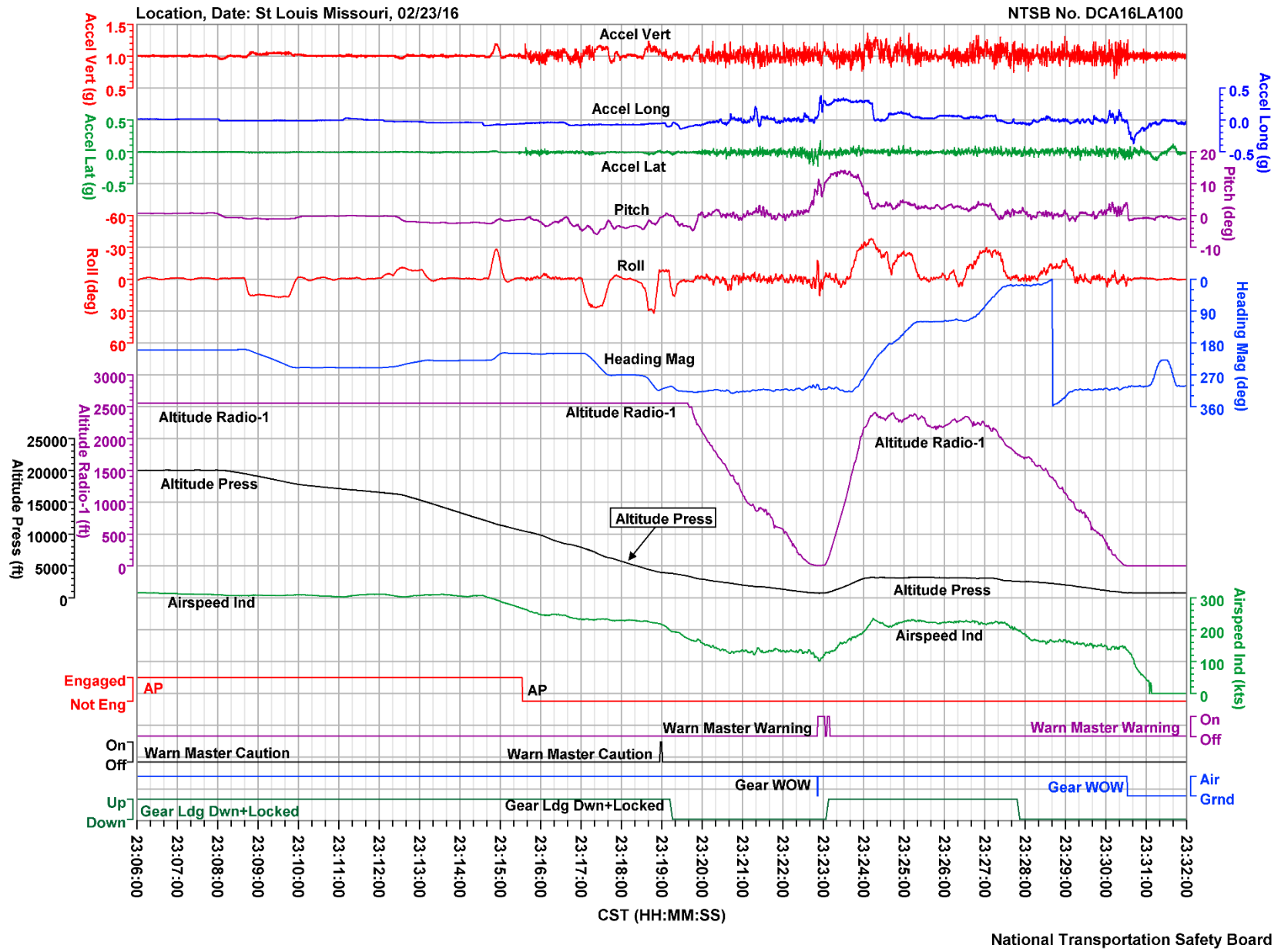
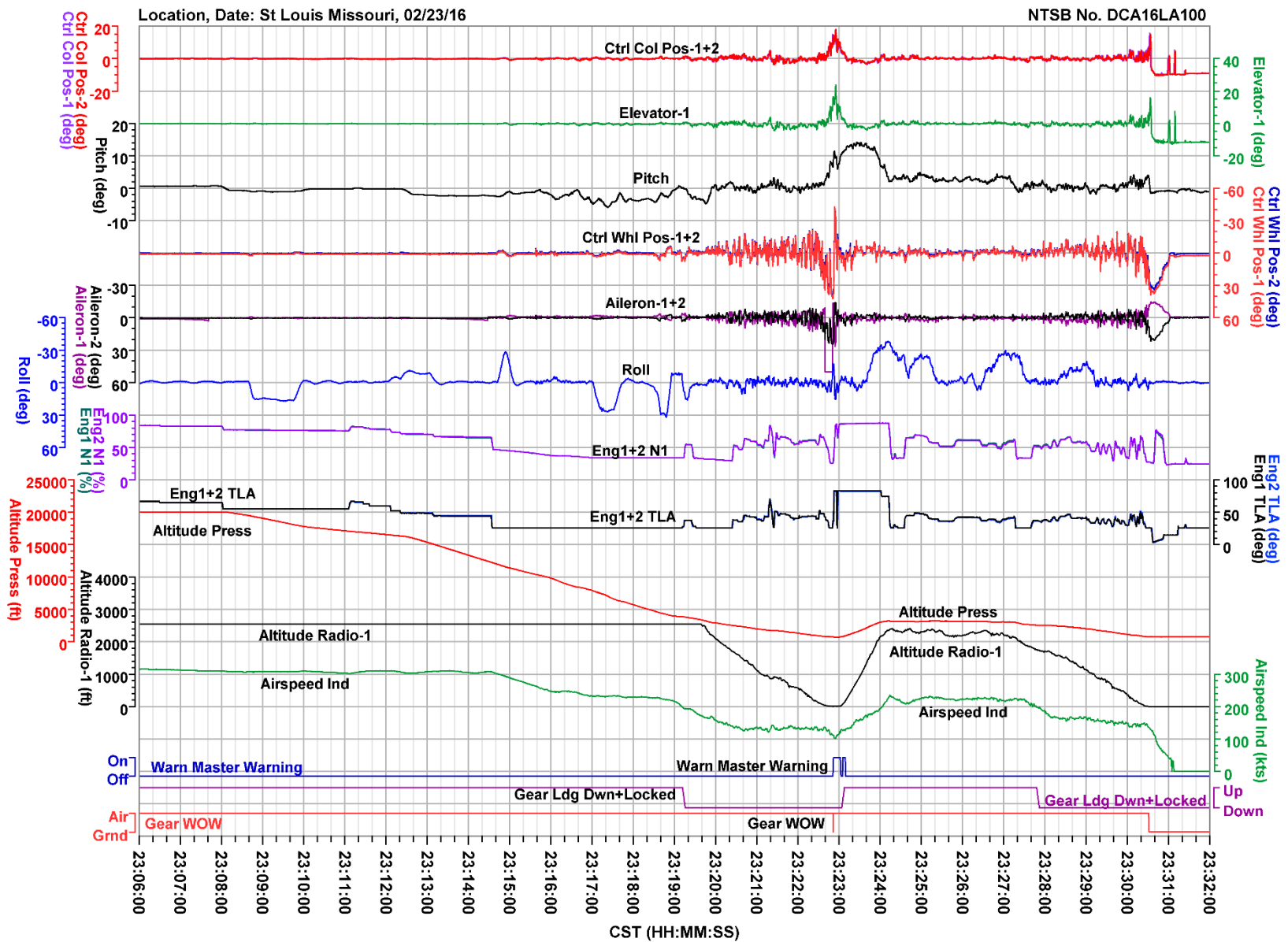


