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

October 14, 2015

Locomotive Event Recorder

Group Chairman's Factual Report
By Cassandra Johnson

1. EVENT SUMMARY

Location:	Philadelphia, Pennsylvania
Date:	May 12, 2015
Company:	Amtrak
Train ID:	188
Locomotive ID (consist position):	601 (lead)
NTSB Number:	DCA15MR010

For a summary of the accident, refer to the Accident Summary report, within this docket.

2. LOCOMOTIVE EVENT RECORDER GROUP

A locomotive event recorder group was convened on May 12, 2015.

Chairman:	Cassandra Johnson Mechanical Engineer National Transportation Safety Board
Member:	Clifford Kendall Director, Locomotive Technology Integration Amtrak
Member:	Robert Ryan Electrical Engineer Amtrak
Member:	J.D. Gee Operating Practice Inspector Federal Railroad Administration

3. LOCOMOTIVE CARRIAGE REQUIREMENTS

The lead locomotive 601 was manufactured in 2013, and was operating such that it was required to be equipped with a locomotive event recorder that recorded, at a minimum, 25 parameters, as cited in Title 49 *Code of Federal Regulations* Part 229.135.

4. DETAILS OF RECORDER INVESTIGATION

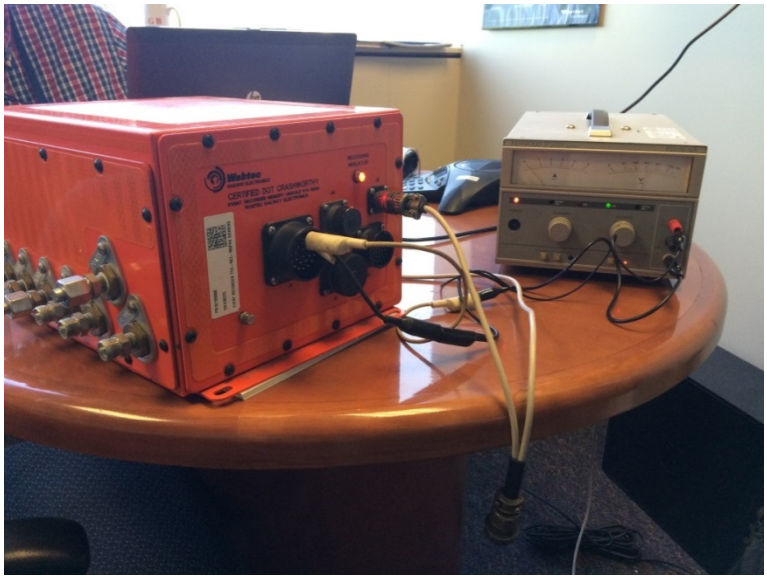
The National Transportation Safety Board (NTSB) Vehicle Recorder Division downloaded the following locomotive event recorder:

Device:	**Wabtec (Train Trax)**
Serial Number:	**636225**
Locomotive ID:	**Amtrak 601**[1]

4.1. Downloading Locomotive Event Recorder

Amtrak 601's locomotive event recorder was removed and transported to Amtrak's facility for downloading. The recorder was in good condition and the data were extracted normally using the Wabtec Railway Electronics Event Recorder Data Analysis Software and Amtrak's equipment (see figure 1).

Figure 1. Downloading Amtrak 601's locomotive event recorder.



4.2. Locomotive Event Recorder Recording Description

Using the wheel size of 43 7/8 inches as measured on-scene, Amtrak 601's locomotive event recorder data were extracted using the Wabtec Railway Electronics Event Recorder Data Analysis Software. This software outputted the locomotive event recorder parameters including distance and speed. The exported data have a sampling rate of one second; therefore, the data have an accuracy of +/- 1 second. Only the data relevant to this event are provided in this report.

The parameters evaluated for the purpose of this report appeared to be in accordance with the federal locomotive event recorder carriage requirements, except throttle position. The NTSB has informed Amtrak that the throttle position parameter was not working for Amtrak 601.

[1] Amtrak locomotive 601 will be referred to Amtrak 601 for the rest of this report.

