1 year on

Liam Hockings, Head of Fleet Commercial, WCPD

Greg Newport, Senior Project Manager, Avanti West Coast

WEST COAST
PARTNERSHIP
DEVELOPMENT

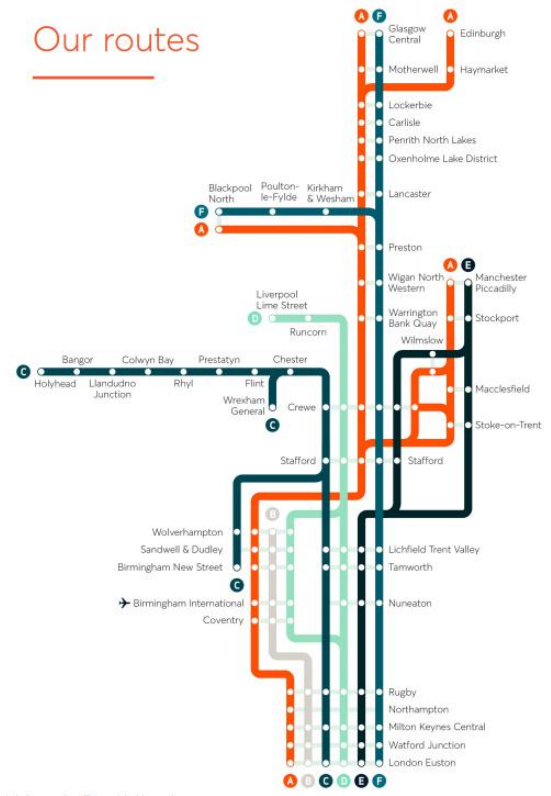
Sustainability means the world to us. Only print if you really have to.

Contents

West Coast Partnership
Why New Trains?

What is West Coast Partnership?

AVANTI
WEST COAST



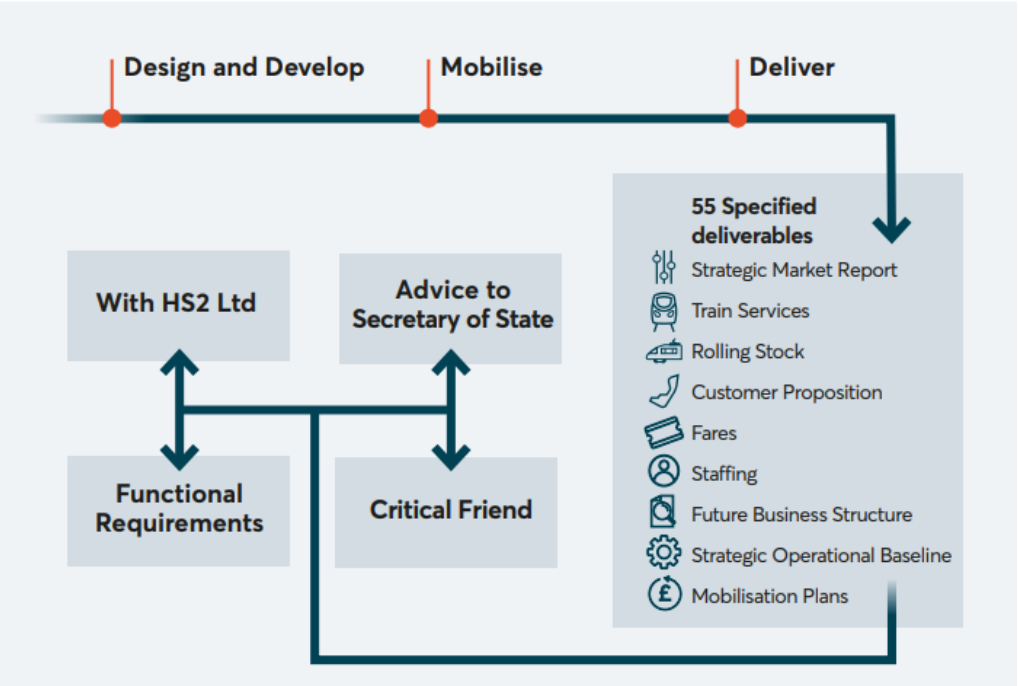
Department for Transport

West Coast Partnership Franchise

Invitation to Tender

27 March 2018

WEST COAST
PARTNERSHIP
DEVELOPMENT



WEST COAST
PARTNERSHIP
DEVELOPMENT

Existing Fleet

- The franchise operated **Class 390 Pendolino electric units** and **Class 221 Super Voyager diesel-electric units**. Both fleets had reached their half-life, but in largely original condition.
- They are the only tilting trains in the UK system which means they can run at **Enhanced Permissible Speed (EPS)** on the WCML route, up to 125mph.
- Class 221 operate services on routes that are not fully electrified and provide additional capacity on electrified routes

