National Transportation Safety Board

Washington, D.C. 20594

Railroad Accident Brief

Accident No:	DCA-02-FR-010
Railroads:	National Railroad Passenger Corporation (Amtrak) Maryland Transit Administration MARC Train Service (MARC)
Trains:	Amtrak train No. 90 (*The Palmetto*) consisting of 2 locomotive units and 11 cars MARC train No. 437 consisting of 1 locomotive unit and 7 cars
Location:	Baltimore, Maryland
Accident date and time:	June 17, 2002, 5:42 p.m. eastern daylight time
Type of Accident:	Collision/sideswipe
Injuries:	Six minor injuries; all injured were treated and released
Property Damage:	$740,000

The Accident

About 5:42 p.m. eastern daylight time on June 17, 2002, northbound Amtrak train No. 90, *The Palmetto*, collided with southbound MARC train No. 437 in Baltimore, Maryland. Amtrak train No. 90 consisted of 2 locomotives and 11 cars (2 mail handlers, 4 coaches, 1 dinette car, 1 baggage car, and 3 RoadRailers[1]). There were 141 passengers and 6 crewmembers on board. MARC train No. 437 consisted of 1 locomotive and 7 cars. There were 60 passengers and 4 crewmembers on board. The collision resulted in six minor injuries.[2]

The engineer of the Amtrak train was an extra-board[3] employee based in New York City. On the day of the accident, the engineer deadheaded[4] from New York to

[1] A *RoadRailer*® is a highway semitrailer that is adapted for mounting on special railway trucks for movement by rail. At the railroad terminal destination, the trailer is removed from the rail trucks and taken to the final destination by highway.

[2] The accident resulted in minor injuries to three MARC passengers, one MARC conductor, one Amtrak passenger, and one Amtrak conductor.

[3] An *extra-board* employee does not have an assigned job but is called as necessary either to substitute for a regular employee who is unavailable for duty or to serve as a crewmember on an unscheduled run.

[4] Refers to a crewmember traveling by train in a non-operational status.

Washington, D.C., to operate Amtrak train No. 90, *The Palmetto*, from Washington to New York.

The engineer told investigators that when she arrived in Washington, she was surprised to learn that the train she was to operate was being pulled by two diesel-electric P-42 locomotives. She said she expected to operate electric equipment on this run, as she had on other occasions. She said her experience in operating P-42s was limited to training and operating in a yard environment and that she had never operated P-42s in revenue service.[5] Amtrak stated that according to its records, the engineer, under the observation of a designated supervisor of locomotive engineers, had operated a train with 2 P-42 locomotives and 16 cars during a December 4, 2001, passenger run between Philadelphia and Washington. Amtrak could find no records to indicate that the engineer was assigned to operate a diesel-electric locomotive in revenue service, either alone or under observation, in the 6 months between December 2001 and the accident in June 2002.

Train No. 90 departed Union Station on time at 4:45 p.m. with the engineer as the only person in the locomotive cab. The engineer said that as the train proceeded out of the station and began to enter the main line, she experienced a penalty air brake application, which stopped the train. The engineer determined that the territory switch[6] was improperly positioned. The engineer stated that the electric locomotives she normally operated within the Northeast Corridor always had cab signals activated and thus did not require that the territory switch be repositioned. The engineer said that she had received a similar penalty brake application on an earlier occasion sometime before January 2002, again because the locomotive cab signals of an Acela train set were not properly configured when she departed Washington, D.C., for New York City. She stated that she was not at fault on that occasion because she was not familiar with that equipment.

The engineer said that after she reported the penalty stop, as required, the trip north toward Baltimore was uneventful, with the exception of being routed around a disabled train near Landover, Maryland.

The engineer stated that as she approached the tunnel in Baltimore, she received an approach medium signal indication, which required a speed reduction to 45 mph.[7] The signal was followed by an approach signal indication, which authorized her to proceed through the tunnel at not more than 30 mph. The engineer said that while traversing the tunnel, she concentrated on maintaining a train speed of 30 mph. She said her "…concentration was on keeping the speed down."

[5] The engineer was hired as a conductor in 1997 and was selected for engineer training in May 2000. She was qualified as an engineer on the territory between New York City and Washington in December 2001.

[6] The *territory switch* controls the system that, in territory so equipped, displays signal indications inside the locomotive cab. When the locomotive is operating in cab signal territory, the territory switch is properly positioned when it is placed in the "in" position. Because the lead locomotive of the accident train had been operating in non-cab signal territory before arriving at Union Station, the territory switch was in the "out" position. If the train is operated above 20 mph in cab signal territory without the switch being properly positioned, the train will receive a penalty brake application.

[7] She had been traveling at or below 30 miles per hour.

The engineer recalled that the brake system for train No. 90 was configured in the direct-release position, as opposed to the graduated-release air brake setup with which she said she was more familiar.[8] She also said she normally engaged the dynamic brakes[9] in electric locomotives but that she "…was not familiar with how to…control the train using the dynamic on those P-42s." Rather, she said she used the automatic brake[10] to slow the train's speed through the tunnel.[11] The engineer said that the track was on a descending grade as it approached the end of the tunnel and that as she traversed this section, her throttle was off and that the train pushed her along. She recalled that she initially used the independent brake (applying to the locomotives only) to slow the train but worried about causing flat spots.[12]

Locomotive event recorder data showed that after receiving the approach signal, the train received a restricting signal indication. This signal required that the engineer reduce train speed below 20 mph and operate the train in a manner that would permit stopping within half the range of vision short of a stop signal. Although the engineer said she did not recall receiving the restricting signal indication, the event recorder showed that she acknowledged receipt of the signal and that she did slow the train to less than 20 mph.