4.3. Parameters

Table A-1 lists the parameters verified and provided in this report for Amtrak 601. Additionally, table A-2 contains the unit and discrete state abbreviations for the parameters.

4.3.1. Distance Traveled

The default output for the distance traveled is the distance decreasing in time. Therefore, the distance traveled began with a very large value and continually decreased to 0 feet.

4.3.2. Throttle Position

Review of the throttle position data revealed throttle positions 1 to 8 were not accurately recorded. Investigators determined the electrical connection was faulty to the locomotive event recorder. For more information, refer to the Mechanical Group Chairman's factual report in this docket for this investigation.

4.4. Time Correlation

At the time of downloading the recorder, the Wabtec Railway Electronics Event Recorder Data Analysis Software program compared the locomotive event recorder time to laptop time. To adjust to laptop time, the software subtracted 4 hours 10 minutes and 41 seconds from the locomotive event recorder time. Additionally, investigators compared the laptop time to real time and an additional 2 seconds was subtracted from the laptop time. Therefore, 4 hours 10 minutes and 39 seconds were subtracted from the locomotive event recorder time within the Wabtec Railway Electronics Event Recorder Data Analysis Software program, thus changing the locomotive event recorder time to real time. Therefore, for the rest of this report, all times are referenced as EDT.

4.5. Plots and Corresponding Tabular Data

Figures 2 to 5 contain Amtrak 601's locomotive event recorder data recorded during the May 12, 2015 event. All the parameters listed in table A-1 were plotted. Figures 2 and 3 cover 12 minutes of data from 21:09:00 EDT to 21:21:00 EDT. Figures 4 and 5 have an expanded scale covering 85 seconds of data from 21:19:15 EDT to 21:20:40 EDT.

In brief, Amtrak 601's locomotive event recorder data indicated at 21:20:31 EDT the train reached a maximum speed of 106 miles per hour (mph). Four seconds later at 21:20:35 EDT, the engineer initiated emergency (EIE) parameter transitioned from "No" to "Yes". Three seconds later at 21:20:38 EDT, the data ended. At this time, the train's speed was 102 mph.

All of the corresponding tabular data used to create figures 2 to 5 are provided in electronic comma separated value (.csv) format as attachment 1 to this factual report.

Figure 2. Amtrak 601's locomotive event recorder parameters (12 minutes).

