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

June 4, 2014

Event Recorders Report

Specialist's Factual Report
By Sean Payne

1 EVENT SUMMARY

Location: Jesup, GA
Date: February 20, 2014, 04:30 P.M. EST (Eastern Standard Time)
Company: CSX Transportation
Train: CSX Train Q12519
NTSB Number: DCA14FR005

On February 20, 2014, about 4:30 p.m. Eastern Standard Time, northbound CSX Transportation (CSX) train Q12519 struck a film crew and an obstruction on a railroad trestle near Jesup, Georgia. At the time of accident, the film crew was preparing to film on the railroad trestle. One person was killed, and six people were transported to hospitals.

2 RECORDER GROUP

An event recorder group was not convened.

3 DETAILS OF RECORDER INVESTIGATION

Two event recorders were sent to the NTSB laboratory for read out and evaluation. The lead[1] locomotive, CSX 372, contained a Wabtec/Pulse recorder (Figure 1) that recorded approximately 17 parameters. The DPU[2] locomotive, CSX 7921, contained a Siemens/Quantum Q1027 recorder (Figure 2). Both recorders were downloaded in the lab without difficulty using the manufacturer's recommended procedure. Data from both recorders captured the accident sequence in its entirety. For this report, only data from the lead locomotive CSX 372 was used to create plots in Section 5.1 and 5.2. The raw data from CSX 372 is included in this report as Attachment 1. Recorder download activities are summarized in Table 1 on the following page.

[1] Lead - Describes the position of the locomotive in the train. Lead indicates that the locomotive was the manned, lead unit.
[2] DPU – Distributed Power Unit. A remotely controlled locomotive that can be placed in different points in the train.

Figure 1. Wabtec/Pulse recorder from lead locomotive CSX 372.

Figure 2. Siemens/Quantum Q1027 recorder from DPU locomotive CSX 7921.

Table 1: Summary of Event Recorder Download Activity				
Loco. No.	Train No.	Position	Recorder Model	Download Type
372	Q12519	Lead	Wabtec/Pulse	Cable/NTSB Lab
7921	Q12519	DPU	Siemens/Quantum	Cable/NTSB Lab

Wheel measurements were taken from each locomotive by CSX Employees. Wheel sizes were entered into the software during download process which was performed at the NTSB Vehicle Recorder Laboratory. The measurements are shown below in Table 2.

Table 2. Wheel Measurements			
Loco. No.	Train No.	Wheel Size (Inches)	Agency Performing Measurement
372	Q12519	39.31	CSX
7921	Q12519	41.06	CSX

3.1 Event Recorder Details

The CSX train involved in this accident was configured as a multiple train unit consist. In this configuration, two self-powered locomotives provide power to the train under the control of the leading locomotive. Each locomotive in the consist contained a federally mandated event recorder. Table 1 shows a summary of all download activity related to the crash protected event recorders involved in this accident.

3.2 Federal Event Recorder Requirements

Federal Regulations regarding the carriage requirements of event recorders on railroad locomotives can be found in Federal Railroad Administration 49 CFR Part 229.135. In general, traditional locomotives are required to have crash survivable event recorders recording a minimum of 25 parameters depending upon the specific type and configuration of the locomotive type as discussed in 49 CFR Part 229.135.

3.3 Recording Description

The data recorded on the locomotives on CSX Transportation Train Q12519 captured the entire accident sequence. The recordings terminate at different times several hours after the train came to rest.

3.4 Recorder Timing

Timing was recorded on each device and was a product of each recording device's internal clock. Each unit individually keeps its own time through the use of an internal clock which is powered by a backup battery when the unit is disconnected from the locomotive's power source. This clock is either set at the factory by the manufacturer of the recording device or the railroad operator. Upon downloading each device, the technician has the option to set the clock to the present local time. In the case of the Wabtec/Pulse unit from lead locomotive CSX 372, the clock was adjusted to local time during the data download process. The recorder then creates an offset from the recorder's internal time clock to the updated local time. This becomes the timing value exported in the tabular data.

