NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division

November 16, 2021

Security Video – Time Correlation

Specialist's Factual Report
By Kyle Garner

1. EVENT

Location:	Phoenix, Arizona
Date:	June 9, 2021
Vehicle:	2016 Freightliner Cascadia Truck Tractor
Operator:	Arizona Milk Transport Inc.
NTSB Number:	HWY21MH008

For a summary of the event, refer to the *Crash Summary Report* which is available in the docket for this investigation.

2. SECURITY VIDEO GROUP

A security video group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received a 4 terabyte (TB) hard disk drive (HDD) containing disk image files from two security camera digital video recorders (DVR) HDDs. The DVR HDDs were recovered from the operator's office, forensically imaged by a third party, copied to the 4TB HDD, and sent to the NTSB for evaluation.

The Vehicle Recorder Division was asked to assist with correlating the timestamps on the security videos to local time. The videos with corrected timestamps will then be used to determine the driver's work schedule in the days leading up to and including the day of the accident[1].

3.1. 4TB HDD Data Recovery

The 4TB HDD was connected to a write-blocker device and the HDD's files were viewed using a lab workstation. Two file folders, one for each DVR image file, were found on the HDD. Within each DVR's file folder there was one raw disk image file in EnCase (.e01) format. The details of each file are shown in Table 1.

[1]For a timeline of the driver's work schedule in the days leading up to and including the accident, see the *Motor Carrier Group Chairman's Factual Report*, which is available in the docket for this investigation.

Table 1. 4TB HDD Contents.

DVR Name	DVR Model	Raw image file size	Image File Format
Black DVR	NVR4204-P-ADT-2	1.81TB	EnCase (.e01)
White DVR	A-ADT8H-500	465GB[2]	EnCase (.e01)

The raw image files were imported into a forensic DVR analysis software which identified each DVRs filesystem, recovered metadata, and presented a list of the recovered video clips.

The DVR analysis software indicated that there were 3,753 video clips and 11,614 video clips recovered from the black and white DVR's raw image files, respectively. After reviewing the individual clips, it was determined that the black DVR recorded data from security cameras installed on the exterior of the operator's office building, and the white DVR recorded data from security cameras installed on the interior of the office building.

3.2. Time Correlation

The third party was instructed to power on the DVRs with the original hard drives removed to determine the internal system time on each DVR. Both DVRs powered on successfully and the third party provided the NTSB with photographs showing each DVRs internal system time next to a reference to real time[3]. The timing information for each DVR is shown in Table 2.

Table 2. DVR timing information provided by third party.

DVR Name	DVR System Time	Real Time	Offset[4]
Black DVR	10/06/2021, 08:28:44 AM	10/05/2021, 08:18:08 AM	-24:10:36
White DVR	09/29/2021, 05:39:23 PM	09/29/2021, 05:26:19 PM	-00:13:04

The offsets from Table 2 for each DVR were input into the DVR analysis software and adjusted timestamps were generated for each video clip. Video from an interior and exterior camera, one from each DVR, with a view of the office's main entrance door was reviewed for continuity with the offsets from Table 2 applied.

Using occupants opening the main office door and entering the office as a point of reference, it was noted that the DVR's adjusted timestamps were still offset by 2 minutes and 6 seconds. This difference was removed from the offset of the black DVR, the adjusted timestamps were regenerated, and the video clips were again validated for continuity. The validation determined that the DVRs were synchronized and the finalized offset for each DVR is shown in Table 3.

Table 3. Finalized timing offset for each DVR.

DVR Name	Offset[4]
Black DVR	-24:08:30
White DVR	-00:13:04

[2]GB = gigabytes
[3]The reference to real time in the photographs was a digital atomic wall clock.
[4]Offset = real time – DVR system time in *hh:mm:ss*, where *hh* is hours, *mm* is minutes, and *ss* is seconds.