WEST COAST
PARTNERSHIP
DEVELOPMENT

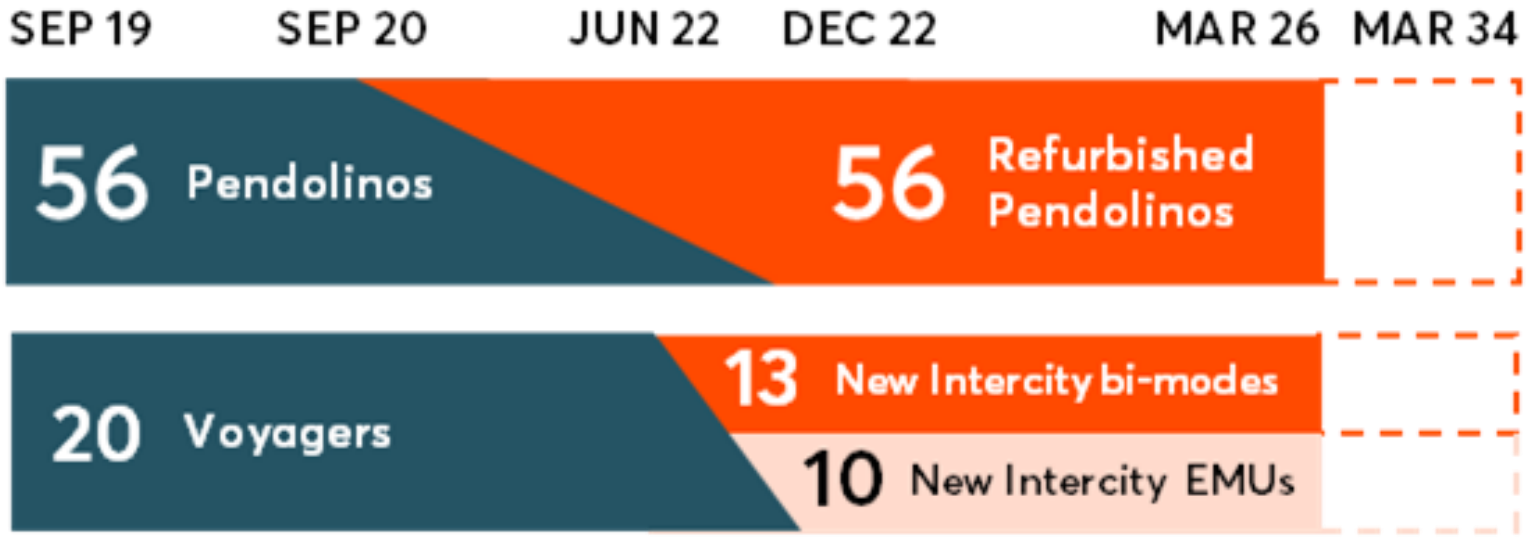
Why New Trains?

Previous Feature	Franchise Requirement	Delivered Outcome
Diesel Voyagers on Electric Routes	Reduce Diesel use on electrified network	Class 805 Bi-Mode Trains for diesel routes
Diesel Voyagers on Diesel Routes	Reduce carbon Emissions on non-electrified network	Stage V emissions compliant Engine
23m vehicle	Additional capacity on existing services	Longer 26m vehicles
20 trains, 100 vehicles	Additional hourly Liverpool service	23 trains, 135 vehicles
125mph with tilt	Maintain journey times and route capacity	Non-tilt MU speed profile High Acceleration Capability
Static PIS and seat reservations, cramped seating	Improved Passenger Environment	Connected Passenger Systems. New Seats

WEST COAST
PARTNERSHIP
DEVELOPMENT

Fleet and depot strategy as bid – the plan

- Replace the Voyagers with two new fleets – **13x5-car bi-mode** trains for services on non-electrified routes, plus **10x7-car EMUs to grow capacity and provide extra Liverpool services**
- Retain the Pendolino fleet and **undertake a major refurbishment** to provide a significant upgrade to the CX, increase the capacity, and renew or upgrade on-board systems.
- Capacity growth: 5% more vehicles and 16% more Standard Class seats in the fleet.
- Out-source the maintenance but use an existing Alstom depot (Oxley) as the main depot for the new EMU/bi-mode trains.



WEST COAST
PARTNERSHIP
DEVELOPMENT

Tilting Trains and Higher Speeds

- The **Permissible Speed (PS)** profile permits a maximum of up to 110mph for all trains. This is the ‘standard’ speed profile
- The **Enhanced Permissible Speed (EPS)** profiles permit speeds above the PS profile and up to a maximum of 125mph for specific trains that have active tilt systems (Class 221s and Class 390s).
- Tilting counteracts the uncomfortable curving forces felt by passengers allowing higher speeds while maintaining comfort
- At the time of the 390 and 221 introduction, no other stock could exceed 110mph on the West Coast, there was no incentive to increase the PS speeds
- For the WCP franchise, No suppliers submitted bids for tilting trains therefore to protect the journey times a different approach was required.