The locomotive also contained a forward looking track image recorder which recorded its own GPS timestamp. The timing offset between each recorder is discussed in Section 3.2 of the Track Image Recorder Factual Report which can be found in the public docket for this accident.

Timing data found in Attachment 1 of this report is in raw format and do not include the time stamp adjustment discussed in Section 3.2 and Table 2 of the Track Image Recorder Factual Report.

3.5 Parameters Provided and Verified

The event recorders from CSX Transportation Train Q12519 recorded a variety of locomotive performance and operating status parameters, some of which have been validated and provided in this report.

Only the event recorder data from the lead locomotive in Train Q12519 from CSX locomotive 372 was used to create plots for this report. The selected parameters used to create these plots were validated and are provided in Table 3 below. Table 4 lists the unit abbreviations used by the recorder in the tabular data and plots. The tabular event

recorder data has been provided in this report as Attachments 1 and 2. Refer to section 4 for a description of attachments included in this report and their contents.

Table 3: Parameters Provided and Verified from Train Q12519		
Parameter Name	Parameter Description	Unit[3]
1. Horn	Horn	NA
2. Bell	Bell	NA
3. DB Excite	Dynamic Braking Excitation	NA
4. Dir Call	Direction Call	NA
5. EAB BC	Electronic Airbrake – Brake Cylinder Pressure	psi
6. EAB BP	Electronic Airbrake – Brake Pipe Pressure	psi
7. EOT BP	End of Train - Brake Pressure	psi
8. PCS Open	Power Cutoff Switch Open/Activated	NA
9. Speed	Speed	mph
10. Throttle	Throttle	NA
11. Tractive Effort	Tractive Effort	klbs

Table 4: Unit and Discrete State Abbreviations from CSX Train Q12519	
Abbreviation	Description
psi	Pounds Per Square Inch
%	Percentage
klbs	Thousands of Pounds
for/Fwd	Forward
rev/Rev	Reverse
Off	Off/Inactive
On	On/Active
DB1 – DB3	Dynamic Braking (Handle Position)
Idle	Idle (Handle Position)
T1 – T8	Throttle Position 1 through Throttle Position 8 (Handle Position)
mph	Miles Per Hour
NA	Not Available
Fwd	Forward
Open	Open/Active/Vented

3.5.1 Emergency Brake and Other Discrete Parameters

Discrete parameters are represented in this report and subsequent plots as either having a value of “1” or “0”. These two values are used to indicate the status of parameters that are recorded as only having an “Off” or “On” state. The tabular data provided as an attachment to this report contains multiple discrete parameters which are described differently by the recorder software. Different terms for the activation of discrete parameters are below in Table 5.

[3] Units designated by NA means the parameter is a discrete or a non-data value. A discrete is typically defined by 1-bit that can be either a 0 state or 1 state where each state is provided a definition.

Table 5: Discrete Parameter State					
Value	Status	Tabular Data Reference			
0	Off	Inactive	No	Closed	Inactive
1	On	Active	Yes	Open	Vented

The Emergency Brake (PCS) would indicate an “Off”, or a “0” Non-Emergency state when the trainline is energized. Specifically, the Emergency Brake Trainline wire is energized by a voltage whenever the appropriate electrical circuit logics have been satisfied in the controlling ("keyed") cab. The energization of this wire permits the brake pipe to be "recharged" by allowing valves to remain energized on each car once a predetermined amount of air pressure has been achieved.

The Emergency Brake would indicate an “On”, or a “1” Emergency state with the de-energization of the trainline wire by an activation from the cab, an accidental car uncoupling or a rupture in the brake line. The Emergency Brake Trainline being activated (“On”) would result in an immediate venting of brake pipe air pressure by the control valve on each car causing an emergency stop.

