



# ATO: Integral to achieve a truly interoperable system

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# Overview

- History of ATO, from beginnings in Mass Transit world
- The need to collaborate between the train and the signal
- Challenges that face railways implementing ATO
- What ATO can unlock for a better future





# Why ATO ?



As demand rises, we will grow with London



c. 4.8m people per day

## About Sydney Metro





# The beginnings of ATO

## London Underground Victoria Line

- The first automatic railway in the world opened 1968-1971
- ATO was a showcase of technical research & innovation but the need was primarily driven by capacity demand (alleviate pressures on the Northern and Piccadilly Lines)



Provided the Opportunity for a whole system approach to the railway design

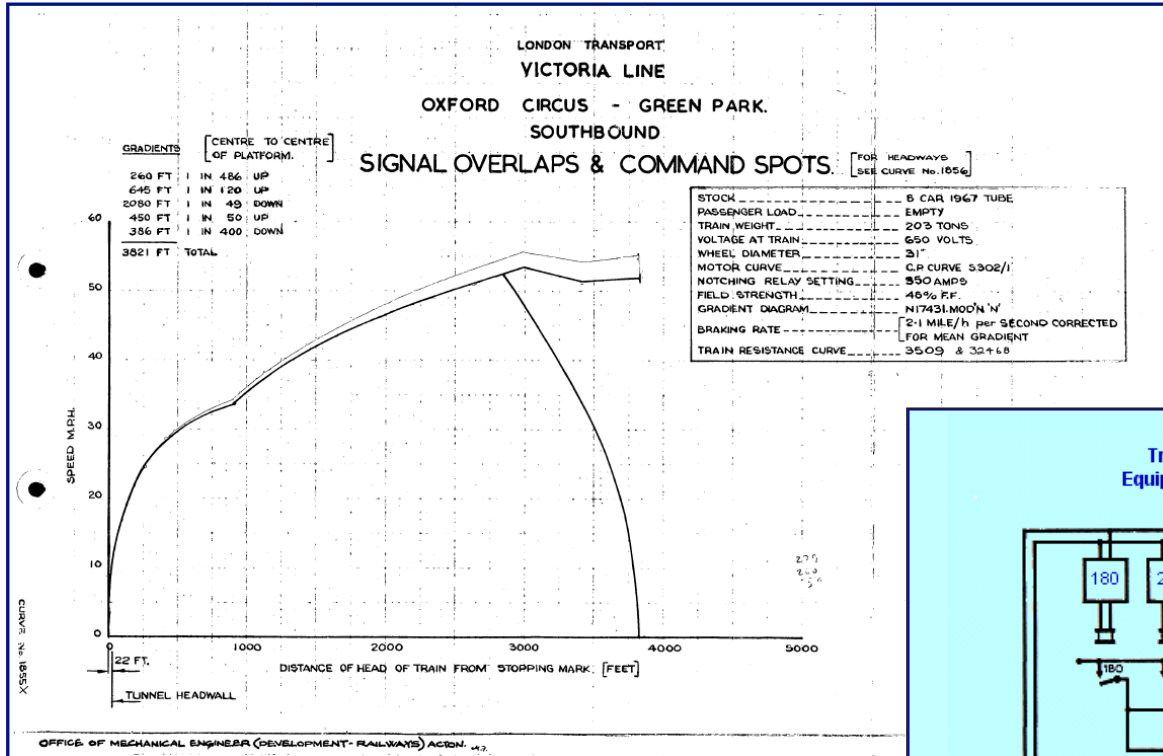
- Social benefits of railways were first introduced
- Every station inter-connect with another line or national rail (except Pimlico)
- Humped station platform design to improve acceleration and braking
- Cross-platform changes, e.g. at Euston with the Northern Line, at Finsbury Park with the Piccadilly Line