WEST COAST
PARTNERSHIP
DEVELOPMENT

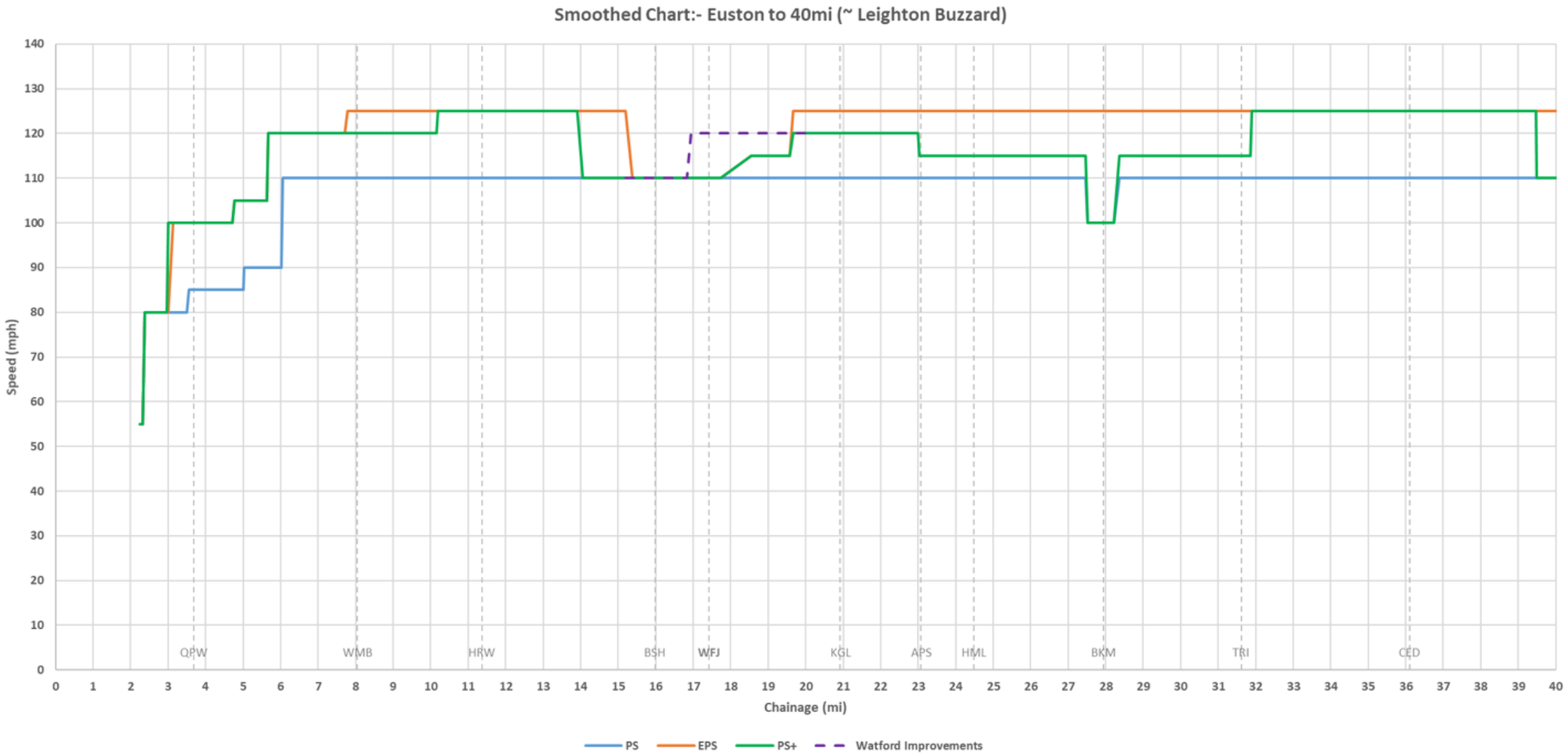
The Line Speed Project – establishing a new speed profile within Standards limits

- A detailed technical study identified that many areas of PS speed could be safely operated at higher speeds **within existing interface standards,** maintaining safety and comfort levels while improving running times.
- Not all areas were capable of reaching EPS speeds and therefore a new differential speed was introduced to WCML – Multiple Unit (MU).
- To benefit from the MU speeds, the new trains required a high level of acceleration in electric traction mode, and are used on services with more frequent station stops.
- The outputs are smoothed for “driveability”, so not all speed improvements can be obtained in reality.

Fleet and Speed	EUS-LIV SRTs	Impact
390 EPS – Baseline	1:58:30	-
80x PS – Without Linespeed	2:08:00	+10mins
80x MU with Linespeed	2:03:30	+5mins

WEST COAST
PARTNERSHIP
DEVELOPMENT

The Line Speed Project – establishing a new speed profile within Standards limits



