NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Vehicle Recorder Division
Washington, D.C. 20594

GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

DCA16FR007

By
Sean Payne

WARNING

The reader of this report is cautioned that the transcription of an image and audio recording is not a precise science but is the best product possible from a Safety Board group investigative effort. The transcript or parts thereof, if taken out of context, could be misleading. The transcript should be viewed as an accident investigation tool to be used in conjunction with other evidence gathered during the investigation. Conclusions or interpretations should not be made using the transcript as the sole source of information.

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

January 25, 2017

Onboard Image Recorder – Inward Facing

Factual Report
By Sean Payne

1. EVENT

Location:	Chester, PA
Date:	April 3, 2016
Locomotive:	ACS-64, 627
Operator:	Amtrak
NTSB Number:	DCA16FR007

2. SUMMARY

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

3. GROUP

A group was convened on April 21, 2016. The group consisted of the following members:

Chairman:	Bill Tuccio, Ph.D. Aerospace Engineer National Transportation Safety Board (NTSB)
Member:	Stephen Jenner, Ph.D. Human Performance Group Chairman National Transportation Safety Board (NTSB)
Member:	John Hines System General Road Forman National Railroad Passenger Corporation (Amtrak)
Member:	Don Hill Party Spokesman Brotherhood of Locomotive and Train Engineers (BLET)

4. DETAILS OF INVEDTIGATION

On April 4, 2016, the NTSB Vehicle Recorder Division received the following solid state hard drive associated with an inward facing image recording system:

Recorder Manufacturer/Model:	**Wabtec Locomotive Data Recording System – Video (LDRS-V)**
Recorder Serial Number:	**DD150817030000003710**

4.1. Recorder Description

The Wabtec Locomotive Data Recording System – Video (LDRS-V) is a crash protected image recorder designed to receive video streams from connected Wabtec rail video systems. The system consists of a 512 GB[1] solid state[2] hard drive (SSD) and an internal 128 GB crash protected solid state memory. The 512 GB hard drive is removable from the device for download via the appropriate Wabtec supplied hardware and software. The removable hard drive is not fire protected. The 128 GB internal crash hardened memory module meets the standards and specifications of crash hardened rail video systems and is designed to be accessed in the event the removable 512 GB SSD is destroyed.

4.2. Recorder Damage

Upon arrival at the NTSB Vehicle Recorder Division, it was evident that the LDRS-V removable 512 GB SSD had not sustained any heat or structural damage. On April 4, 2016, a file transfer was supplied by Amtrak containing an initial download of the system. Additionally, the NTSB traveled to the Wabtec Railway Electronics manufacturing facility on April 8, 2016 to extract the data from the 512 GB SSD with the assistance from the manufacturer. Information was extracted normally, using the manufacturer's designed procedures and hardware.

4.3. Video Files

One LDRS-V video file was exported from the 512 GB SSD. That file was named 000000000000FCAB_INWARD201604030700.vdat. According to the recorder's internal time clock, this file showed continuous recording which began at 06:59:02 EDT and ended around 07:48:03 EDT. Some additional video footage was present in the file that was a result of the recorded being powered on post-accident by on-scene officials. The time interval of this additional video was not quantified.

4.4. Timing and Correlation

The times used in this report are expressed as local time of the accident (EDT).

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[1] GB – gigabyte – 1,073,741,824 bytes

[2] Solid State – A non-volatile memory device constructed entirely from solid materials and in which the electrons or other charge carriers, are confined entirely within the solid material.

Timing of the transcript was established by correlating the video events to common events on the locomotive's event recorder. Specifically, the moment the locomotive engineer applied the emergency brake was present in the inward facing video file. At this moment, the cab illuminated with a higher intensity lighting system. The time of this lighting change was compared to the event recorder time for emergency brake application.

Therefore, a relationship between locomotive event recorder time to EDT was developed.

Specifically for this report, the time correlation is as follows:

Inward Facing Video EDT = Locomotive Event Recorder Time – 92 seconds

This equation will provide timing accuracy to +/- 1 second relative to the locomotive event recorder, given the limitations of the LDRS-V viewing software.

