National Transportation Safety Board

Washington, DC 20594

Safety Recommendation

Date: July 8, 2015

In reply refer to: R-10-1 and -2 (Reiteration)

The Honorable Sarah Feinberg
Acting Administrator
Federal Railroad Administration
Washington, DC 20590

About 9:21 p.m. on May 12, 2015, National Railroad Passenger Corporation (Amtrak) passenger train 188 derailed at milepost 81.62 near Frankfort Junction in Philadelphia, Pennsylvania. The tracks in the area of the derailment have a 4-degree curve with a permanent speed restriction of 50 mph. Event recorder data indicated the train was traveling 106 mph when the engineer made an emergency brake application; soon afterward, the train derailed at the curve. There were 250 passengers and 8 Amtrak employees on board. Eight passengers died, and more than 200 passengers were treated for injuries

Background

The National Transportation Safety Board (NTSB) has long advocated the use of recording devices inside locomotive cabs as an aid in accident investigations and for use by transportation management in efficiency testing and performance monitoring programs. Our initial recommendation for "voice recorders" came as a result of our investigation into the 1996 collision of a Maryland Rail Commuter (MARC) train—operated by CSX Transportation (CSXT)—and an Amtrak train near Silver Spring, Maryland. Eleven people died, including all three CSXT operating crewmembers.[1] We reiterated this safety recommendation in our investigation of the 1999 Bryan, Ohio, railroad accident where there were no surviving crewmembers.[2] However, the Federal Railroad Administration (FRA) stated that no action would be taken to implement the recommendation. Since the FRA's refusal to act on the recommendation of in-cab audio recorders, the NTSB has investigated additional accidents in which audio recorders would have provided information to help determine probable cause and improve safety. That was underscored by a 2005 collision in Anding, Mississippi. All four crew members were killed, and 15,000 gallons of diesel fuel was spilled, causing a fire and the

[1] National Transportation Safety Board, *Collision and Derailment of Maryland Rail Commuter* MARC *Train 286 and National Railroad Passenger Corporation* Amtrak *Train 29 Near Silver Spring, Maryland, on February 16, 1996*, RAR-97/02 (Washington, DC: National Transportation Safety Board, 1997).

[2] National Transportation Safety Board, *Collision Involving Three Consolidated Rail Corporation Freight Trains Operating in Fog on a Double Main Track Near Bryan, Ohio, January 17, 1999*, (Washington, DC: National Transportation Safety Board, RAR-01/01, 2001).

evacuation of 100 residents.[3] Autopsies with toxicological specimens could not be performed on the northbound crewmembers, so the NTSB could not determine if they were incapacitated before the accident, prompting us to expand our previous recommendation. As a result, in issuing recommendations to the FRA after investigating this accident, the NTSB included a recommendation to require the installation of inward-facing video recorders in all controlling locomotive cabs and cab car operating compartments.[4]

However, the benefit of recording audio and images of operating crew members is not limited to investigations. These recordings could help railroad management prevent accidents by identifying safety issues before they lead to injuries and loss of life by using them to develop valuable training tools. The Chatsworth, California, tragedy demonstrated the importance of understanding the activities of crewmembers in the minutes and seconds leading up to an accident.[5] Twenty-five people were killed and 102 were injured as a result of this accident. The NTSB found that the probable cause of the accident was the failure of the Metrolink engineer to respond to a red signal because he was texting. Our investigation revealed the engineer had a history of noncompliance with Metrolink's operating rules. Discussing the strong safety case for a requirement for inward-facing cameras in locomotives, the NTSB noted that:

> (I)n all too many accidents, the individuals directly involved are either limited in their recollection of events or, as in the case of the Chatsworth accident, are not available to be interviewed because of fatal injuries. In a number of accidents the NTSB has investigated, a better knowledge of crewmembers' actions before an accident would have helped reveal the key causal factors and would perhaps have facilitated the development of more effective safety recommendations.[6]

Accordingly, the NTSB enhanced its earlier recommendation and called for the FRA to require the installation, in control compartments, of "crash- and fire-protected inward- and outward-facing audio and image recorders capable of providing recordings [for at least 12 hours] to verify that train crew actions are in accordance with rules and procedures that are essential to safety as well as train operating conditions."[7] The NTSB also recommended that the FRA "[r]equire that railroads regularly review and use in-cab audio and image recordings . . . to verify that train crew actions are in accordance with rules and procedures that are essential to safety."[8]

The NTSB reiterated these important recommendations in its report on the collision of a BNSF coal train with the rear end of a standing BNSF maintenance-of- way equipment train near

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[3] National Transportation Safety Board, *Collision of Two CN Freight Trains, Anding, Mississippi, July 10, 2005*, RAR-07/01 (Washington, DC: National Transportation Safety Board, 2007).