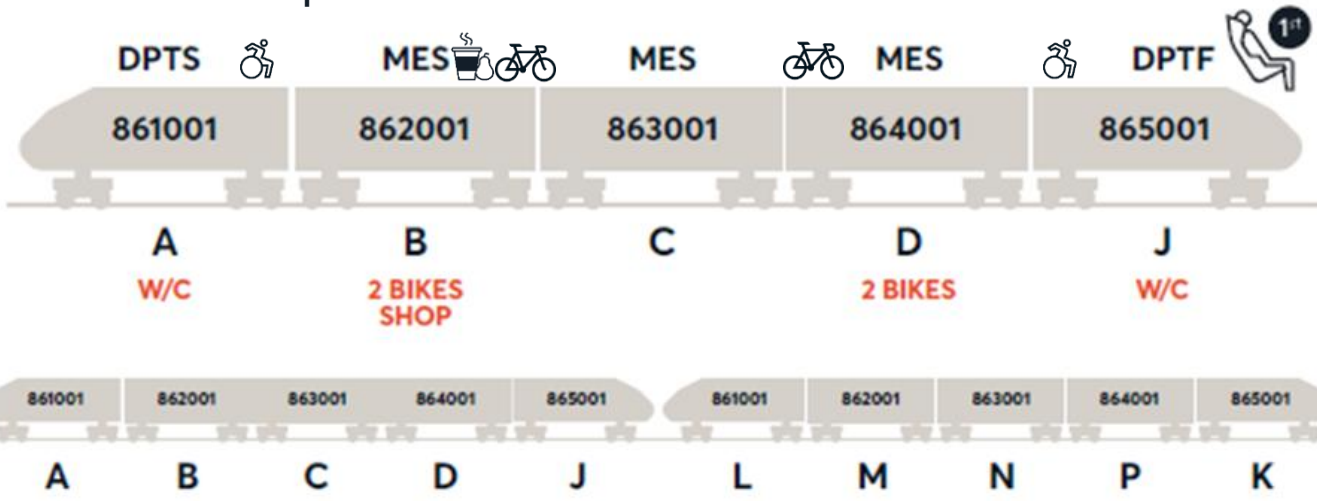
WEST COAST
PARTNERSHIP
DEVELOPMENT

02

Evero
Class 805 & 807

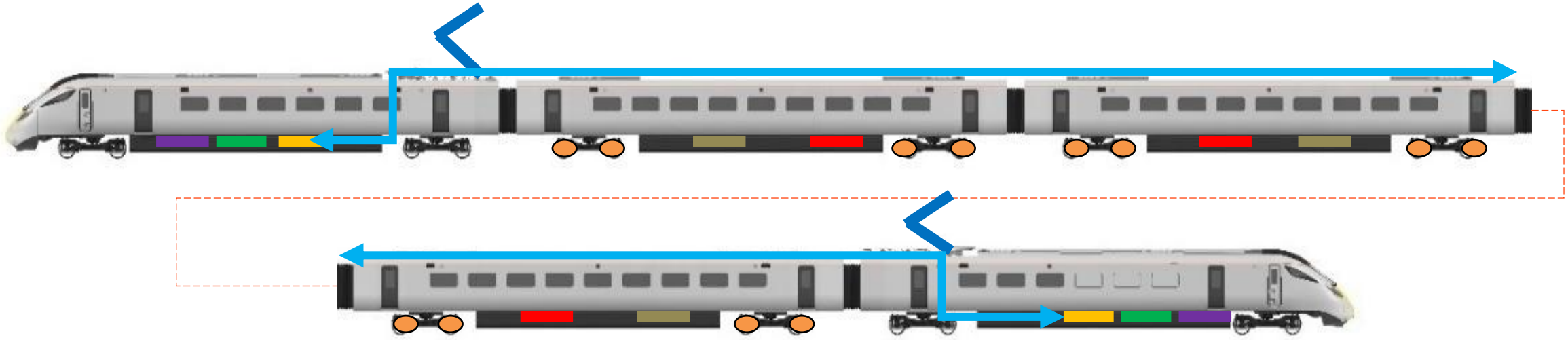
Class 805

- 13 x 5 Car Bi-Mode
- 274 Std Seats
- 25 1st Class
- 2 wheelchair locations
- 4 bicycles
- 5 toilets
- Small Galley
- Onboard Shop



