From Business Requirements to System Performance Requirements by Railway Engineering Simulations

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Overview

• Review of Simulating Capability Paper
• Systems Engineering as an integral part of the SSR Upgrade & SSR ATC Contract
• Modelling and Simulation within the SSR ATC Contract and Beyond
• The Simulation Tool
• Ongoing Challenges
• Conclusions
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Review of Simulating Capability Paper

- **Summary**

- **Conclusions**

- **What has happened since**
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Sub-Surface Upgrade Programme
Assets
Sub-Surface Upgrade Programme Integration Challenge
Systems Engineering Focus: Sub-Surface Upgrade Programme

Integrate sub-systems
Performance targets
Economical solution
Reduce risk
Improved Reliability
Energy Efficiency
Reduce Access

MIND THE GAP
Systems Engineering Focus:
Automatic Train Control Contract

• Performance Targets
• Remove Ambiguity
• Improve Bid Evaluation
• Reduced risk in Contract
• Capped targets
• Performance margins
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Modelling and Simulation: Automatic Train Control Contract

• Setting realistic and achievable performance targets
• Bid Evaluation
• Parallel Virtual Worlds
  – Understanding the integrated system
  – Understanding the contribution of the ATC System
• Convergence
• Agreed method for Performance Measurement
• Modelling ATR Systems and Strategies
Setting Performance Targets

• Specify Performance Targets
  – Trains per hour
  – Junction Capacity
  – Reoccupation Times

• Compare performance to targets

• Achievable Targets
Bid Evaluation

• Modelling used by supplier to determine performance of their system on our infrastructure

• Design application exercise to demonstrate performance

• Simulation Strategy Document
Parallel Virtual Worlds

- Static World
- Real World
Convergence

Best Case

Most Likely

Worst Case

Project Lifecycle
Performance Measurement

• Required to:
  – Predict performance through the life of the contract
  – Measure the final delivered performance

• Engineering Management
  – Agreed testing, measurement and calibration activities
  – Planning, programming and resourcing
  – Agreed simulation tool
Modelling and Simulation: Beyond the Automatic Train Control Contract

- Verification of the integrated SUP performance
  - Power, track, signalling and rolling stock
- Operational and Timetabling Strategies
- ATR Systems and Strategies
- Energy Saving Strategies
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Simulation Tool Management

- Tasks
- Tool modifications
- Access & Logistics
- Programme
Railway Engineering Simulator

• Models the railway system - rolling stock, signalling, track and power to a high level of detail

• Used extensively on London Underground Lines

• Data driven

• In-house training, support and development
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Modelling a Complex System

- Determine level of abstraction
- Calibration
- Sensitivity analysis
- Tool development
- Support
- Skills retention and development
Managing data

- Independent preparation and check
- Data Control and traceability
- Managing several scenarios
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Conclusions

• New Systems Engineering Approach

• Use of Modelling throughout the project lifecycle

• Clarity on delivery responsibilities

• Build confidence in the delivery of the Sub-Surface Railway Upgrade

• Supports the vision to reduce access