[4] R-07-3.

[5] National Transportation Safety Board, *Collision of Metrolink Train 111 With Union Pacific Train LOF65–12, Chatsworth, California, September 12, 2008*, RAR-10/01 (Washington, DC: National Transportation Safety Board, 2010).

[6] National Transportation Safety Board, *Collision of Metrolink Train 111 With Union Pacific Train LOF65–12, Chatsworth, California, September 12, 2008*, RAR-10/01 (Washington, DC: National Transportation Safety Board, 2010).

[7] R-10-1.

[8] R-10-2.

Red Oak, Iowa, resulting in the deaths of the two crewmembers of the striking train.[9] The accident again demonstrated the need for in-cab audio and image recording devices to better understand—and, thereby, prevent—railroad crashes that claim the lives of crewmembers, passengers, and the public.

Subsequent to the Red Oak, Iowa, accident, the NTSB investigated the June 2012 collision of two Union Pacific freight trains near Goodwell, Oklahoma, that resulted in three crewmember fatalities and $14.8 million in estimated damage.[10] In the NTSB Accident Report, we noted that the FRA had failed to take action on the NTSB's two recommendations from the 2010 Chatsworth accident for in-cab audio and image recording devices and again reiterated these two recommendations.

The NTSB recognizes the significant privacy concerns regarding the public disclosure of audio and image recordings. Congress also has been sensitive to the public disclosure of these sensitive data and information after transportation accidents. For this reason, in 1990, it enacted confidentiality protections that prohibit the NTSB from publicly disclosing aviation cockpit voice recordings and from prematurely disclosing transcripts of oral communications by flight crewmembers.[11] In 2000, it enacted similar confidentiality protections prohibiting the disclosure of aviation cockpit video recordings and surface vehicle voice or video recordings, as well as premature disclosure of aviation cockpit video transcripts and surface vehicle voice or video transcripts of oral communications of train employees or other surface transportation operating employees.[12] Congress also precluded litigants from using discovery to obtain cockpit and surface vehicle recordings and transcripts in any judicial proceeding.[13]

Audio and image recorders in locomotives and cab car operating compartments are critically important because they could assist NTSB investigators and others with understanding what happened in a train before an accident. During interviews, the engineer of Amtrak 188 stated that he could not recall the events leading up to the derailment. So far, investigators have been unable to determine specific information about the engineer's behavior while the train was accelerating in the moments before the derailment. The Amtrak 188 accident in Philadelphia is only the latest example where the engineer's recollection of events is limited, and inward-facing recorders could have provided valuable information as NTSB determines the probable cause of this tragic accident. The following table lists rail accidents in which the NTSB recommended the use of audio and/or image recorders in the cab. In almost all cases, the NTSB's investigations were hampered by the lack of audio and/or image data.

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[9] National Transportation Safety Board, *Collision of BNSF Coal Train With the Rear End of Standing BNSF Maintenance-of-Way Equipment Train, Red Oak, Iowa, April 17, 2011*, RAR-12/02 (Washington, DC: National Transportation Safety Board, 2012).

[10] National Transportation Safety Board, *Head-On Collision of Two Union Pacific Railroad Freight Trains Near Goodwell, Oklahoma, June 24, 2012*, RAR-13/02 (Washington, DC: National Transportation Safety Board, 2012).

[11] Independent Safety Board Act Amendments of 1990, Pub. L. 101-641, § 3(b), codified at 49 U.S.C. § 1114(c).

[12] National Transportation Safety Board Amendments Act of 2000, Pub. L. 106-424, § 5, codified at 49 U.S.C. § 1114(d).

[13] 49 U.S.C. § 1154.

Table 1. Damages incurred in previous accidents.

Location	Date	Fatalities	Injuries	Damages/Costs
Silver Spring, MD	Feb. 16, 1996	11	26	$7.5 million
Bryan, Ohio	Jan. 17, 1999	2		$5.3 million
Gunter, TX[a]	May 19, 2004	1	4	$2.1 million
Macdona, TX[b]	June 28, 2004	3	32	$5.85 million
Anding, MS	July 10, 2005	4		$10.1 million
Texarkana, AR[c]	Oct. 15, 2005	1		$2.3 million
Chatsworth, CA	Sept. 12, 2008	25	102	$12 million
Two Harbors, MN	Sept. 30, 2010		5	$8.1 million
Red Oak, Iowa	April 17, 2011	2		$8.7 million
Goodwell, OK	June 24, 2012	3		$14.8 million
Chaffee, MO[d]	May 25, 2013		2	$11 million
Bronx, NY	Dec. 1, 2013	4	59	$9 million
Total:		**56**	**230**	**$96.75 million**

[a] National Transportation Safety Board, *Collision Between Two BNSF Railway Company Freight Trains Near Gunter, Texas, May 19, 2004,* RAR-06/02 (Washington, DC: National Transportation Safety Board, 2006).