3.5.2 Throttle Position Command Data

The recorded throttle command data allowed for a simple number to string text scale (for example, 1=Idle and 2=T1 (Throttle Selector - Position 1). Therefore, the Throttle command number is used for the scale in the plots and the associated throttle commands are as follows: (0=DB (Dynamic Braking), 1=Idle, 2=T1, 3=T2, 4=T3, 5=T4, 6=T5, 7=T6, 8=T7 and 9=T8). This number to string conversion allows the plotting software to interpret the train’s propulsion or dynamic braking command as selected by the engineer with the throttle controller in the lead locomotive’s cab.

3.5.3 Speed and Distance Parameters and the Relationship to Wheel Size

For each locomotive, the recorded speed and the recorded internal distance counter are based on the number of axle revolutions with a measured wheel diameter as shown in Table 2. Normally, the wheel diameters will decrease due to regular wear on the wheels during their service life.

4 Summary of Attachments Provided for this Report

Table 6, shown below, provides a summary of the attachments for this report. Tabular data from each recorder are included as attachments to this report.

Table 6: Summary of Attachments			
Attachment No.	Description	Time Range[4]	File Type
1	Locomotive 372 – Event Recorder Data	16:00-16:40 EST	CSV

[4] The time range in exported recorder time that has been extracted for this report. The time range given was not adjusted using the offset provided in Section 3.2 and Table 2 of the Track Image Recorder Factual Report which can be found in the public docket for this accident.

4 Plots and Corresponding Tabular Data

Accident data plots show both elements of operator actions and vehicle performance. Two plots for this accident have been created from the recorded data set. The first plot shows operator actions and vehicle performance from 04:00 P.M. (EST) until a few minutes after the train comes to a stop at 04:31:58 P.M. (EST). The second plot shows the same parameters but in an expanded time scale of the same event for greater clarity from 04:29 P.M. (EST) to 04:33 P.M. (EST). All data are provided as attachments to this report and are referenced above in Table 6.

