

**Washington Metropolitan Area Transit Authority
Board Action/Information Summary**

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TITLE

Automatic Train Control (ATC) Update

PRESENTATION SUMMARY

Provide an overview of the major steps that Metro is undertaking to transition from Manual Train Operation back to Automatic Train Operation (ATO).

PURPOSE

The purpose of this presentation is to provide the Committee a briefing on Metro's plan to ensure the timely and successful reactivation of ATO.

DESCRIPTION

Key Highlights:

- The National Transportation Safety Board (NTSB) has closed all Metro safety recommendations issued in the wake of the 2009 Fort Totten collision which directly related to ATC.
- ATO will provide a smoother ride to our passengers through software controlled acceleration and programmed braking profiles.
- The Red Line ATO reactivation will be implemented in March 2015 after successful completion of reactivation process certification and operator/technician familiarization training.
- The ATO reactivation of remaining lines is scheduled to begin in Fall 2017.

Background and History:

The Automatic Train Control (ATC) network provides for the safe and efficient movement of trains through a series of track circuits and integrated logic for routing controls and speed controls. Major subcomponents of the ATC network include Automatic Train Operation (ATO) and Automatic Train Protection (ATP). ATO is a system that uses integrated logic between the wayside system where the train speeds and braking are regulated automatically without required intervention from the operator. ATP is the system that provides safe train separation through the same network but where the operator is in direct control of the train speed and braking. It should be noted that while the train is in "manual" control, the ATP is still active and any violation of speed command by the operator will cause the train to automatically

reduce speed, thereby resulting in the safe separation of trains or automatic train protection. ATO is desirable because of the efficiency and consistency of accelerating and braking provided by the trains on-board ATC system. Therefore, Metro is taking a systematic and calculated approach to returning to ATO.

WMATA's train control system is capable of operating trains in automatic mode by maintaining train separation, automatic routing based on destination, stopping at platforms, and opening train doors. Prior to June 22, 2009, this was the standard mode of operation.

After the June 22, 2009 train collision near the Fort Totten station, automatic operation was suspended by WMATA. The National Transportation Safety Board performed a broad-spectrum investigation and issued a series of recommendations covering hardware, audits, testing and real time alerts of potentially hazardous situations, which directly related to ATC. Some of the related recommendations include:

- R-10-8: Because of the susceptibility to pulse-type parasitic oscillation that can cause a loss of train detection by the Generation 2 General Railway Signal Company audio frequency track circuit modules, establish a program to permanently remove from service all of these modules within the Metrorail system.
- R-10-9: Establish periodic inspection and maintenance procedures to examine all audio frequency track circuit modules within the Metrorail system to identify and remove from service any modules that exhibit pulse-type parasitic oscillation.
- R-10-12: Conduct a comprehensive safety analysis of the Metrorail automatic train control system to evaluate all foreseeable failures of this system that could result in a loss of train separation, and work with the train control equipment manufacturers to address in that analysis all potential failure modes that could cause a loss of train detection, including parasitic oscillation, cable faults and placement, and corrugated rail.
- R-10-13: Based on the findings of the safety analysis recommended in R-10-12, incorporate the design, operational, and maintenance controls necessary to address potential failures in the automatic train control system.
- R-10-14: Implement cable insulation resistance testing as part of Metrorail's periodic maintenance program.
- R-09-6: Take action to enhance the safety redundancy of the train control system by evaluating track occupancy data on a real-time basis in order to detect losses in track occupancy and automatically generate alerts. Alerts should prompt actions that include immediately stopping train movements or implementing appropriate speed restrictions to prevent collisions.

Metro contracted an independent consultant to perform a safety analysis of the automatic train control system to address the NTSB recommendations.

The ATC Safety Analysis primary focus is the wayside audio frequency track circuit system and the car bourn ATC system with hazard analysis of the operating and support functions as well as specific components level subsystem analysis. The primary analysis findings fall in two major categories:

1. Process - Addressed with updated preventative maintenance and testing guidelines, standard specifications and operating procedures; and
2. The original product safety cases for the track circuits produced at the time of manufacture did not include all requirements of present day safety cases. Closure of these findings has been accomplished through various methods of update to safety cases, review of service history and replacement or upgrade to equipment.

This independent review was initiated in 2010 and all analysis has been concluded. A final report was provided to the NTSB for closure of the recommendation.

Discussion:

WMATA is preparing to return to ATO after operating in manual mode since 2009. Currently trains have been operated (driven) by train operators who control train speed, acceleration, slowing and stopping, and opening and closing the doors. Manual operation is less efficient and contributes an inconsistent 'jerky' ride for passengers due to sudden increases in speed and harsh braking. This also creates added wear on train components increasing maintenance costs.

ATO will provide a smoother ride to our passengers through software controlled acceleration and programed braking profiles. Automatic operation also improves train spacing which improves the flow and predictability of trains through stations.

Metro has been undertaking major steps to return to ATO for the safe and efficient movement of trains throughout the system. The major steps include:

- Organizational changes
- Development and implementation of processes, equipment, and procedures
- Deployment of the right equipment and tools
- Closure of NTSB recommendations issued in the wake of the 2009 Fort Totten collision which directly related to ATC:
 - ATC System Safety Analysis
 - Replacement of GRS Generation II Track circuits
 - Track Circuit Monitoring Tool or Loss of Shunt detection
 - ATC-1000, 2000 and 3000
- Safety Reactivation Certification

Due to the discovery that parasitic oscillations within Alstom Generation II Audio Frequency Track Circuits (AFTC) contributed to the June 22 collision, WMATA decided to replace all Generation II AFTCs before authorizing a return to ATO on any given rail line.