[b] National Transportation Safety Board, *Collision of Union Pacific Railroad Train MHOTU-23 With BNSF Railway Company Train MEAP-TUL-126-D With Subsequent Derailment and Hazardous Materials Release, Macdona, Texas, June 28, 2004,* Railroad Accident Report NTSB/RAR-06/03(Washington, DC: NTSB, 2006).

[c] National Transportation Safety Board, *Collision of Two Union Pacific Railroad Freight Trains, Texarkana, Arkansas, October 15, 2005,* Railroad Accident Brief NTSB/RAB-06/04 (Washington, DC: NTSB, 2006).

[d] National Transportation Safety Board, *Collision of Union Pacific Railroad Freight Train with BNSF Railway Freight Train Near Chaffee, Missouri, May 25, 2013*, RAR-14/02 (Washington, DC: National Transportation Safety Board, 2014).

Recently, two NTSB rail investigations were aided by inward-facing audio and image recorders. In a 2013 accident in which a Bay Area Rapid Transit train struck roadway workers, a digital audio and video recorder was mounted above the operator's seat in the lead car.[14] It was positioned to record the operator and the car control panel. The information gathered from the recording helped verify the accident sequence and provided an accurate timeline of events. In a second case, a Metrolink commuter train collided with a truck tractor on February 24, 2015, in Oxnard, California. The Metrolink locomotive was equipped with inward- and outward-facing audio and image recorders. Although the investigation is ongoing, the information provided by the inward-facing audio and image recorder has been critical in corroborating the engineer's description of events.

The need for recorded information—including audio and images—for operational and safety oversight is an important issue across transportation modes. The NTSB has made recommendations in aviation that address this issue for large transport category aircraft operations, as well as helicopter emergency services operations. Similarly, the NTSB issued recommendations for heavy commercial highway vehicles to require that motor carrier operators use recorded information for operational and safety oversight.

[14] National Transportation Safety Board, *Bay Area Rapid Transit Train 963 Struck Roadway Workers, Walnut Creek, California, October 19,* 2013, RAB-15/02 (Washington, DC: National Transportation Safety Board, 2015).

Recommendations

The NTSB continues to believe inward- and outward-facing audio and image recorders improve the quality of accident investigations and provide the opportunity for proactive steps by railroad management to improve operational safety. We have been encouraged by the inclusion of these recommendations previously proposed in rail safety legislation, and we hope this can be part of a rail safety legislative proposal that may be considered by this Congress. We are also encouraged that two Class I railroads and some commuter railroads have proceeded with installing in-cab audio and image recorder devices in their locomotives. Although we will continue to address the recommendation to individual railroads, we believe the FRA should take the lead on this important safety initiative. Because of this, the National Transportation Safety Board reiterates the following recommendations to the Federal Railroad Administration:

R-10-1

> Require the installation, in all controlling locomotive cabs and cab car operating compartments, of crash- and fire-protected inward- and outward-facing audio and image recorders capable of providing recordings to verify that train crew actions are in accordance with rules and procedures that are essential to safety as well as train operating conditions. The devices should have a minimum 12-hour continuous recording capability with recordings that are easily accessible for review, with appropriate limitations on public release, for the investigation of accidents or for use by management in carrying out efficiency testing and systemwide performance monitoring programs.

R-10-2

> Require that railroads regularly review and use in-cab audio and image recordings (with appropriate limitations on public release), in conjunction with other performance data, to verify that train crew actions are in accordance with rules and procedures that are essential to safety.

We are also making three recommendations to Amtrak pertaining to the installation of inward- and outward-facing audio and image recorders.

Chairman HART, Vice Chairman DINH-ZARR, and Members SUMWALT and WEENER concurred in these recommendations.

The NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives. We would appreciate a response within 90 days detailing the actions you have taken or intend to take to implement the recommendations. When replying, please refer to the safety recommendations by number. We encourage you to submit your response electronically to correspondence@ntsb.gov. If it exceeds 10 megabytes, including attachments, please e-mail us at the same address for instructions. Please do not submit both an electronic copy and a hard copy of the same response.