WEST COAST
PARTNERSHIP
DEVELOPMENT

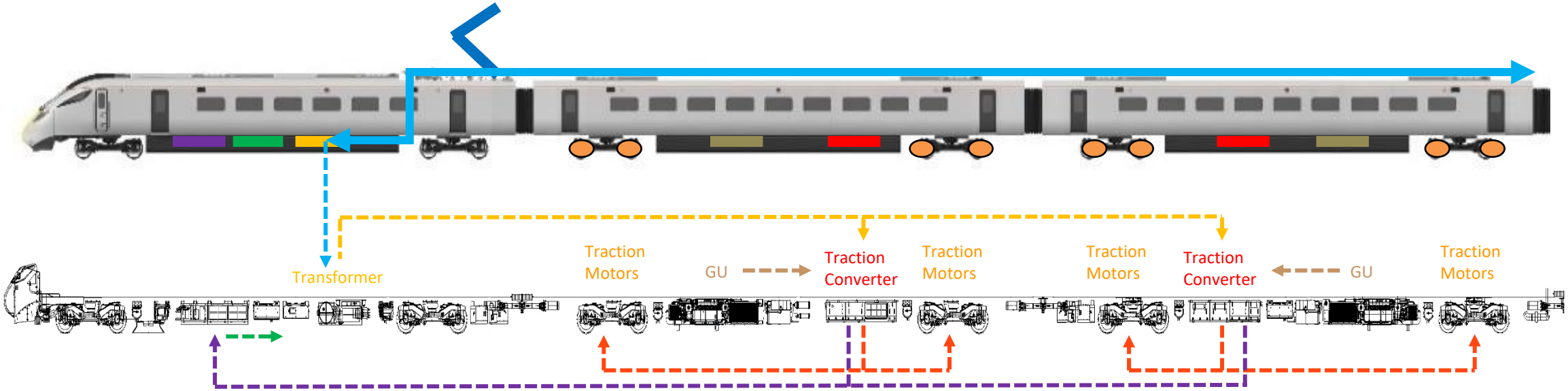
Power and Traction Layout Class 805



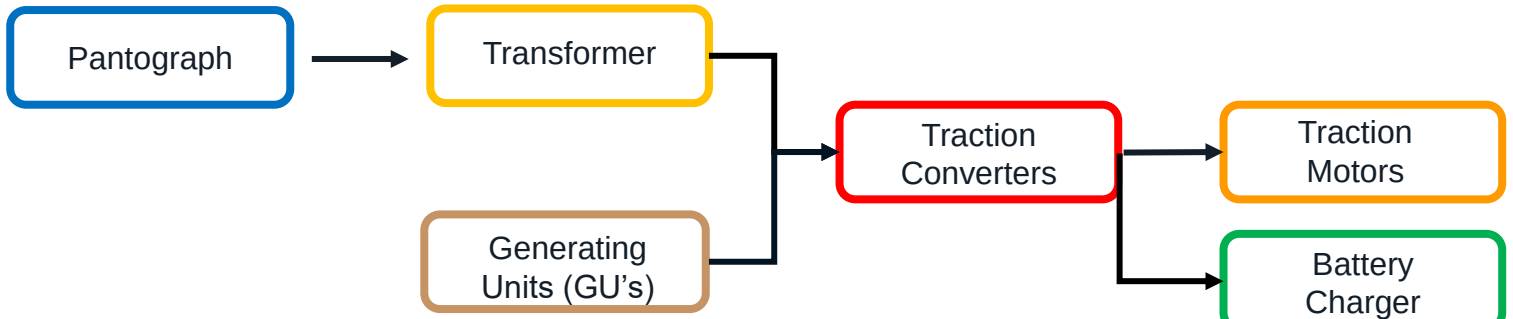
- Pantograph and Circuit Breakers
- 25kV Bus
- Main Transformer
- Auxiliary Power Supply
- Battery
- Traction Converter
- Generator Unit
- Traction Motors