Figure 2. Plot of basic parameters covering descent from 20,000 ft to about 1 minute and 28 seconds after final touchdown.



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Figure 3. Plot of flight control parameters covering descent from 20,000 ft to about 1 minute and 28 seconds after final touchdown.

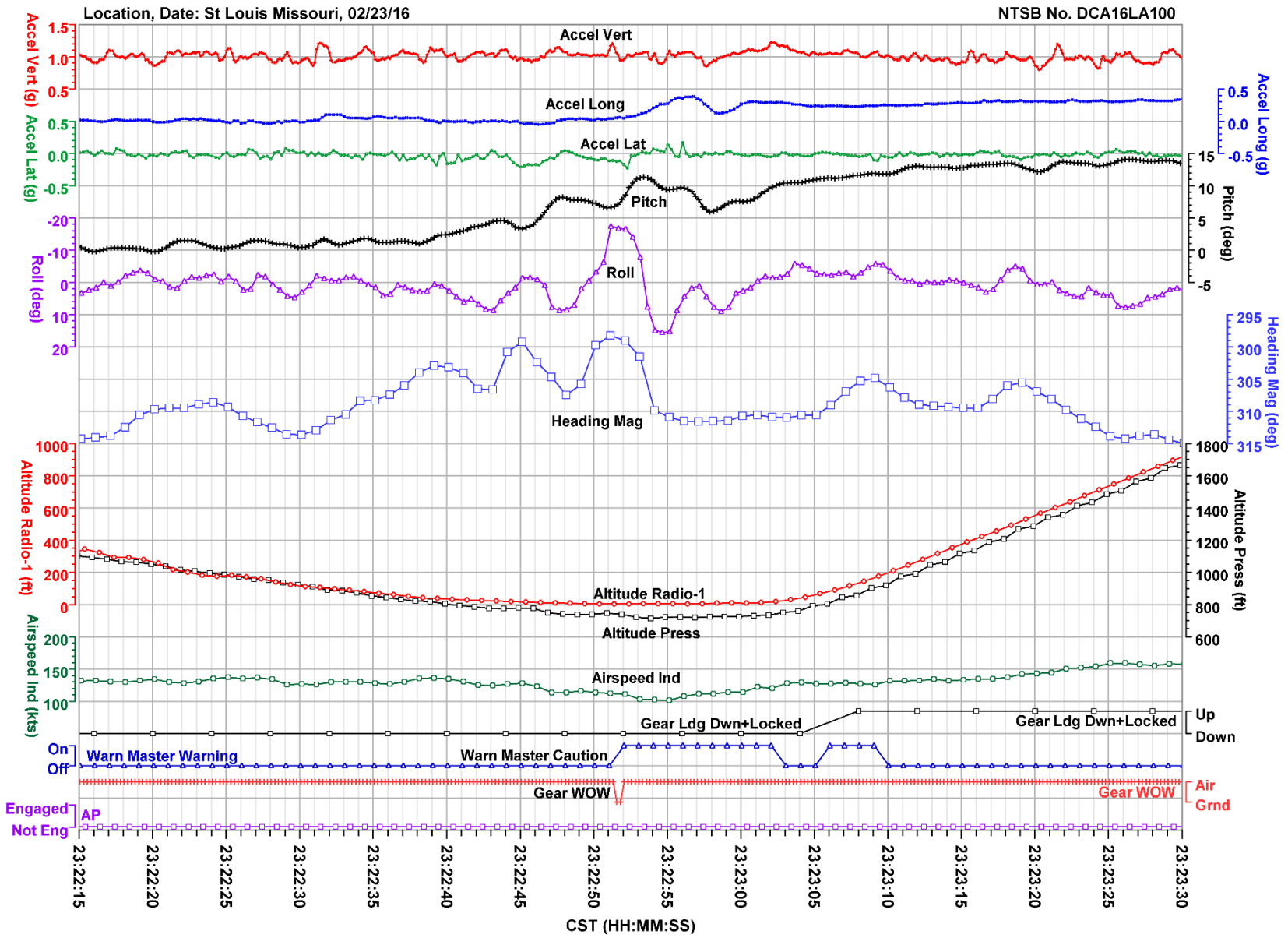
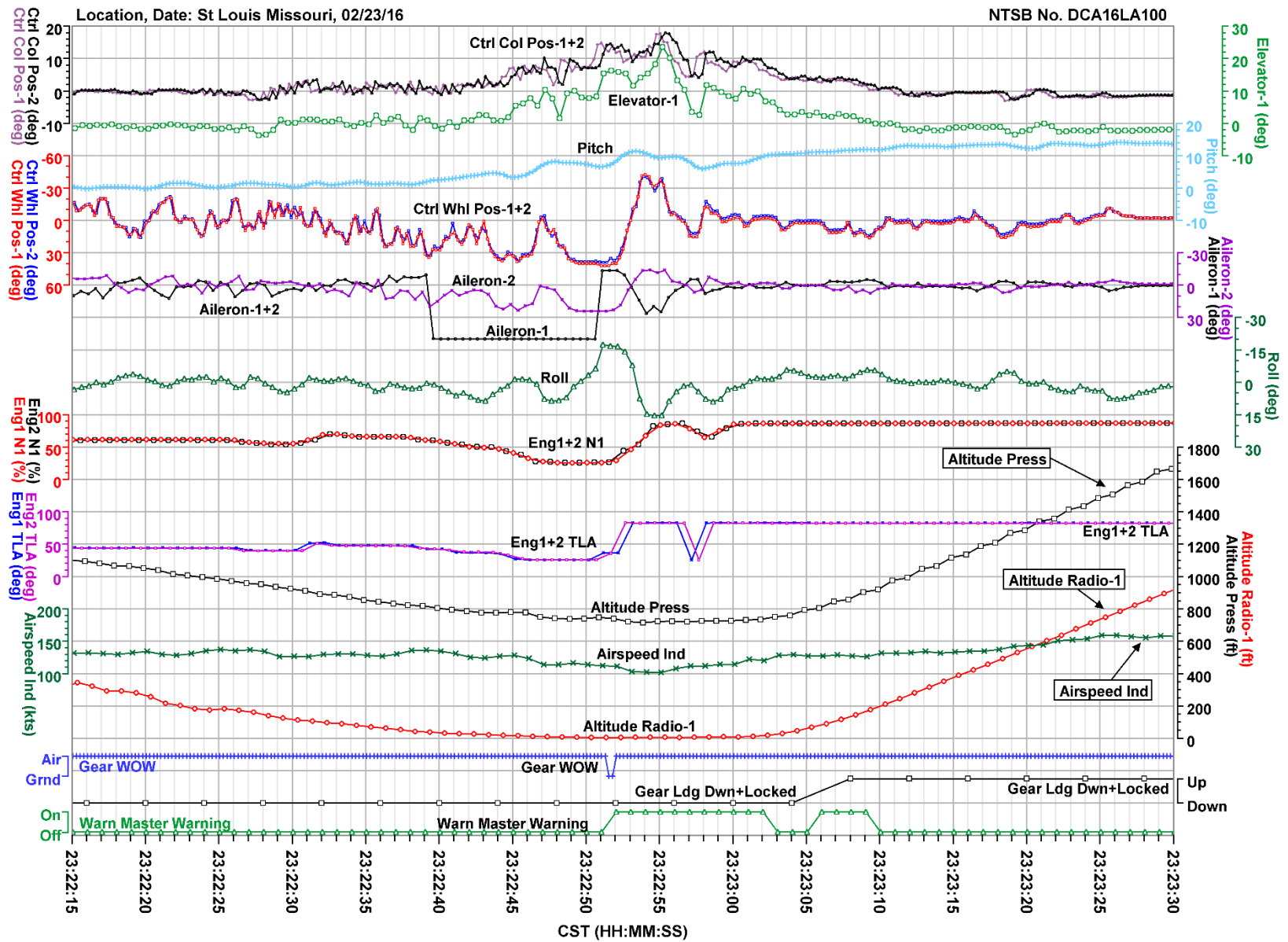