The engineer said she continued to operate on an approach signal until she exited the tunnel, and that "…to my recollection, the only other signal, the only thing I had in the cab was an approach." She said she was not distracted while traversing the tunnel and that she was "just trying to control these two motors. My concentration was on keeping the speed down."

Two main tracks, track No. 2 to the east and track No. 3 to the west, are in the vicinity of the accident. The two main tracks diverge into the station tracks for Baltimore's Penn Station. Train No. 90 was operating on track No. 2 through the tunnel. Meanwhile, southbound MARC train No. 437 was operating on a permissive diverging aspect at the interlocking signal outside the station. The route lined through the Charles Interlocking was a crossover route from station platform track No. 5 to the No. 2 main track, continuing through the crossover to the No. 3 main track. While train No. 437 was traversing the interlocking, the signal governing the movement of train No. 90 on No. 2 main track was displaying a stop indication.

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[8] In direct-release mode, the brakes are either applied or they are released, as opposed to graduated-release mode, in which brake application pressure can be modulated.

[9] *Dynamic braking* is a method of train braking whereby the kinetic energy of a moving train is used to generate electric current through the locomotive's traction motors. This current is dissipated as heat through banks of resistor grids in the locomotive car body.

[10] The *automatic brake* refers to the pneumatic train braking system that is controlled by the engineer and that applies, releases, and recharges the air brake system. This system also automatically applies emergency braking if the train should become uncoupled or experience any other failure that bleeds air from the braking system.

[11] Event recorder data showed that the engineer did use the locomotive's dynamic brakes but that the brakes were deactivated within about 1 minute of the time she applied emergency brakes in an attempt to prevent the collision with the MARC train.

[12] *Flat spots* on locomotive wheels result when the wheels lock and slide along the rails.

The train No. 90 engineer said that as her train rounded a curve after leaving the tunnel, she saw the MARC train crossing over in front of her. She said that she "went for the brake" but that she could not recall if she "put it in emergency all the way or what."

According to event recorder data, train No. 90 was traveling about 15 mph when the engineer put the train into emergency braking. The left leading corner of the lead Amtrak locomotive struck the 4th car from the head-end of the MARC train. The 5th and 6th cars on the MARC train derailed upright, and the lead truck of the Amtrak locomotive derailed. The collision occurred about 330 feet north of the signal governing the movements of northbound trains, such as train No. 90, through the Charles Interlocking.

The circumstances of the accident are consistent with evidence that the engineer lost situational awareness as her train traveled through the tunnel toward Penn Station. One researcher[13] has defined situation awareness as "the (1) perception [noticing] of the elements in the environment, the (2) comprehension of their meaning, and the (3) projection of their status in the near future." In simpler terms, situational awareness "…is knowing what is going on around you."[14] While there exist a number of clues to loss of situational awareness, including use of improper procedures and not watching for hazards or unresolved discrepancies, one in particular appears relevant to the circumstances of this accident: fixation or preoccupation. When people fixate on or become preoccupied with a certain task, their ability to detect and respond appropriately to other important information can be degraded or lost. The engineer said that as her train traveled through the tunnel she focused on the speed of the train. The fact that the engineer was not comfortable with P-42 equipment likely exacerbated her excessive focus on regulating her train's speed through the tunnel, to the exclusion of more significant stimuli, such as responding appropriately to a change in cab signals governing the movement of her train.

Actions Taken Since the Accident

Since the accident, Amtrak representatives have stated that the company has thoroughly reviewed the procedures used to track and document the demonstrated proficiencies of student engineers. Specifically, forms used to document each student's training, on-the-job experience, and qualifications to operate various types of equipment have been significantly revised. In addition, Amtrak has developed and implemented a new form designed to document when an engineer operates a specific type of locomotive within Amtrak's locomotive inventory.

Before the accident, a designated supervisor of locomotive engineers would accompany and evaluate engineers at least once every 6 months after the engineers completed 1 full year of service. Immediately following the accident, Amtrak amended its evaluation program to permit greater scrutiny of the proficiency of its newly promoted engineers, as well as of its experienced engineers who were newly hired from other

[13] M.R. Endsley, "Theoretical Underpinnings of Situation Awareness," eds. M.R. Endsley and D.J. Garland, *Situation Awareness Analysis and Measurement (*Mahwah, N.J.: Erlbaum, 2000), pp 1-21.

[14] Geiss-Alvarado Associates, *Human Error Accident Training*, U.S. Coast Guard training manual, July 1991.

carriers. These engineers are now observed and evaluated by a designated supervisor of locomotive engineers at least once each month for the first year following their promotion or hiring. After completing a full year of service, Amtrak engineers are then routinely observed and evaluated at least once every 6 months.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the Amtrak engineer's loss of situational awareness in the moments before the collision because of excess focus on regulating train speed, which led to a failure to comply with signal indications. Contributing to the accident was the engineer's lack of familiarity with and proficiency in the operation of the diesel-electric locomotives assigned for the trip and the lack of a positive train control system.

Adopted: May 12, 2003