Stimulated the collaboration between different engineering disciplines



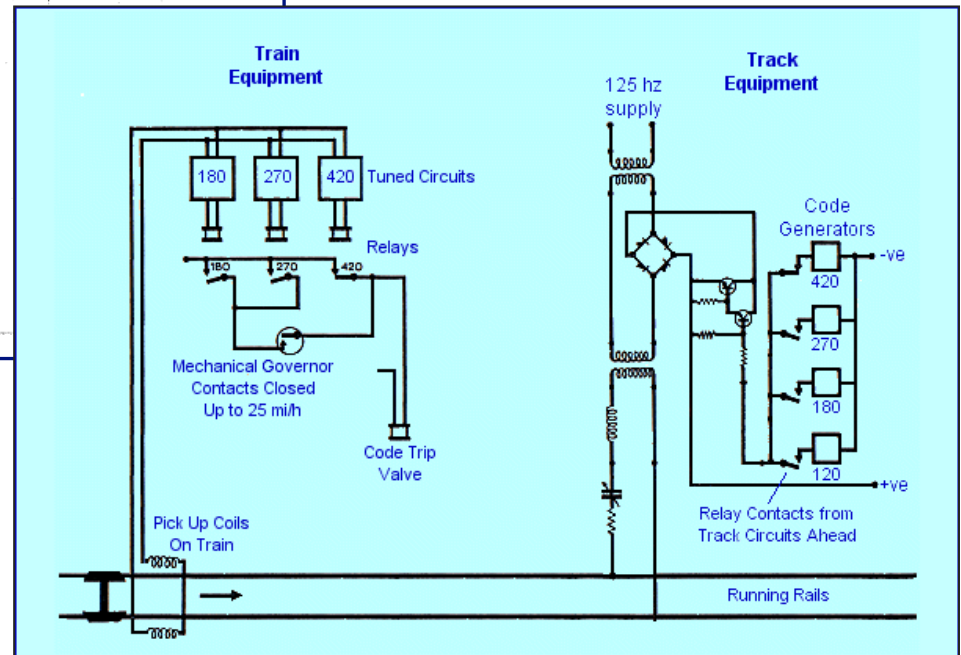


# The beginnings of collaboration



1967TS Performance Curve  
Signal Overlap & Command Spots

- Examples of rolling stock engineers working together with Signal engineers to deliver the capacity outcome



1960's ATO architecture

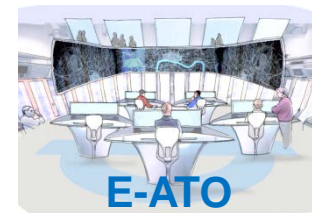




# Essential for ATO: systems integration

- Increasing system complexity means more parts have to work together to delivery the outcome

**Demands a Systems Approach**



E-ATO

Full Automation.  
Demand based  
service  
management

Auto Dwell  
Management.  
Full Automatic Train  
Regulation

Decision Support

Integrated Signals  
and Comm Systems

Integrated Real  
Time Information

Mobile Phone and  
TV services below  
ground



Enhanced Service  
Control

Partial Automatic  
Train Regulation

Air Conditioned  
Train Cars

Auto turnaround

Tunnel Cooling

Mobile Phone and  
TV services above  
and below ground



Capacity  
enhancements  
through software ATO  
\ ATR

Integrated Train  
Identification and  
Comms Systems

Integrated ticketing  
and payment systems



Train Management  
Systems for asset  
management & comms  
link to control room.  
Enhanced electronics &  
SCADA

