



Safety and Service Delivery Committee

Information Item III-A

December 14, 2017

Automatic Train Operation Update

Washington Metropolitan Area Transit Authority
Board Action/Information Summary

<input type="radio"/> Action <input checked="" type="radio"/> Information	MEAD Number: 201939	Resolution: <input type="radio"/> Yes <input checked="" type="radio"/> No
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TITLE:

Update on Automatic Train Operation

PRESENTATION SUMMARY:

Provide an overview of the steps underway to analyze the transition from manual train operation to Automatic Train Operation (ATO).

PURPOSE:

The purpose of this presentation is to provide the Committee a briefing on WMATA's progress in evaluating the return to ATO.

DESCRIPTION:

Key Highlights:

- Returning to ATO has many benefits for both the riding public and Metro's assets.
- Returning to ATO requires an operational review that will take in consideration system changes that have occurred since June 2009.
- Metro is outsourcing a review that will evaluate the impacts of returning to ATO.

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 Protection (ATP), Automatic Train Supervision (ATS), and Automatic Train Operation (ATO).

ATO is a system that uses integrated logic between the wayside system where the train speeds and braking are regulated automatically without requiring 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 train's on-board ATC system. Therefore, WMATA is taking a systematic and comprehensive approach to evaluating the return 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.

WMATA will be contracting an independent consultant to perform a safety analysis of returning to ATO.

Discussion:

WMATA is reviewing the potential return to ATO after operating in manual mode since 2009. Currently trains have been operated 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 sudden braking. This also creates added wear on train components, thus increasing maintenance costs.

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

Several changes in the operations environment have taken place over the last eight years that will need to be considered in any resumption of ATO. These include ensuring that ATO is compatible with the enhanced Roadway Worker Protection (RWP) measures that have been recently instituted (e.g., advanced mobile flagger). Standard operating procedures and ATC system upgrades need to be reviewed to ensure they are compatible with how the system functions. Finally, operators will need to be trained on how to operate under ATO, and mechanics need to be trained on how to program and repair the integrated systems.

WMATA is engaging a third party expert to conduct an analysis that will review the return to ATO. This analysis will be divided into two phases: evaluation and then determine if WMATA should proceed to implementation.

Under the evaluation phase, past incidents (prior to June 2009) will be reviewed that may have involved ATO. This will determine if similar failures have been mitigated or if further action is required. The analysis will also review the transition from ATO to manual operations in conjunction with RWP safeguards assuring workers' safety.

A validation of ATS and ATO functionality will also be performed. This will validate all ATS and ATO functions via the Rail Operations Control Center (ROCC), wayside, and rail vehicle-based. A review of Standard Operating Procedures (SOPs) of the same functions will also occur. This will ensure that any SOPs that have been developed since 2009 are compatible with the system's functions.

Findings and any necessary recommendations will be developed at the end of the analysis. This will also include technical enhancements, and additional equipment and software that would further support ATO.

After review of the evaluation findings, a determination will be made to continue with the second (implementation) phase. This phase will include a cost/benefit analysis on moving to ATO, updated draft SOPs, training materials for ROCC staff and Rail Transportation operators. Training will include both computer based training and mainline 'seat' training. Finally, a detailed implementation plan will be developed that would list the sequence of events, timelines, and required actions to restore ATO.

A separate study will be conducted in 2018 to evaluate Communication-Based Train Control technology. This newer technology provides enhanced RWP features and increased capacity.

FUNDING IMPACT:

Information item only.	
Project Manager:	Patrick Lavin
Project Department/Office:	SAFE

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" • 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 (ATC) System Update" • April 24, 2014: Presentation to the Safety and Security Committee on "Automatic Train Control (ATC) Update" • September 24, 2014: Presentation to the Safety and Security Committee on "Automatic Train Control (ATC) Update"
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Anticipated actions after presentation	Future Board information items will be brought for review, as needed.