Figure 4. Plot of basic parameters focusing on missed approach.





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Figure 5. Plot of flight control parameters focusing on missed approach.

## 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. Table A-2 describes the unit and discrete abbreviations for the parameters.

**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-1	Left Aileron Position	deg
Aileron-2	Right Aileron Position	deg
Airspeed Ind	Indicated Airspeed	kts
Altitude Press	Pressure Altitude	ft
Altitude Radio-1	Radio Altitude	ft
AP	Autopilot	
Ctrl Col Pos-1	Control Column Position-1	deg
Ctrl Col Pos-2	Control Column Position-2	deg
Ctrl Whl Pos-1	Control Wheel Position-1	deg
Ctrl Whl Pos-2	Control Wheel Position-2	deg
Elevator-1	Elevator Position-1	deg
Eng1 N1	Engine 1 Fan Speed	%
Eng1 TLA	Engine 1 Throttle Lever Angle	deg
Eng2 N1	Engine 2 Fan Speed	%
Eng2 TLA	Engine 1 Throttle Lever Angle	deg
Gear Ldg Dwn+Locked	Landing Gear Down and Locked	
Gear WOW	Gear Weight on Wheels	
Heading Mag	Magnetic Heading	deg
Key	Microphone Keying	
Pitch	Pitch Angle	deg
Roll	Roll Angle	deg
Stick Pusher	Stick Pusher	
Stick Shaker	Stick Shaker	
Time GMT Hrs	Greenwich Mean Time Hours	hrs
Time GMT Min	Greenwich Mean Time Minutes	min
Time GMT Sec	Greenwich Mean Time Seconds	sec
Warn Master Caution	Warn Master Caution	
Warn Master Warning	Warn Master Warning	

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 and discrete abbreviations.**

Unit and Discrete Abbreviations	Descriptions
deg	degrees
Eng	Engaged
ft	feet
g	g
Grnd	Ground

## APPENDIX A

<b>Unit and Discrete Abbreviations</b>	<b>Descriptions</b>
hrs	hours
kts	knots
min	minutes
sec	seconds