Enhanced signalling  
functionality based on  
solid state technology

DC Cam-shaft controllers  
& motors replaced by AC  
drives



Electro mechanical /  
Relays /  
simple discreet  
component  
electronics

Automatic Train  
Operation



Electro/ pneumatic /  
mechanical/ relays

Basic Automatic  
Train Protection





# Environmental Factors

- Need for Train location
- Need to lubricate
- Vegetation control

Automatic Train Operation

– Need for Enhanced Adhesion Management

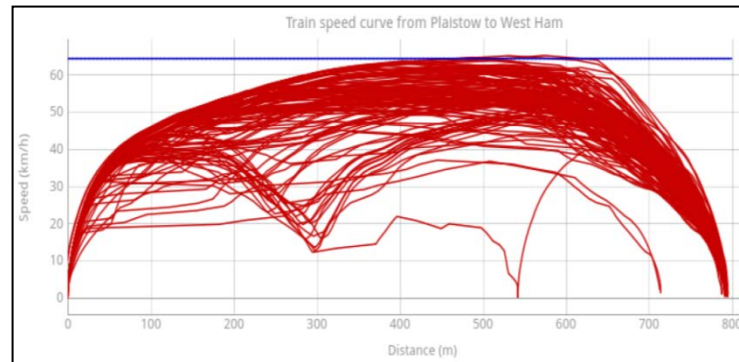




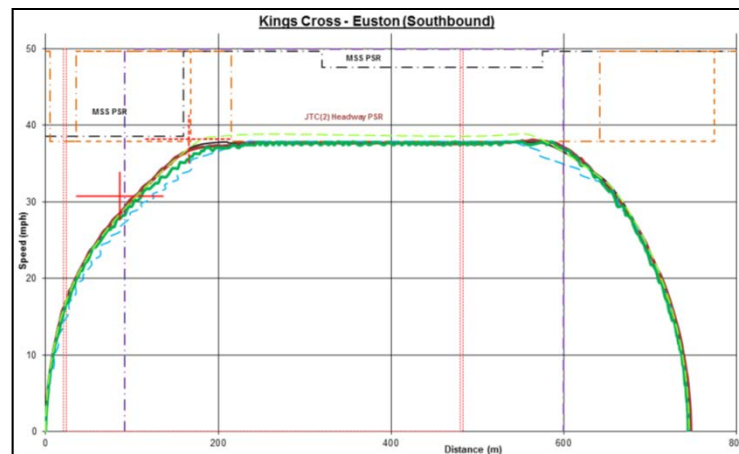
# The benefits of ATO

- Delivers a step-change to capacity and safety
- Improves runtime variability
  - taking out the slack and delivers faster journey times
- Maximise acceleration and braking profiles
  - improving headway and minimises recovery margins to deliver a higher frequency service
- Improves timetable adherence
  - minimising excess journey times and increase schedule confidence
- Opens up the opportunities for wider systems integration, e.g. ATR, TMS
  - improving journey time reliability and implementing energy efficiency strategies

Manual driving profiles



ATO driving profiles





# The challenges with ATO

- Acceptance of change
  - How does the driver know the system is functioning correctly?  
How do you manage driver under-loading and maintain awareness & concentration?
  - Training and up-skilling is needed to adapt to the technology and ways of working
- Designing to the margin
  - Minimising safety margins to realise the full capability of the train and infrastructure; otherwise, performance, specifically, at junctions and schedule termini may be worse than manual driving



- Sweating the assets
  - The ability to work the assets harder and at high frequencies creates a new generation of wear and tear, meaning an increased focus on system reliability and maintenance is needed
- Climate change