[Original Signed]

By: Christopher A. Hart,
Chairman

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: February 23, 2010

In reply refer to: R-10-1 and -2

The Honorable Joseph C. Szabo
Administrator
Federal Railroad Administration
1200 New Jersey Avenue, SE
East Building
Washington, D.C. 20590

About 4:22 p.m., Pacific daylight time, on Friday, September 12, 2008, westbound Southern California Regional Rail Authority (SCRRA) Metrolink train 111, consisting of one locomotive and three passenger cars, collided head on with eastbound Union Pacific Railroad (UP) freight train LOF65–12 (Leesdale Local) near Chatsworth, California. The Metrolink train derailed its locomotive and lead passenger car; the UP train derailed its 2 locomotives and 10 of its 17 cars. The force of the collision caused the locomotive of train 111 to telescope into the lead passenger coach by about 52 feet. The accident resulted in 25 fatalities, including the engineer of train 111. Emergency response agencies reported transporting 102 injured passengers to local hospitals. Damages were estimated to be in excess of $12 million.[1]

The National Transportation Safety Board determined that the probable cause of this accident was the failure of the Metrolink engineer to observe and appropriately respond to the red signal aspect at Control Point (CP) Topanga because he was engaged in prohibited use of a wireless device, specifically text messaging, that distracted him from his duties. Contributing to the accident was the lack of a positive train control system that would have stopped the Metrolink train short of the red signal and thus prevented the collision.

When Metrolink train 111 departed Chatsworth station (about 1 mile before CP Topanga), the engineer had time to observe and respond to the westbound signal at CP Topanga, which was displaying a red aspect. But the engineer was not recorded calling out this signal over the radio, and he clearly did not respond appropriately to the *stop* indication. The engineer's action, or lack of action, with regard to the red stop signal at CP Topanga suggests that he was not fully attentive to his primary task of operating his train safely. He did manipulate the train controls during this time, but these manipulations involved long-practiced and ingrained tasks

[1] For more information, see <http://ntsb.gov/publictn/2010/RAR1001.pdf>. *Collision of Metrolink Train 111 With Union Pacific Train LOF65–12, Chatsworth, California, September 12, 2008*, Railroad Accident Report NTSB/RAR-10/01 (Washington, DC: National Transportation Safety Board, 2010).

that he could carry out with little conscious effort and without being particularly focused on his work.

Records from the engineer's cell phone provider show activity on the engineer's wireless device between the time the train left the station and the time of the collision, indicating that the device was on and being used during that period. The records show that at 4:21:03 p.m., or 47 seconds after departing the station, the engineer received a 71-character text message on his wireless device. Sometime within the next minute he responded with a 32-character text message. This was the last text message the engineer sent or received before the collision.

Because wireless network records regarding "sent" times are less precise than those regarding "received" times, it cannot be known with certainty at what time the engineer pressed the "send" button on his wireless device to transmit his last message. But the content of the message clearly shows that it was in response to the previous message, which he had received just as the train was pulling out of the station. Thus, during at least part of the time that he could have been, and should have been, observing the signal at CP Topanga, the engineer was likely reading an incoming text message, formulating a response, and entering that response into his wireless device.

The train 111 engineer's participation in text messaging after departing Chatsworth station distracted him from adequately attending to a critical task—observing and properly responding to the signal indication at Topanga. He should have known to expect a red signal there because of the flashing yellow signal at CP Bernson that he had reported and the solid yellow signal (4451) he had passed only moments before. He may have thought, or hoped, that the signal would clear before his train reached it, but even this expectation would have required that he proceed while being prepared to stop and that he continue to observe the signal until his train reached it. He did neither. The engineer's operation of the train throttle, bell, and horn after he left the station, as well as his text messaging, indicated that he was alert and should have been able to operate his train in accordance with operating rules. But evidence gathered during the investigation suggests that, temporarily at least, the engineer was more attentive to his text messaging and to his anticipated meeting later that evening with young rail fans than he was to the safe operation of his train. The engineer's deficient performance reinforces the research findings that, in operational settings such as this, text messaging can lead to performance decrements related to distraction and inattention.[2] The National Transportation Safety Board (NTSB) concludes that the engineer of train 111 was actively, if intermittently, using his wireless device shortly after his train departed Chatsworth station, and his text messaging activity during this time compromised his ability to observe and appropriately respond to the *stop* signal at CP Topanga.