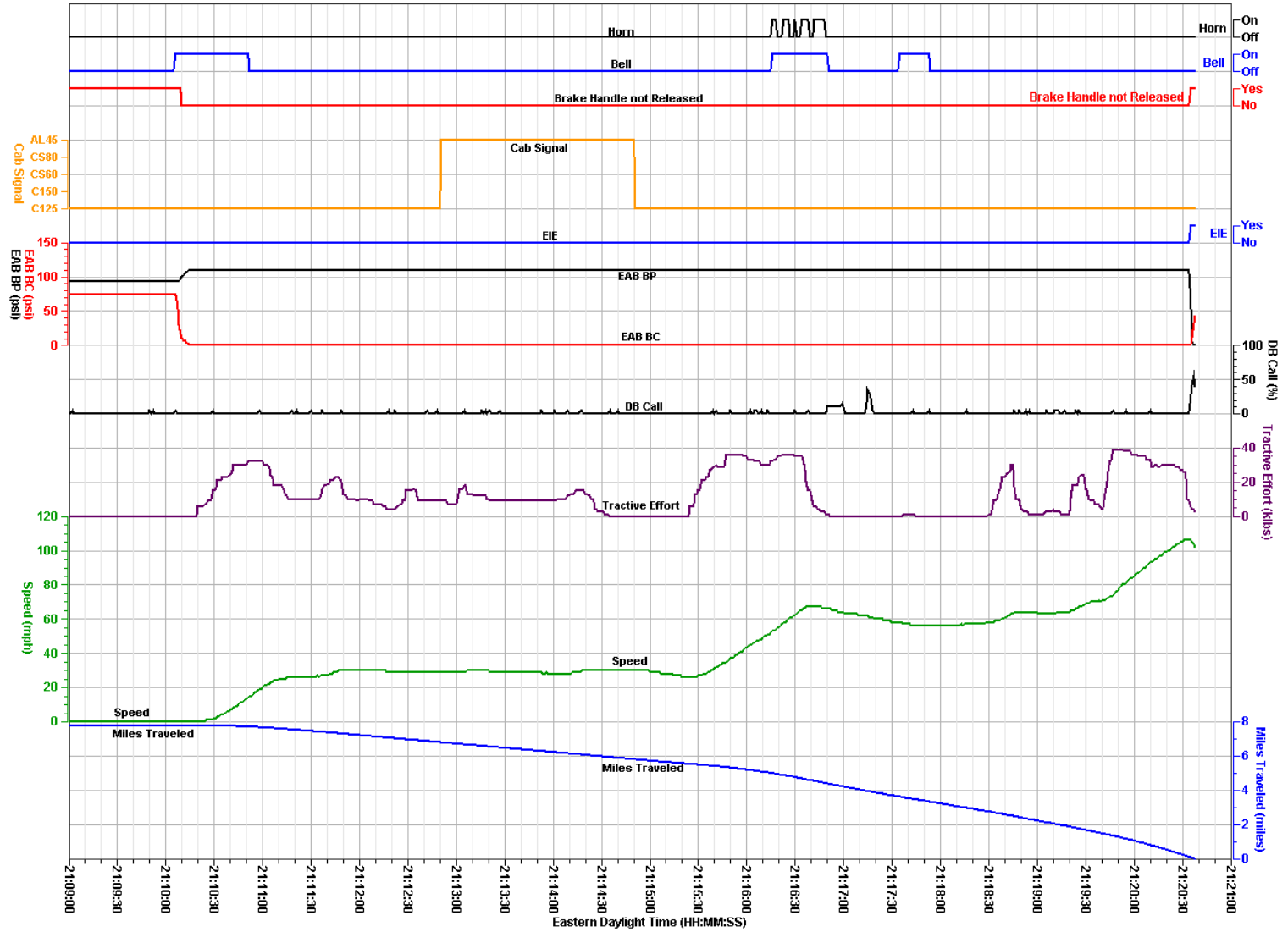


Figure 3. Amtrak 601's locomotive event recorder additional parameters (12 minutes).