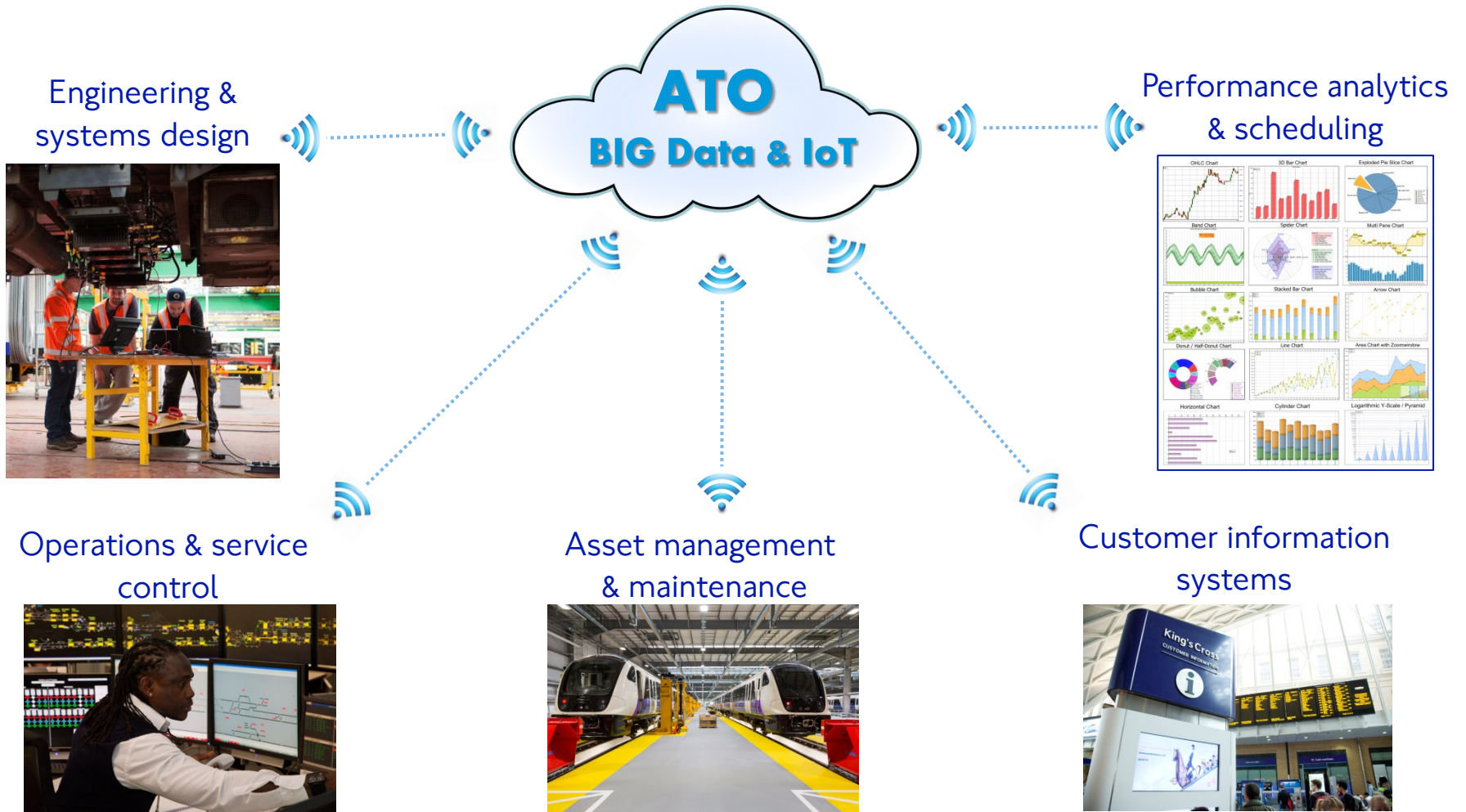
- System upgrade and migration
  - Ensuring the railway continues to operate seamlessly during the period of change is like running a marathon whilst undertaking open-heart surgery





# The ATO future

- At the heart of a fully integrated railway system



The logo consists of the letters 'AI' in a white box on the left and 'ATO' in a white box on the right, connected by a horizontal line. The background of the slide is a dark space with colorful light trails and a futuristic robot head on the right side.

# AI-ATO

i am aware the performance of passenger door Z80 has been sub-optimal  
... initiating diagnosis and filing maintenance report

i am experiencing adhesion problems  
... optimising traction at 85% and updating scheduling system

i am aware the approach platform is at crowded at 95%  
... adjusting dwell time and uploading forecast to customer system

i am aware communications line x.286 has failed  
... initiating diagnosis and back-up system

i am aware...

Thank You !