Train 111 Engineer's Pattern of Wireless Device Use

The investigation revealed that, between about 6:05 a.m. and 4:22 p.m. on the day of the accident, the engineer sent or received a total of 95 text messages. During the time periods

[2] Studies of the perceptual phenomenon known as "inattentional blindness" have demonstrated that distracted viewers can fail to detect critical visual stimuli even when they are fixating on those stimuli. See A. Mack and I. Rock, *Inattentional Blindness* (Cambridge, MA: MIT Press, 1998), for a complete discussion of the topic.

(morning and evening shifts) that he was responsible for operating a train, he sent 21 text messages, received 20 text messages, and made four outgoing telephone calls. The investigation further revealed that this amount of activity was not unusual for this engineer. Wireless records for the 7 days preceding the accident showed that on each workday, the engineer had sent or received text messages or made voice calls during the time he was responsible for operating a train. On the day with the least wireless activity, he sent or received (during his work period) about 30 text messages. On Wednesday, 2 days before the accident, he sent or received about 125 messages during the time he was responsible for operating a train. He had also made phone calls during these periods.

The *General Code of Operating Rules* and Connex operating rules forbid non-work-related and non-emergency use of personal wireless devices by operating crewmembers. In fact, the train 111 engineer was in violation of Connex operating rules simply by having his wireless device in the locomotive cab and turned on while he was at the controls of the locomotive or cab control car. But the engineer went further, from simply having the device to actually using it to read and compose messages during the time his primary task was to operate the train safely and to be attentive and properly responsive to all signal indications.

The engineer was well aware that he was violating company rules with regard to his use of a wireless device. In 2006, as part of an efficiency test, he was found to have his cell phone turned on in his briefcase. He said that he had forgotten to turn it off when he went on duty, but he was documented at that time as having failed to comply with company safety rules. Only about a month before the accident, the conductor on the engineer's train saw the engineer using his cell phone, and he reminded him of the prohibition. The conductor said the engineer acknowledged that such use was a violation of company rules. The conductor reported the incident to a supervisor who, according to testimony during the March 3 and 4, 2009, public hearing on this accident, once again counseled the engineer with regard to the rule regarding use of wireless devices. The NTSB concludes that the Metrolink engineer was aware that he was violating company safety rules when he used his cell phone to make calls or to send and receive text messages while on duty, but he continued the practice nonetheless.

Leesdale Local Conductor's Use of Wireless Device

The engineer of train 111 was not the only crewmember involved in this accident to have made prohibited use of a wireless device. The records indicate that the conductor of the Leesdale Local sent or received a total of 41 text messages while on duty, with 35 of these being sent or received during the time the conductor's report shows that the train was moving. His last outgoing text message was received and logged by the Verizon network at 4:20 p.m., about the time his train exited tunnel 27 and about 2 minutes before the collision.

Although the conductor was in the cab of the locomotive at the time he sent his last text message before the accident, he was not at the controls. And although he, along with the engineer, was responsible for observing signal indications and helping ensure compliance with those indications, no evidence was found to indicate that the train handling of the Leesdale Local was unusual or inconsistent with the signal indications the train was operating under. The NTSB therefore concludes that, although the conductor of the Leesdale Local violated operating rules

by sending and receiving text messages during times when he shared responsibility for the safe operations of his train, any distraction caused by such use did not cause or contribute to this accident.

Unauthorized Persons in Locomotive Cab

The prohibition against cell phone use was not the only company safety rule the engineer of train 111 knowingly violated. As was clear from the content of the text messages the engineer exchanged with a young rail fan identified in this investigation as "Person A," the engineer had, earlier in the week, allowed Person A and one or more friends to board his train and join him in the locomotive cab. The engineer apparently had allowed at least one of these individuals to operate the train for a portion of the trip. On the day of the accident, the engineer planned to have Person A and one or more others board the locomotive at the Moorpark station. He further planned to allow Person A and perhaps one or more others to actually operate the train from Moorpark to the end of the line at Montalvo. This plan was only about 3 1/2 hours from fruition when the accident occurred.

As with wireless devices, Connex had specific rules prohibiting unauthorized persons from occupying the locomotive cab or operating compartment of a train while the train was in service. The engineer was obviously aware of the rules because he conspired with the rail fans to have them board his train surreptitiously. Many of the text messages the engineer exchanged with Person A on the afternoon of the accident had to do with the planned boarding at Moorpark, with several comments reflecting full awareness, by both parties, that allowing unauthorized persons to board the train, not to mention actually operating it, constituted a violation of railroad rules.