Beginning in 2012, Metro staff started the replacement of all Alstom Generation II Audio Frequency Track Circuit modules with Ansaldo AF-800W AFTC modules thus eliminating the parasitic oscillation hazard. All Generation II modules have been replaced on the Red Line; therefore Metro is in the process of reactivating ATO between Glenmont and Shady Grove stations.

AFTC replacements are required to be certified prior to operations. All AFTC modules installed to replace Generation II on the Red Line have been tested and have Installation Safety Certificates from the manufacturer.

Metro have established a comprehensive reactivation process certification which allows the Department of Safety & Environmental Management (SAFE) to certify all steps necessary for reactivation have been completed. The reactivation process, which will be shared with the Tri-State Oversight Committee, includes:

- Track Circuit replacement with the Federal Transit Administration (FTA) Safety Certifiable Item List (SCIL)
- Closure of NTSB recommendations (including system safety analysis)
- Review of the safety analysis by Burns Engineering
- Review of requirements for ATO operation by CH2MHill
- Training schedule
- Vehicle and maintenance departments schedule for readiness

The Red Line ATO reactivation will be implemented in March 2015 after successful completion of reactivation process certification and operator/technician familiarization training.

The ATO reactivation of remaining lines is scheduled to begin in Fall 2017.

FUNDING IMPACT

Information item only.

TIMELINE

Previous actions	<ul style="list-style-type: none"> • March 11, 2010: Presentation to the Customer Service and Operations Committee on "Manual vs. Automatic Train Operation and Operational Restrictions"
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	<ul style="list-style-type: none"> • November 01, 2012: Presentation to the Safety and Security Committee on "Automatic Train Control (ATC) Update" • June 13, 2013: Presentation to the Safety and Security Committee on "Automatic Train Control System Update" • April 24, 2014 Presentation to the Safety and Security Committee on "Automatic Train Control (ATC) Update"
<p>Anticipated actions after presentation:</p>	<ul style="list-style-type: none"> • Future Board information items will be brought for review, as needed

RECOMMENDATION

N/A

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Automatic Train Control (ATC) Update

Safety and Security Committee

September 24, 2014

Automatic Train Control (ATC)

ATC – *“To provide for the safe and efficient movement of trains”*

The track circuit is the foundation of that principle. Metro uses audio frequency track circuits (AFTC) which provide for:

- Train detection
- Train separation
- Speed control
- Integrated routing logic

Major subcomponents include:

- Automatic Train Protection (ATP)
- Automatic Train Operation (ATO)





Steps to Automatic Train Operation (ATO)



*NTSB= The National Transportation Safety Board



Major National Transportation Safety Board (NTSB) Recommendations

R-10-08: Replace Generation II track circuit

CLOSED

R-10-09: Establish periodic inspection to examine for pulse-type parasitic oscillation

CLOSED

R-09-006: Develop real-time loss of shunt detection

CLOSED

R-10-014: Implement cable resistance testing

CLOSED

R-10-012: Perform System Safety Analysis (SSA) on ATC network

CLOSED

R-10-013: Implement programs to resolve findings of R-10-12

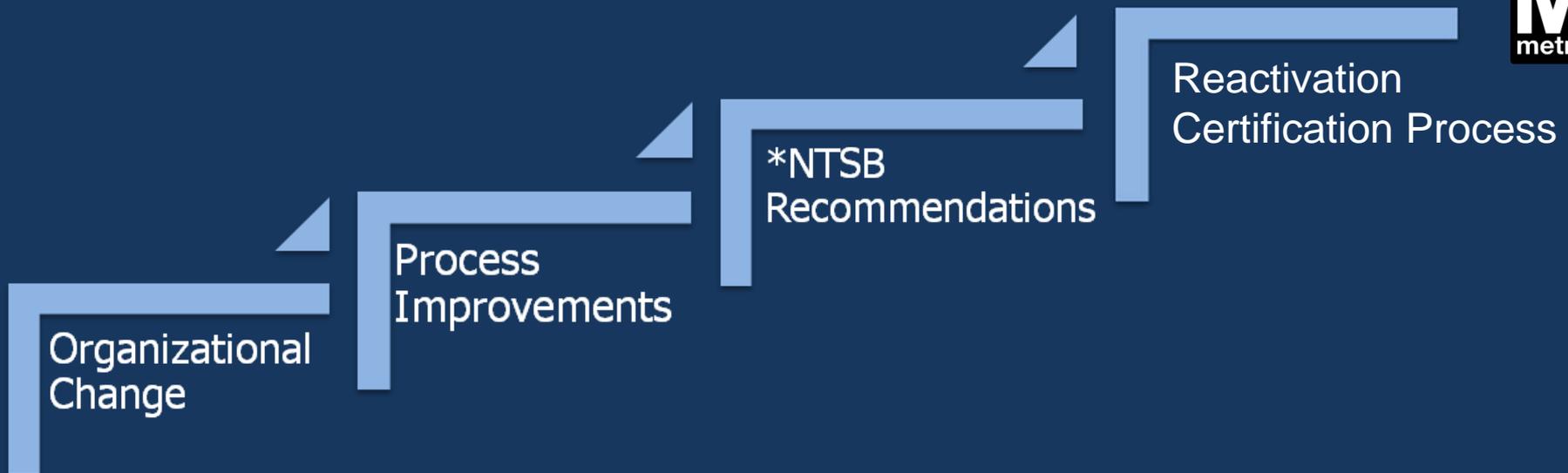
CLOSED





Steps to Automatic Train Operation (ATO)

 ATO



*NTSB= The National Transportation Safety Board



ATO Implementation