WEST COAST
PARTNERSHIP
DEVELOPMENT

Bi-Mode Architecture



ELECTRIC MODE



DIESEL MODE

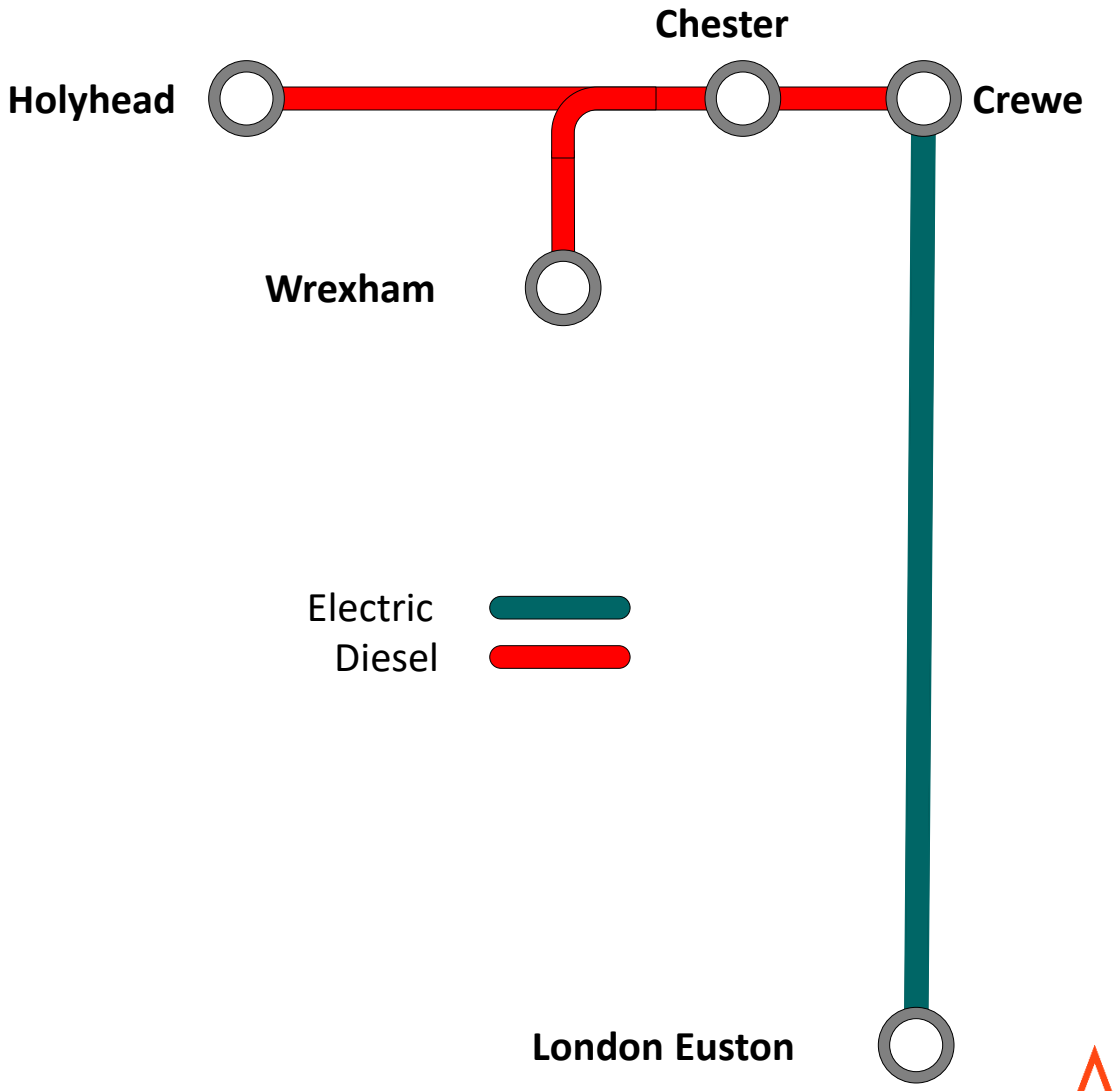
WEST COAST PARTNERSHIP DEVELOPMENT

Class 805 Power Change Over

Train offers automatic, manual, static and dynamic

Service Operation is largely straightforward

Changeover at Key Stations

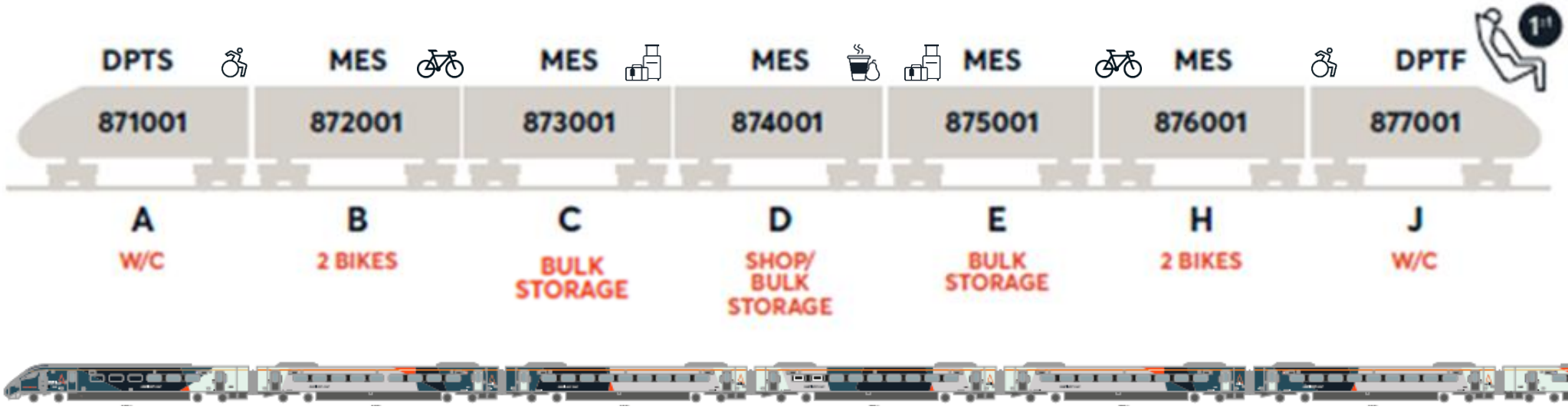


Depots moves are less so…

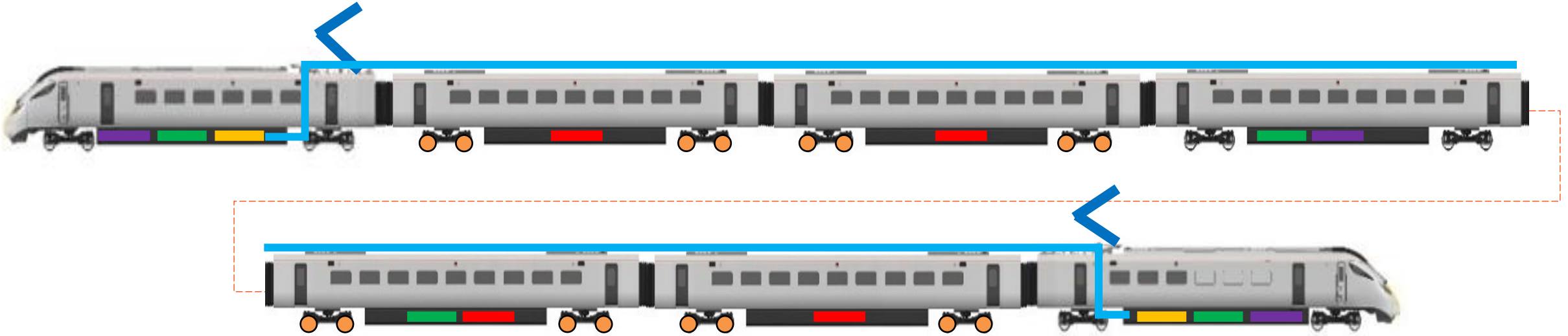
WEST COAST PARTNERSHIP DEVELOPMENT

Class 807

- 10 x 7 car EMU
- 402 Std Seats
- 49 1st Class
- 2 wheelchair locations
- 4 bicycles
- 6 toilets
- Full-service Galley
- Onboard Shop



Power and Traction Layout Class 807



- Pantograph and Vacuum Circuit Breakers (VCB1 & 2)
- Main Transformer
- Traction Converter
- Traction Motors
- Auxiliary Power Supply
- Battery Container

WEST COAST
PARTNERSHIP
DEVELOPMENT

Improvements and Evolution

Class 805 and 807 Improvements – Compared to Voyager and Pendolino

Environment & Safety

Bi-Mode reduces Carbon Emissions by 61%.

Stage V Engine is cleaner and provides a quieter external environment

TPWS 4 safety system

Bodyside Cameras

ETCS fitted

Integrated Selective Door Opening

Capacity

Longer vehicles means more efficient use of space.

For a Fleet size increase 3 units and 35 vehicles, there was a gain of 3293 seats.

As a Fleet, quantity seats increased by 64.5% from 5104 to 8397 for a 35% increase in vehicles.