Efficiency Testing and Management Oversight

The engineer of train 111 had been subject to efficiency and rules testing throughout his railroad career. Nothing exceptional was found in the records of this testing. As already noted, on two occasions in the previous 2 years he had been counseled about his use of a cell phone while on duty, but neither instance suggested a pattern of violations or an ongoing, willful disregard for the rules. And yet, as shown by his wireless account records (which would not have been available to Connex managers), the engineer habitually used his cell phone at times when he knew that any distraction from the task at hand could have serious safety consequences. Further, by actively encouraging and facilitating access by unauthorized persons to the locomotive cab, he created a situation that could pose another serious safety risk.

As acknowledged during the public hearing on this accident, the nature of rail operations makes enforcement of certain operating rules extremely difficult, if not impossible. Metrolink trains, as is common with other passenger trains, have only the engineer in the operating compartment. No reasonable method exists for management, by personal observation, to determine whether the engineer (or other crewmember) boards the train with a personal wireless device in his or her possession, and once the train leaves a station, no mechanism is currently in place to determine whether the device is in use.

The conductor on train 111, who 1 month before the accident had cautioned the engineer about his use of his cell phone while on duty and had taken the extra step of reporting the incident to a manager, stated that he believed this to be an isolated event and that he was not aware of the engineer's pattern of cell phone use while on duty. The engineer clearly took advantage of the privacy afforded by the locked locomotive cab to freely and repeatedly use his cell phone in violation of railroad operating rules. Even though this engineer and conductor had worked together 5 days a week, two shifts per day, for the previous 5 months, the conductor was not aware of the extent to which the engineer was using his wireless device while aboard the train. It is therefore unlikely that routine efficiency testing would ever have identified the scope of the engineer's violations with regard to wireless devices.

Similarly, the engineer's permitting of unauthorized persons to occupy the operating compartment of his locomotive stood a very low likelihood of being discovered through ordinary management supervision or efficiency testing. The engineer was familiar enough with his route and with the scope of management's oversight to be able to violate the rules without discovery. He had already allowed his rail fan friends one "ride-along" earlier in the week, and he knew where, when, and how they could again board his train undetected on the evening of the accident.

After the accident, Metrolink stiffened the penalty for unauthorized use of wireless devices by crewmembers on moving trains. Such violations will now result in immediate termination of employment. Similarly, with the issuance of Emergency Order 26, the Federal Railroad Administration (FRA) has raised violations involving the use of wireless devices to the Federal level. But making the violation more serious or the penalty more severe does not address the difficulty in identifying violators. With regard to both cell phone use and allowing unauthorized persons into his train's operating compartment, the train 111 engineer obviously had a high degree of confidence that his actions would not be detected.

As shown in the case of the conductor of the Leesdale Local, who also made inappropriate use of a wireless device to send a text message only minutes before the collision, even having other crewmembers present is an insufficient deterrent against such use.

The NTSB therefore concludes that, because of the privacy afforded by a locomotive cab or train operating compartment, routine efficiency testing and performance monitoring practices are inadequate to determine whether or to what extent engineers or other crewmembers may not be complying with safety rules such as those regarding use of wireless devices or allowing access by unauthorized persons.

In-Cab Audio and Image Recording Devices

The engineer in this accident was able to conceal his inappropriate behavior because he was aware each time he was, or could have been, observed by management. He would likely have been deterred in his cell phone use and in his allowing access to unauthorized persons only if he had known that his performance at the train controls was subject to review at any time, not just when a manager was in the operating compartment or nearby. The NTSB believes that the only reasonable and reliable mechanism for making such observations is an in-cab audio and

image recorder that will capture a crewmember's activities while in the train operating compartment.

The NTSB has long supported the installation of audio recording devices in locomotive cabs and train operating compartments. In all too many accidents, the individuals directly involved are either limited in their recollection of events or, as in the case of the Chatsworth accident, are not available to be interviewed because of fatal injuries. In a number of accidents the NTSB has investigated, a better knowledge of crewmembers' actions before an accident would have helped reveal the key causal factors and would perhaps have facilitated the development of more effective safety recommendations.

As a result of its investigation of the collision between a Maryland Rail Commuter train and an Amtrak train near Silver Spring, Maryland, on February 16, 1996,[3] in which no operating crewmembers survived, the NTSB was unable to determine whether certain crewmember activities leading up to the accident may have contributed to the accident. Consequently, the NTSB made the following recommendation to the FRA:

> R-97-9
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> Amend 49 *Code of Federal Regulations* Part 229 to require the recording of train crewmembers' voice communications for exclusive use in accident investigations and with appropriate limitations on the public release of such recordings.

After its investigation of another railroad accident with no surviving crewmembers that occurred in 1999 in Bryan, Ohio,[4] the NTSB reiterated Safety Recommendation R-97-9 to the FRA. The FRA responded that it

> has reluctantly come to the conclusion that this recommendation should not be implemented at the present time.… [The] FRA appreciates that, as time passes and other uses are found for recording media that may create synergies with other public and private purposes, the Board's recommendation may warrant re-examination.