Washington Metropolitan Area Transit Authority

Update on Automatic Train Operation

Safety and Service Delivery Committee
December 14, 2017

Agenda

- History
- Automatic Train Control
- Automatic Train Operation Benefits
- Operations Changes
- Automatic Train Operation Review
 - Two Phased Approach
 - Evaluation
 - Implementation
- Additional Considerations





Automatic Train Operation History

- December 1969: Metro Breaks Ground at Judiciary Square
- March 1976: System Opens

- June 2009: Fort Totten Collision
- June 2009: All ATO use discontinued

- April 2015: Red Line ATO Pilot commenced; discontinued shortly thereafter

Automatic Train Operation

ATO

Automatic Train Control

Automatic Train Control (ATC)

[Operating System]

Automatic Train
Protection
(ATP)

[Safe train separation,
movement]

Automatic Train
Supervision
(ATS)

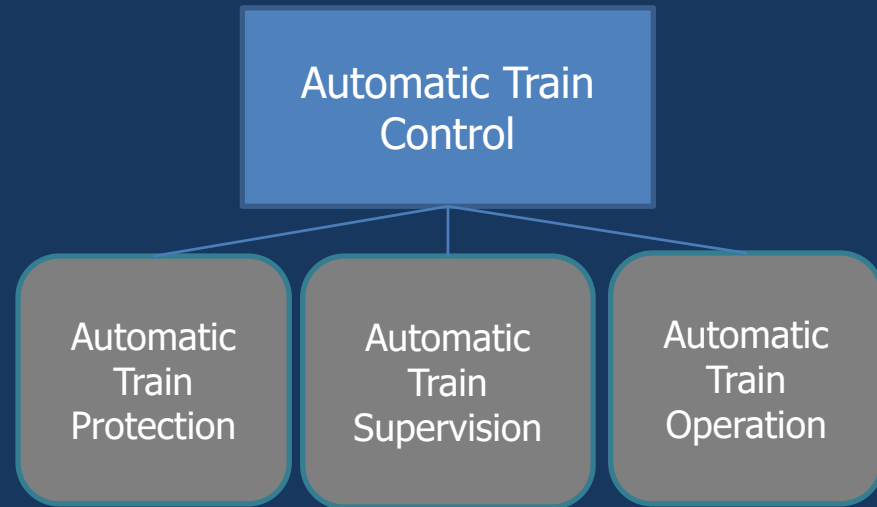
[Safe train routing,
schedule adherence]

Automatic Train
Operation
(ATO)

[Safe automated train
operation]

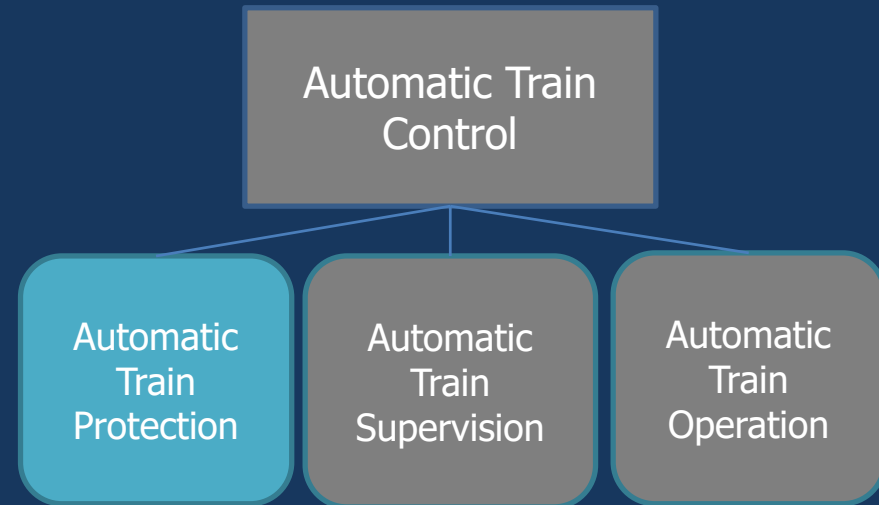
Automatic Train Control

- Provides for the safe and efficient movement of trains through a series of track circuits and integrated logic for train routing and speed controls
- Major subcomponents of the Automatic Train Control network include:
 - Automatic Train Protection (ATP)
 - Automatic Train Supervision (ATS)
 - Automatic Train Operation (ATO)