Passenger

New Std class seat specifically design for long distance comfort – also being fitted to Pendolino

More bay tables (over 50%) and luggage space between with most seats aligning with windows

Table and plug/USB charging for all with inductive charging in fixed tables

Systems

Real time connected passenger systems

Remote access to passenger systems

Operator owned passenger data flows

Remote Access to wide range of onboard TMS and OTDR Data

Key Class 805 and 807 Changes and Improvements over Legacy AT300

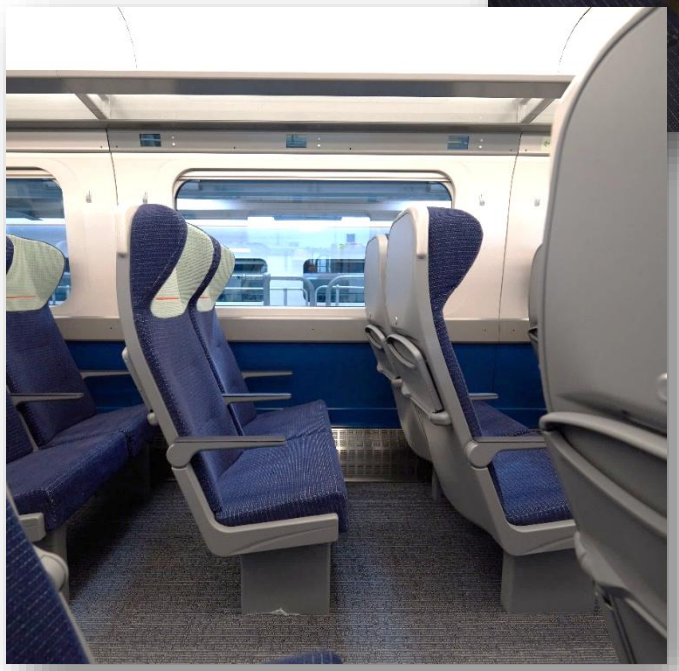
- New Engine with lower emissions to Euro V standard (75% less NOx)
- New High Voltage Transformer to include EMC mods
- High acceleration retained to higher speeds
- Revised shop area with bigger serving counter
- New ‘CX’ system removes key passenger systems from TMS. Allows for easier updates and data handling
- CCTV – real time download/stream
- PIS auto Darwin journey updates with full colour screens
- Seat Reservations – real time updates
- Seat Occupancy – fed to off shore. Clears unoccupied reservations
- Passenger Counting with real time feed
- Changes to UAT
- Improved train to shore data feeds and system
- New seats, new tables, warmer lighting, softer interior colours
- New 7 car formation

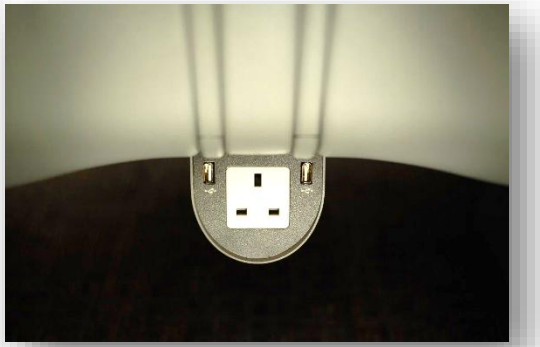
With change comes challenge…

WEST COAST
PARTNERSHIP
DEVELOPMENT

New Standard Class Seats

- New Seats Development lead by First Group and ergonomic study provides reclined position and more leg room
- Seat Pitch increased from 790mm (Voyager) to 830mm - 40mm increase
- Initial variant fitted to Lumo Class 803
- Power socket under seat in front to aid visibility
- Parallel development of projects to fit to Class 390 refurbishment and Class 805 and 807
- Technical challenges to integrate seat size structure into 2 vehicle types while maintaining consistency.
- New Crash tests required due to different mounting and tables
- Significant production volume (32k) created manufacturing and logistical challenges to supply both programmes
- 805 and 807 version featured seat occupancy detection – passive capacitance pad under fire blanket
- Each pad is linked to seat number in software - Ongoing maintenance challenge