Based on this response and further meetings, the NTSB classified Safety Recommendation R-97-9 "Closed—Unacceptable Action."

Since the refusal by the FRA to act on the recommendation regarding in-cab recorders, the NTSB has continued to investigate accidents in which such recorders would have provided valuable information to help determine probable cause and develop safety recommendations.

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[3] *Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29 Near Silver Spring, Maryland, on February 16, 1996*, Railroad Accident Report NTSB/RAR-97/02 (Washington, DC: National Transportation Safety Board, 1997).

[4] *Collision Involving Three Consolidated Rail Corporation Freight Trains Operating in Fog on a Double Main Track Near Bryan, Ohio, January 17, 1999*, Railroad Accident Report NTSB/RAR-01/01 (Washington, DC: National Transportation Safety Board, 2001).

Most recently, as a result of its investigation of a July 10, 2005, collision of two CN freight trains in Anding, Mississippi,[5] the NTSB made the following safety recommendation to the FRA:

> R-07-3
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> Require the installation of a crash- and fire-protected locomotive cab voice recorder, or a combined voice and video recorder, (for the exclusive use in accident investigations and with appropriate limitations on the public release of such recordings) in all controlling locomotive cabs and cab car operating compartments. The recorder should have a minimum 2-hour continuous recording capability, microphones capable of capturing crewmembers' voices and sounds generated within the cab, and a channel to record all radio conversations to and from crewmembers.

Investigators in those transportation modes where such recordings are available have not only been able to analyze voice communication between operating crewmembers in the moments leading up to an accident, but they have also been able to review and analyze other sounds originating from the vehicle. From such sounds, parameters such as engine rpm, system failures, speed, and the time at which certain events occur can often be determined, leading to more precise findings and determination of probable cause. The FRA indicated in its response to the NTSB's recommendation that the subject of in-cab video and audio recordings had been discussed at a meeting of the Railroad Safety Advisory Committee Locomotive Working Group. Pending more information about those discussions, Safety Recommendation R-07-3 was classified "Open—Acceptable Response" on July 31, 2009.

As is clear from the wording of Safety Recommendations R-97-9 and R-07-3, the NTSB's emphasis up to this point has been on the use of audio and/or image recordings as a tool of accident investigation. But this accident demonstrates that audio-only in-cab recordings that may be reviewed only after an accident do not represent the most effective use of recorder technology for accident prevention. Even if the Metrolink locomotive in this accident had been equipped with audio recording devices, the Metrolink engineer, with the appropriate settings on his wireless device, would most likely have been able to continue with his text messaging activities without the equipment having captured it.

The presence, in addition to audio recording capability, of in-cab image recording capability would have been the only means available to have determined exactly what actions the engineer was taking during the accident trip. These images would have revealed the engineer's text messaging activities even absent any sounds that could have been captured by an audio recorder. Similarly, any entry into the locomotive or train operating compartment by unauthorized persons would be evident on image recorders.

In accidents or incidents in which employee misbehavior is not a factor, in-cab audio and video recordings could be used to validate train crew performance as well as identify potential causal or contributory system design deficiencies or equipment malfunctions that may not be evident from other available parametric data.

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[5] *Collision of Two CN Freight Trains, Anding, Mississippi, July 10, 2005*, Railroad Accident Report NTSB/RAR-07/01 (Washington, DC: National Transportation Safety Board, 2007).

Some railroads have already installed one type of image recorder—a forward-facing video recorder—on their locomotives, primarily for use after grade crossing accidents. The two locomotives of the Leesdale Local were equipped with forward-facing video recorders. The output of those recorders was used in this accident investigation to validate the information drawn from signal data records. Although other evidence in this accident was sufficient to show conclusively that the engineer failed to comply with a red signal, forward-facing image and audio recorders can often be helpful in determining not only signal aspect, but also signal visibility, as well as in identifying other external factors that may influence a train crew's performance in the period leading up to an accident.