For the remainder of this report, all times are given in EDT. Transcript times are given in EDT in the format HH:MM:SS.D.

4.5. Summary of Recording Contents

In agreement with the Investigator-In-Charge, an inward facing video group convened on April 21, 2016, and a transcript was prepared. It was determined that events would be transcribed between the time at which the locomotive was stopped at 30th Street Station in Philadelphia, PA, (07:33:19.27 EDT) and a few moments after the engineer returned to his feet post impact (07:54:34.20 EDT).

4.5.1. Video Recording:

[07:33:19.27] Train was stopped in 30th street station. Engineer was in cab, wearing glasses (and remained so until and during the collision), occasionally lifted cup to mouth.

[07:33:29.83] Engineer stood up and exited cab through the fireman's side door; door remained open after engineer exited.

[07:34:26.90] Engineer returned to cab through fireman's side door and closed door.

[07:34:31.60] Engineer sat down in engineer's seat and continued alone in the cab engaging in movements/activities, including: lift cup to mouth, sit and look forward, and lean forward. The waiting activity continued through [07:38:15.08].

[07:38:15.27] Sound of two identical buzzing sounds, similar to conductor signaling engineer to proceed. Engineer immediately responded to the buzzers

by sitting up, putting his left hand on the throttle, and his right hand on the independent brake handle.

[07:38:17.43] Engineer moved the independent brake handle backwards, consistent with the release position.

[07:38:19.33] Engineer moved automatic brake handle towards backwards, consistent with releasing the brakes.

[07:38:25.93] Engineer moved throttle forward with his left hand as he moved his right hand and pushed the bell button.

[07:38:27.30] Bell button light illuminated and bell began to ring (ringing continued until the locomotive exited the station).

[07:38:33.33] Engineer moved throttle further forward, and train began to move forward.

[07:38:41.87] Engineer moved his head and torso forward (and laterally towards the fireman's side), while looking towards the engineer's side, consistent with looking at the rearward facing camera display on the engineer's console.

[07:38:54.93] Engineer moved left hand forward and towards the fireman's side and two beeps were recorded, similar to the engineer adjusting the radio volume.

[07:38:57.73] The display in front of the engineer displayed a yellow alerter bar.

[07:38:59.33] Engineer moved his left hand from the throttle and momentarily pressed the red acknowledgement button; this was followed by three high pitch tones, similar to the alerter acknowledgement tone.

[07:39:15.53] As the locomotive exited the station, the engineer used his right hand to press the bell button; the bell button illumination turned off, and the bell stopped.

Between [07:39:15.53] and [07:40:13.29], the engineer moved the throttle forward and back and raised and lowered a cup to his mouth.

[07:40:17.77] Sound of three high pitched alerts, similar to passing an ACSES[3] transponder. The engineer pressed the red acknowledgement button.

Between [07:40:17.80] and [07:41:00.09] the engineer moved his head between looking forward and right, adjusted the throttle, crossed his arms, and moved his torso forward and back.

[3] ACSES – Advanced Civil Speed Enforcement System – A positive train control cab signaling system.

[07:41:02.83] Sound of one high pitch alert, similar to ACSES transponder. Engineer moved his left hand to the throttle.

Between [07:41:02.83] and [07:42:13.20] the engineer moved his head left, right, and forward; lifted a cup to his mouth; adjusted the throttle; and the ACSES tone sounded.

Between [07:42:14.83] and [07:42:31.43] the engineer removed white pieces of paper from a clip of papers on the engineer's console. He lifted and looked at the white papers. The engineer replaced the white papers under the clip on the engineer's console. As the engineer completed clipping the paper back to the console, the yellow alerter bar began to flash on the engineer's console (center screen).

[07:42:34.90] Engineer pressed the red acknowledgement button; this was followed by three high pitch tones, similar to the alerter acknowledgement tone.