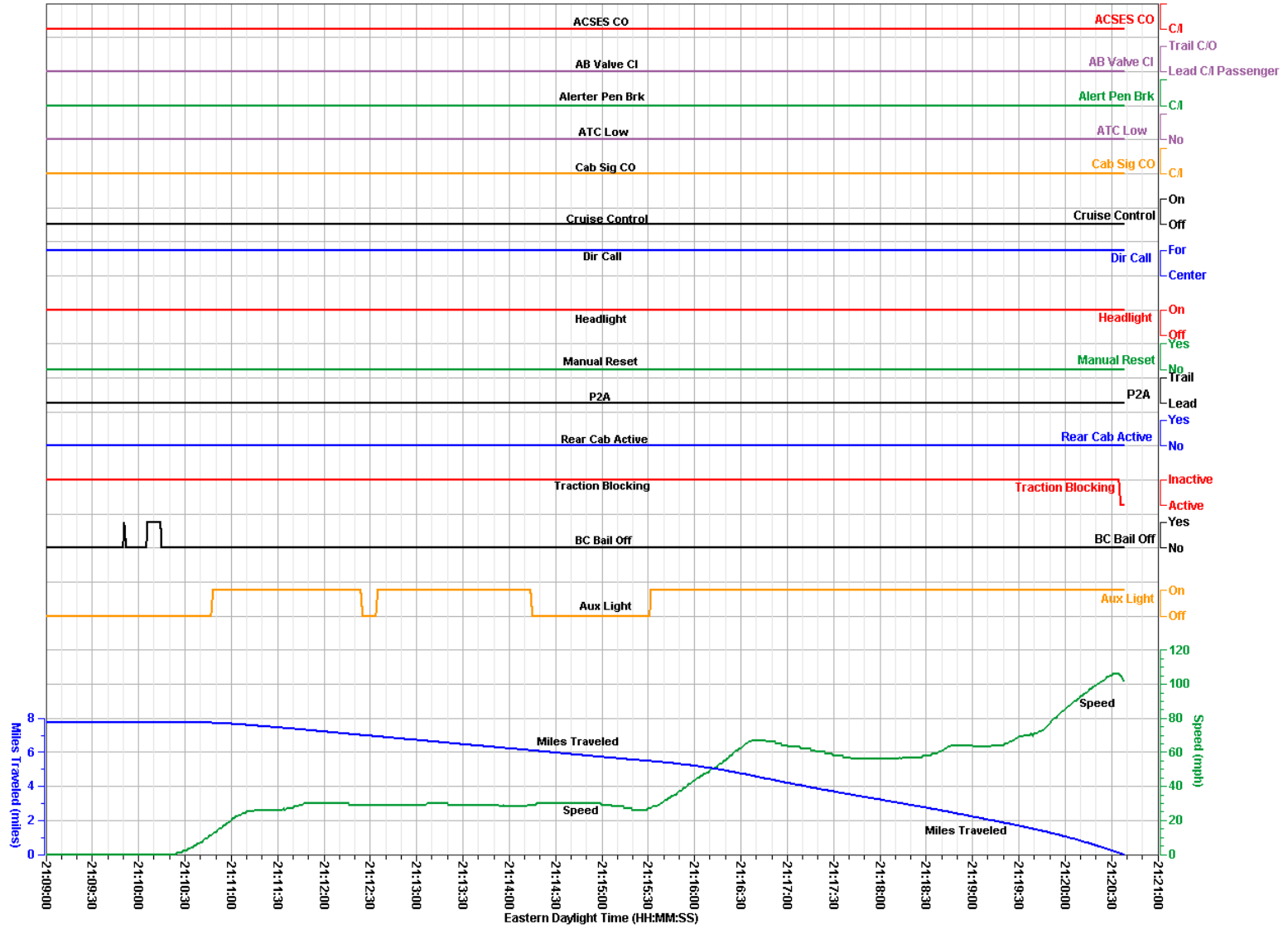
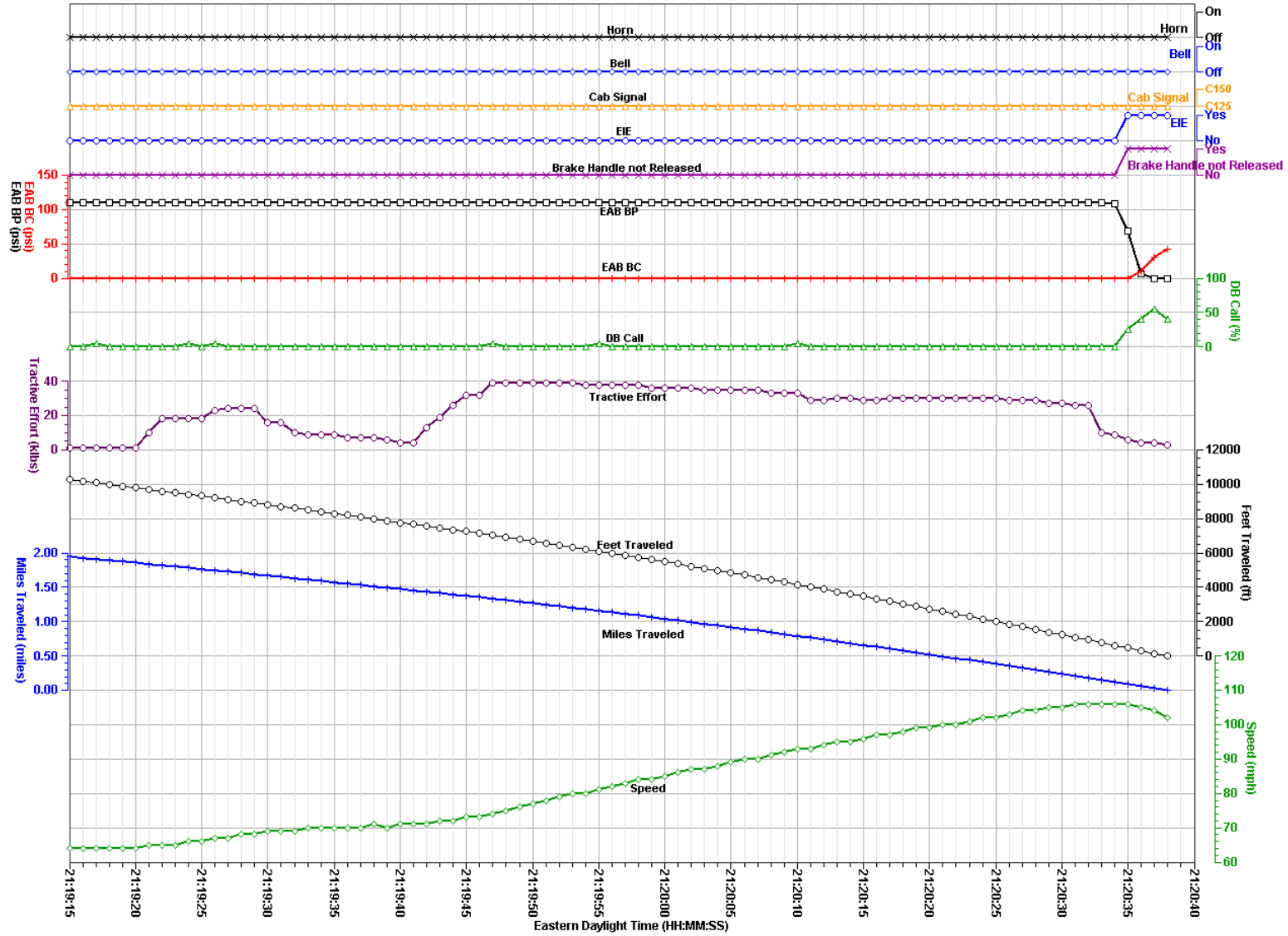