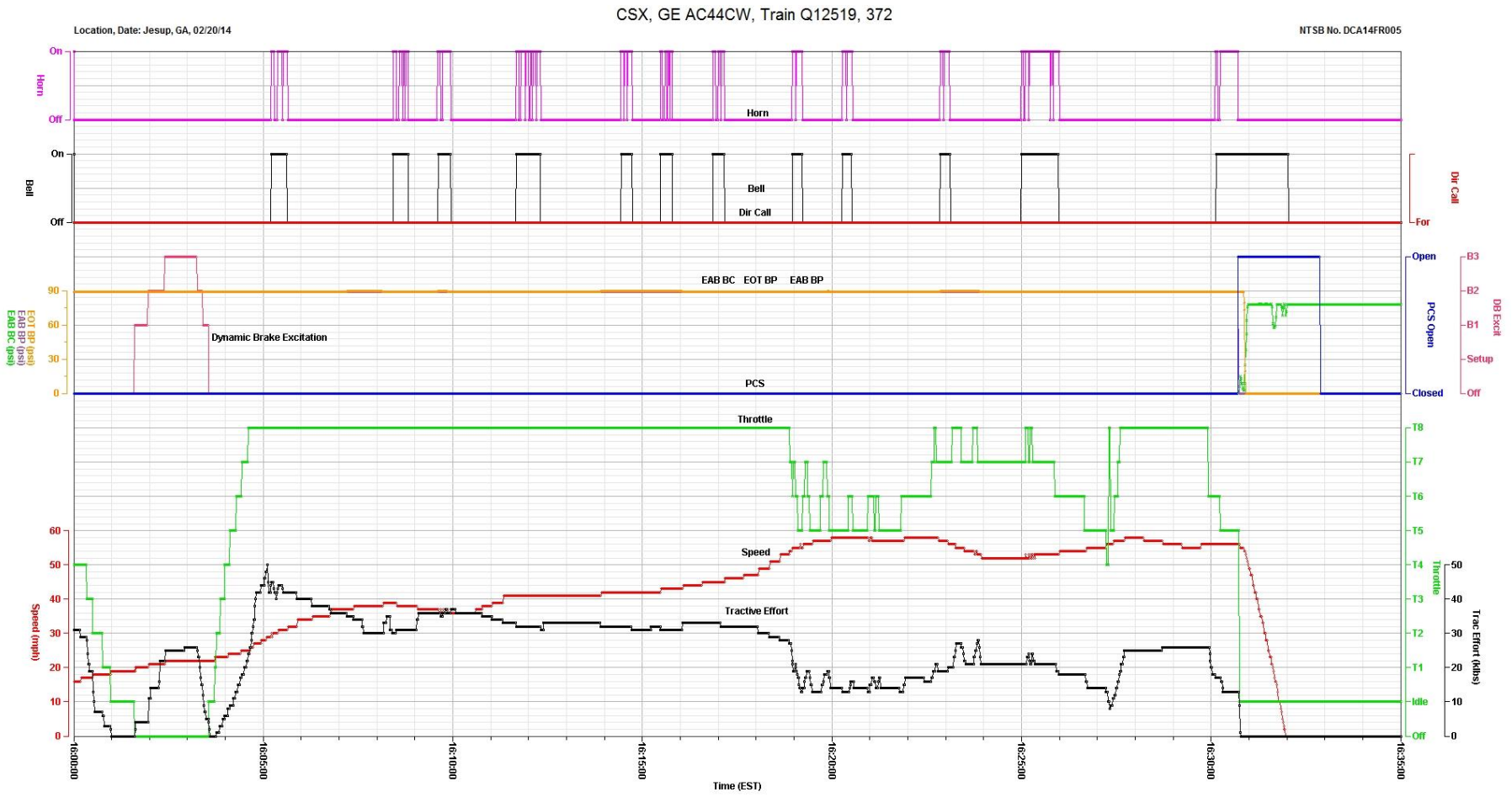
5.1 Train Q12519 – Locomotive 372 - 04:00 P.M. (EST) to 04:35 P.M. (EST)

Event recorder data shows the train traveling northbound with all systems operating in a normal state. The data shows the train increasing speed from about 15 mph until it reached just under 60 mph around 04:20 P.M. (EST) for the plotted time interval. The horn and bell were activated at various times during the plotted period of time. The throttle position was changed multiple times between positions T4 and T8 as the operator maintained a speed of between 50 and 60 mph. A minor reduction in throttle position was noted around a minute prior to Emergency Brake application at 04:30:43 P.M. (EST). After Emergency Brake application, the train came to rest at 04:31:58 P.M. (EST).

5.2 Train Q12519 – Locomotive 372 - 04:29 P.M. (EST) to 04:33 P.M. (EST)

The train was traveling at 56 mph in throttle setting T8 as it neared the accident location at 04:29 P.M. (EST). At 04:29:56 P.M. (EST) the throttle is reduced to position T6. At 04:30:07 P.M. (EST) the horn was first activated followed by the bell one second later at 04:30:08 P.M. (EST). At 04:30:15 P.M. (EST) the throttle was further reduced to position T5 and the horn was activated continuously from this time until Emergency Brake application at 04:30:43 P.M. (EST). The Emergency Brake application comes via PCS and data shows a subsequent rapid decrease in Brake Pipe Pressure and corresponding increase in Brake Cylinder Pressure in the immediate seconds following. The throttle was reduced to Idle two seconds later at 04:30:43 P.M. (EST) and the train came to rest at 04:31:58 P.M. (EST).

Plot 1: Train Q12519 – Locomotive 372 - 04:00 P.M. (EST) to 04:35 P.M. (EST)



Plot 2: Train Q12519 – Locomotive 372 - 04:29 P.M. (EST) to 04:33 P.M. (EST)