Between [07:42:43.17] and [07:49:24.40] the engineer was seated, looking forward, making throttle and brake manipulations. During this period, the following other activities were observed: the engineer lifted a cup to his mouth, changed hand positions, the alerter annunciated and was followed by immediate engineer acknowledgment, sounds of ACSES tones and acknowledgments by the engineer (when required), and background unintelligible radio receptions.

[07:49:27.83] Engineer pressed the red acknowledgement button; this was followed by three high pitch tones, similar to the alerter acknowledgement tone.

[07:49:29.97] Engineer was seated and looking forward, moved throttle backward to off position, and began to move his torso forward.

[07:49:30.93] Engineer moved his head and torso forward with his gaze strictly forward, and moved his right hand towards the independent brake handle.

[07:49:31.37] Engineer moved his right hand above the independent brake handle.

[07:49:31.60] Engineer moved his left hand off the throttle to the left hand side of the red acknowledgement button.

[07:49:32.17] Engineer moved his right hand to the right, onto the horn switch.

[07:49:32.23] Engineer activated the horn switch.

[07:49:32.27] The bell light illuminated. Sound of the horn was first recorded.

[07:49:33.30] While holding the horn switch with his right hand, the engineer moved his left hand across his torso to the automatic brake handle on the right side of the console.

[07:49:33.87] While holding the horn switch with his right hand, engineer moved his left hand to the independent brake handle.

[07:49:34.20] While holding the horn switch with his right hand, engineer moved his left hand back to the automatic brake handle.

[07:49:34.47] While holding the horn switch with his right hand, engineer began to move the automatic brake handle forward.

[07:49:34.57] While holding the horn switch with his right hand, engineer moved the automatic brake handle forward to the emergency position. Sound of swooshing sound, similar to the locomotive emergency brake application began.

[07:49:35.00] The interior lighting increased in intensity, similar to the cab lights illuminating in response to the locomotive brakes being placed in the emergency position.

By [07:49:37.83], while holding the horn switch with his right hand, the engineer had gotten out of his seat, and assumed a crouching position near the center of the cab. His left hand was on the console. His gaze remained strictly forward.

[07:49:39.67] The engineer lowered his crouch, with his right arm now fully extended holding the horn switch. His gaze remained strictly forward.

[07:49:40.00] The engineer removed his right hand from the horn switch and the bell light remained illuminated.

[07:49:40.40] The engineer moved his body towards the center rear bulkhead of the cab.

[07:49:41.20] The engineer assumed a self-protective position (bent at knees, hands covering face, lying face down) on the floor of the cab near the center rear bulkhead.

[07:49:41.47] The interior lighting decreased in intensity. The bell light remained illuminated.

[07:49:41.60] Unidentified debris began to appear in the cab from the area of the windshield. A plastic cover over the fire extinguisher in the rear of the cab began to come loose.

[07:49:41.87] Sound of impact. Debris in the cab began to restrict visibility inside the cab.

[07:49:42.87] The cab console began to lift up. The engineer was lifted upwards from the floor of the cab.

[07:49:43.97] The lower field of view of the camera began to be obstructed by the fireman's side sun visor.

About [07:49:47.27] a repetitive rapid beeping tone, similar to a locomotive fault alarm, began and continued until [07:54:34.20].

By [07:50:07.33], the locomotive had slowed substantially (but was still moving forward). The visibility improved in the cab. The engineer began to raise his head, and it was apparent his glasses were not on (they had fallen off during the accident sequence).

At about [07:50:19.27] the background sounds decreased such that the bell became audible.

[07:50:20.93] The locomotive came to a stop. The engineer was still on the floor of the cab, with his right hand on the arm rest of the fireman's chair.

[07:50:26.33] The engineer rolled on to his back on the floor of the cab.

[07:50:31.43] The engineer sat up on the floor.

[07:50:34.70] The engineer stood up, looked toward the front of the locomotive and yelled, "What the #."[4]

Between [07:50:34.70] and [07:54:34.20], the engineer moved about the cab, opened the engineer's side door of the locomotive, and looked outside towards the rear of the train.

[07:54:34.20] The rapid beeping sound ceased.

[4] # indicates an expletive.