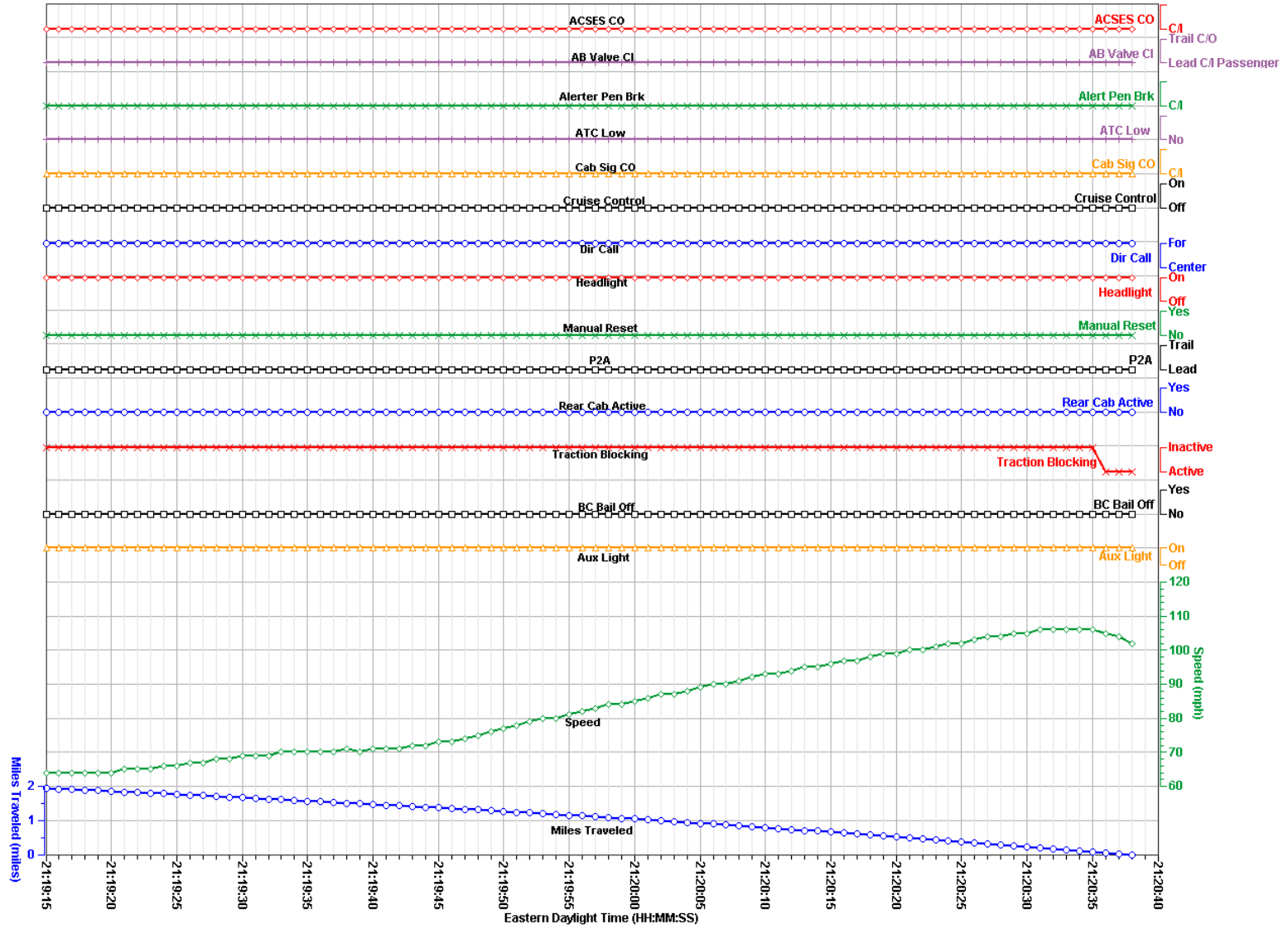