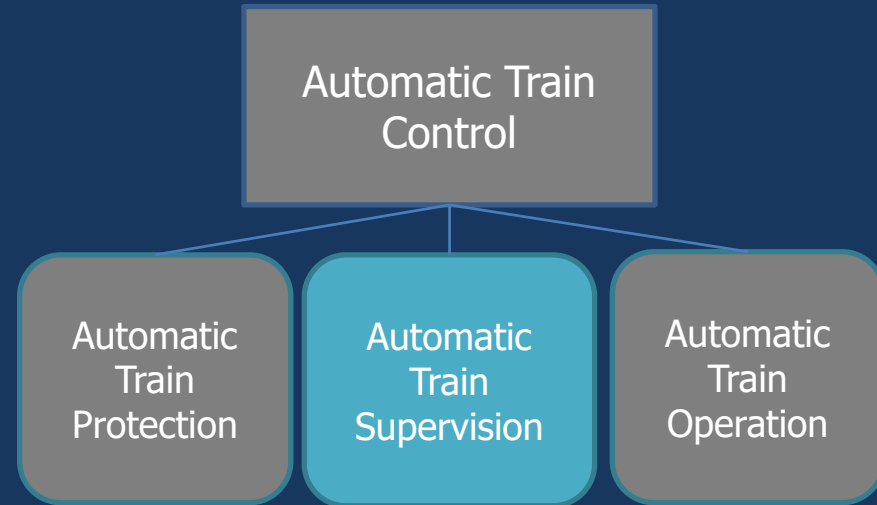
Automatic Train Protection

- Primary safety system that protects train movement (manual/automatic)
- Always active whether operating in “manual” or “automatic” mode
 - Provides safe train separation by detecting trains in track circuits
 - Enforces speed commands and overrides the actions of the train operator



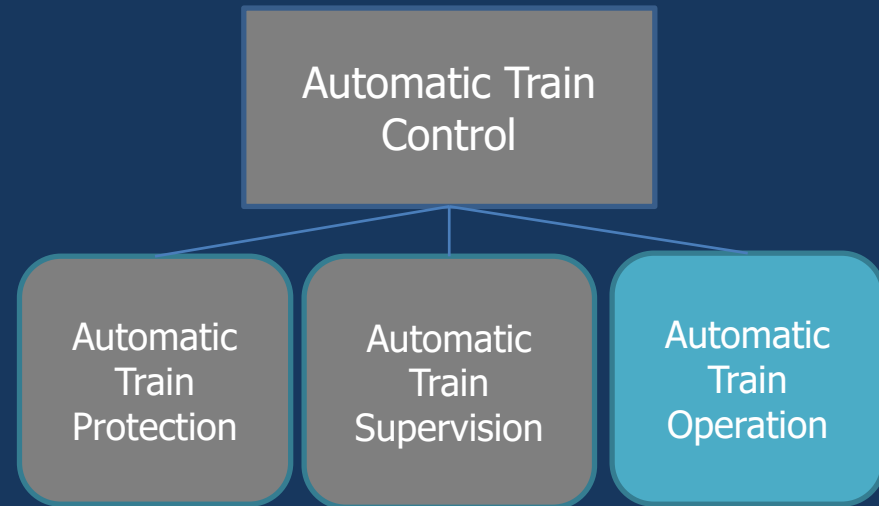
Automatic Train Supervision

- Supervision provides:
 - Dispatching functions
 - Headway management
 - Routes trains
 - Assists in maintaining adherence to schedule



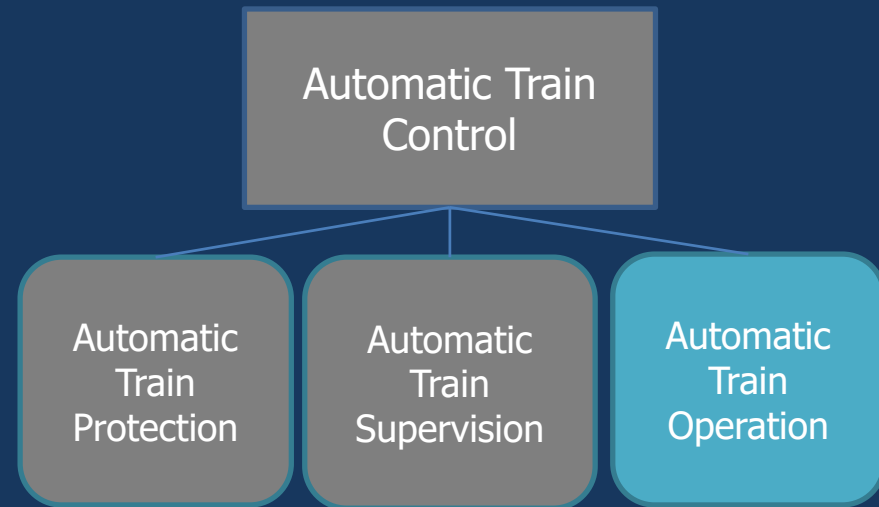
Automatic Train Operation

- Automatic Train Operation does not mean “No Operator”
- Train speeds governed by the Automatic Train Protection sub-system and routed by the Automatic Train Supervision sub-system
- Automatic Train Operation can provide train berthing and door commands at stations