But even if audio and video recording devices had been installed in the Metrolink train 111 locomotive before this accident, they would not have contributed to preventing it so long as their output could be used only after the accident occurred. The NTSB has long advocated the use of recorded audio and images not only after an accident has occurred, but routinely, as part of management's efficiency testing and performance monitoring programs. In the same way that railroad operating employees are continually tested on signal compliance or speed control, audio and image recordings of engineers and other crewmembers could be reviewed at random to verify compliance with safety rules and procedures. In particular, this information could allow railroads to identify noncompliant behaviors and pursue corrective action before an accident occurs. Further, an employee who is aware that his or her activities in the train control compartment are subject to review by management will be much less likely to engage in conduct—such as using a wireless device or allowing unauthorized persons in the locomotive cab—that could lead to an accident. Even if an employee is not discouraged from performing these or other unsafe acts, detection of those behaviors would prompt corrective actions that would improve safety. Additionally, not all actions or conditions that have safety implications involve employee misconduct or rules violations. Regular review of in-cab audio and image recordings would give managers insight into other potential safety issues or unsafe operating practices that may not be revealed by any other means and of which the crews themselves may be unaware. Action could then be taken to address these issues through changes in rules, operating practices, or employee training programs.

The NTSB therefore concludes that a train crew performance monitoring program that includes the use of in-cab audio and image recordings would serve as a significant deterrent to the types of noncompliance with safety rules engaged in by the Metrolink engineer and the Union Pacific Leesdale Local conductor in this accident and would provide railroads with a more comprehensive means to evaluate the adequacy of their safety programs.

To be effective, any such recording devices must be capable of capturing crewmember activities during a wide range of operating conditions and over a considerable period of time. The image recorders should have a resolution and frame rate sufficient to capture crew movements under typical operating conditions, which includes daylight, night, and conditions of varying sun angles.[6] The duration of the recording should be at least 12 hours. Railroad

[6] International specifications for aircraft accident investigation recorders state a minimum frame rate of 4 images per second and overall resolution sufficient to distinguish between parallel 5 millimeter resolution bars on a standard image resolution chart. Source: *Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems*, ED-112 (Paris: The European Organisation for Civil Aviation Equipment, 2003).

crewmembers may be on duty for up to 12 hours, and their actions or inactions at any time during that period could set the stage for an accident. Also, from the standpoint of efficiency testing and performance monitoring, the more information that is available to management, the more likely it is that the company can assess the performance of its people or the effectiveness of its training.

If image and audio recordings are to be used to prevent, and not simply to reconstruct, accidents, railroad managers must be authorized to review the recordings regularly as part of their programs of efficiency testing and performance monitoring of train crews.

Therefore, the National Transportation Safety Board makes the following recommendations to the Federal Railroad Administration:

> Require the installation, in all controlling locomotive cabs and cab car operating compartments, of crash- and fire-protected inward- and outward-facing audio and image recorders capable of providing recordings to verify that train crew actions are in accordance with rules and procedures that are essential to safety as well as train operating conditions. The devices should have a minimum 12-hour continuous recording capability with recordings that are easily accessible for review, with appropriate limitations on public release, for the investigation of accidents or for use by management in carrying out efficiency testing and systemwide performance monitoring programs. (R-10-1)
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> Require that railroads regularly review and use in-cab audio and image recordings (with appropriate limitations on public release), in conjunction with other performance data, to verify that train crew actions are in accordance with rules and procedures that are essential to safety. (R-10-2)

The National Transportation Safety Board has also reclassified the following safety recommendation previously issued to the Federal Railroad Administration:

> <u>R-07-3</u>
>
> Require the installation of a crash- and fire-protected locomotive cab voice recorder, or a combined voice and video recorder, (for the exclusive use in accident investigations and with appropriate limitations on the public release of such recordings) in all controlling locomotive cabs and cab car operating compartments. The recorder should have a minimum 2-hour continuous recording capability, microphones capable of capturing crewmembers' voices and sounds generated within the cab, and a channel to record all radio conversations to and from crewmembers.

Because Safety Recommendation R-10-1, issued as a result of this accident investigation, expands upon and reinforces the intent of Safety Recommendation R-07-3, that recommendation, which was previously classified "Open—Acceptable Response," is reclassified "Closed—Unacceptable Action/Superseded."

In response to the recommendations in this letter, please refer to Safety Recommendations R-10-1 and -2. If you would like to submit your response electronically rather than in hard copy, you may send it to the following e-mail address: correspondence@ntsb.gov. If your response includes attachments that exceed 5 megabytes, please e-mail us asking for instructions on how to use our Tumbleweed secure mailbox procedures. To avoid confusion, please use only one method of submission (that is, do not submit both an electronic copy and a hard copy of the same response letter).

Chairman HERSMAN, Vice Chairman HART, and Member SUMWALT concurred in these recommendations. Chairman Hersman filed a concurring statement, in which Vice Chairman Hart and Member Sumwalt joined, which is attached to the final Railroad Accident Report.

[Original Signed]

By: Deborah A.P. Hersman
Chairman