Figure 4. Amtrak 601's locomotive event recorder parameters (85 seconds).



Revised: 3 September 2015 Last 85 Seconds National Transportation Safety Board

Figure 5. Amtrak 601's locomotive event recorder additional parameters (85 seconds).



APPENDIX A

This appendix describes the locomotive event recorder parameters provided and verified in this report for Amtrak 601. Table A-1 lists the parameters and table A-2 contains the unit and discrete state abbreviations for the parameters.

Table A-1. Verified and provided locomotive event recorder parameters for Amtrak 601.

Parameter Name	Parameter Description
1. AB Valve CI (discrete)	Automatic Brake Valve Cutin
2. ACSES CO (discrete)	Advanced Civil Speed Enforcement System Cutout
3. Alert Pen Brk (discrete)	Alerter Penalty Brake
4. ATC Low (discrete)	Automatic Train Control Low
5. Aux Light (discrete)	Auxiliary Light
6. BC Bail Off (discrete)	Brake Cylinder Bail Off
7. Bell (discrete)	Bell
8. Brake Handle not Released (discrete)	Brake Handle not Released
9. Cab Sig CO (discrete)	Cab Signal Cutout
10. Cab Signal (discrete)	Cab Signal
11. Cruise Control (discrete)	Cruise Control
12. DB Call (%)	Dynamic Brake
13. Dir Call (discrete)	Direction of Travel
14. EAB BC (psi)	Electronic Air Brake – Brake Cylinder Pressure
15. EAB BP (psi)	Electronic Air Brake – Brake Pipe Pressure
16. EIE (discrete)	Engineer Initiated Emergency
17. Feet Traveled (ft)	Feet Traveled
18. Headlight (discrete)	Headlight
19. Horn (discrete)	Horn
20. Manual Reset (discrete)	Manual Reset
21. Miles Traveled (miles)	Miles Traveled
22. P2A (discrete)	Controlling Brake Valve either lead or trail
23. Rear Cab Active (discrete)	Rear Cab Active
24. Speed (mph)	Speed
25. Traction Blocking (discrete)	Traction Blocking
26. Tractive Effort (klbs)	Tractive Effort

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.

Table A-2. Unit and discrete state abbreviations.

Units Abbreviation	Description
%	percentage
AL45	Approach Limited 45 mph
C/I	Cutin

Units Abbreviation	Description
C/O	Cutout
C125	Clear 125 mph
C150	Clear 150 mph
CS60	Cab Speed 60 mph
CS80	Cab Speed 80 mph
discrete	discrete
For	Forward
ft	feet
klbs	kilo pounds
mph	miles per hour
psi	pounds per square inch