Automatic Train Operation

- Disabled in June 2009
- Not a safety-critical system
- Piloted along the Red Line starting in April 2015
 - Only eight car trains (limited availability) during rush hour
 - One direction
- Effort ceased due to more pressing concerns





Automatic Train Operation Benefits

- Smoother ride
- Improves schedule adherence
- Improves power utilization
- Reduces maintenance costs (e.g., wheel flats, master controllers)
- Reduces red signal overruns
- Reduces wrong-side door openings



Operation Changes

- Roadway worker protection (RWP)
- Automatic Train Control system upgrades since 2009
- Changes in Workforce
 - Train Operators
 - Vehicle Mechanics
 - ATC Mechanics

Automatic Train Operation Review

- Review to address two-phased approach
 - Evaluation
 - Implementation





Evaluation

- Safety Analysis
 - Review of past incidents
 - RWP impacts
- Validation of Automatic Train Operations functionality (e.g., interface with the Automatic Train Supervision system)
- Standard operating procedure review
 - Rail Operations Control Center
 - ATC technicians and mechanics
 - Rail vehicles (Class 1)

- Proposed technical enhancements
- Findings and recommendations
- Determine if WMATA should proceed to Automatic Train Operation





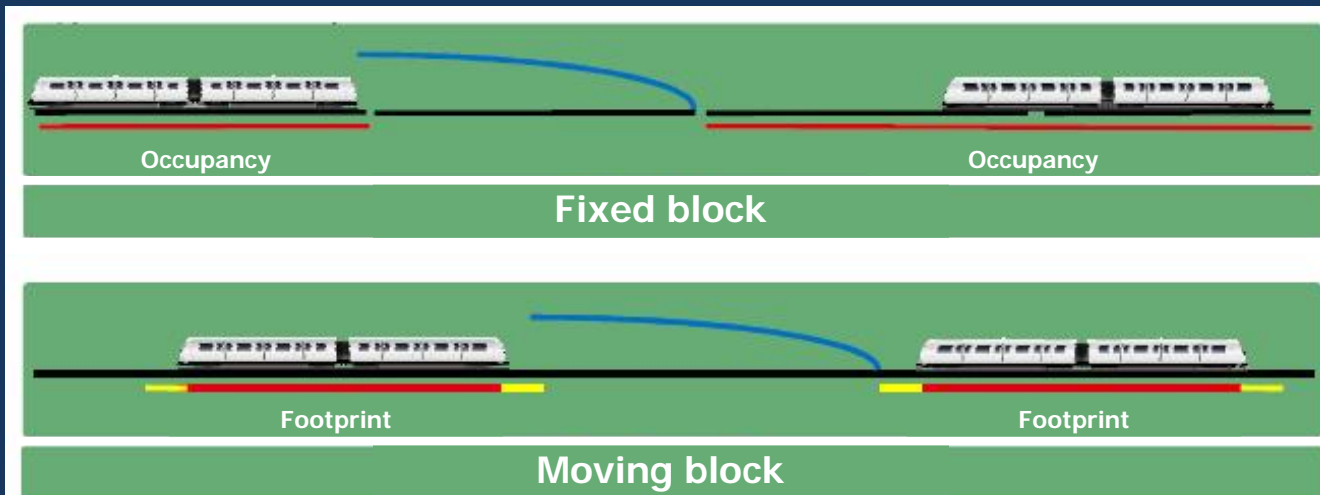
Implementation

- Cost / Benefit Analysis & Funding
- Implementation Plan
- Scheduling and Tracking
- Training
 - Rail Operations Control Center
 - Train Operators
 - ATC Engineers
 - Rail Car Equipment Mechanics



Additional Considerations

- Communication-Based Train Control (CBTC)
 - Newer technology
 - Enhanced RWP features
 - Increase capacity
- Outsourcing a high-level review that will occur next year





Questions