WEST COAST
PARTNERSHIP
DEVELOPMENT

New Trains – Evolutionary Improvements

Capacity

Comfort

Connectivity

Environment

Class 805

Power Changeover

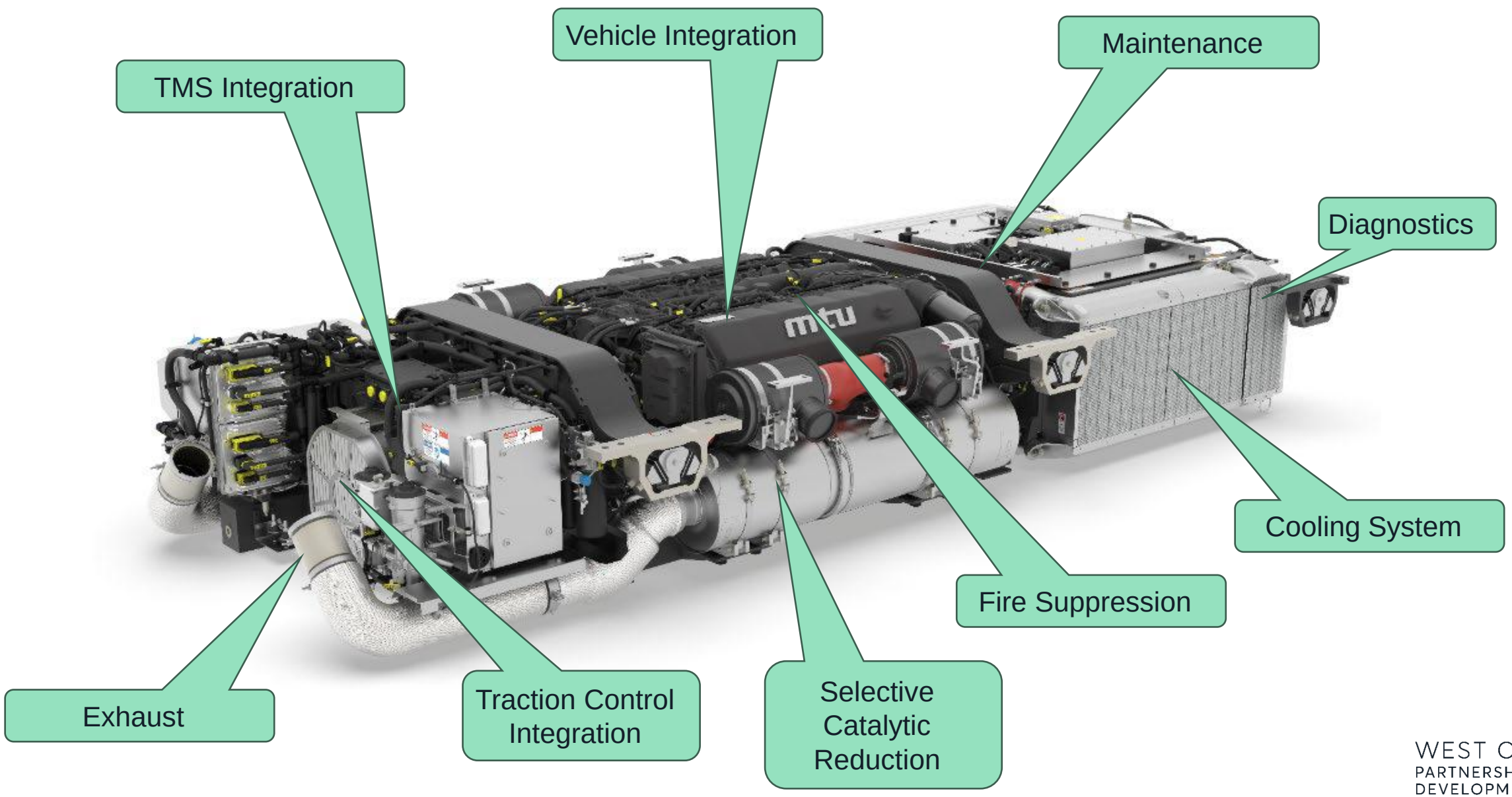
ELECTRIC Birmingham

Capability

Technical Design Challenges

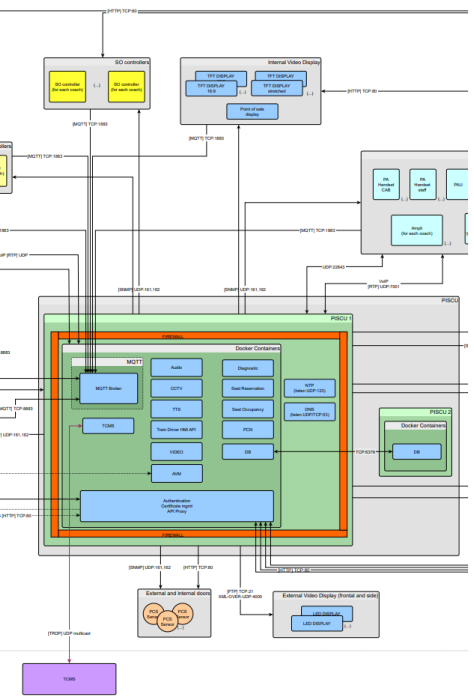
04

New GU (Engine) – Stage V Emissions Compliant



WEST COAST
PARTNERSHIP
DEVELOPMENT

Passenger Facing Systems



System Architecture Changes

Interfaces with multiple on-board Systems – TMS, brakes, OTDR

TMS, requiring different inputs and outputs from TMS

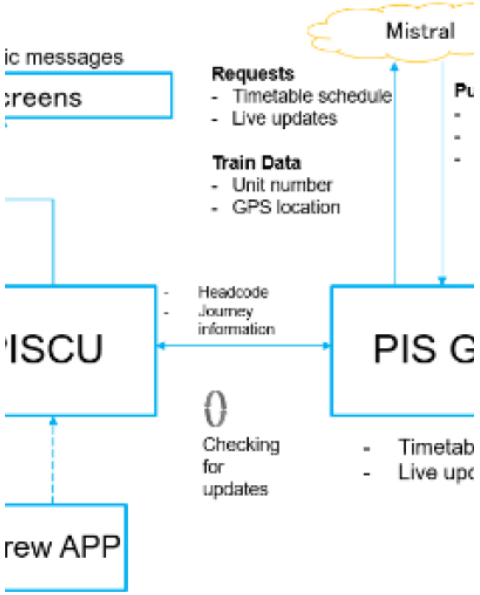
Separate TMS development

Vehicle Integration

Hardware installation changes

Substantial wiring changes across vehicles.

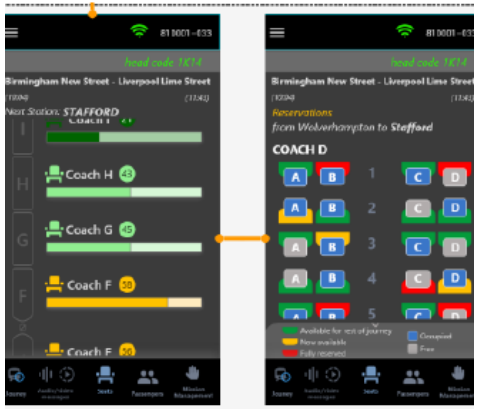
Entire new separate databus



Data Flows

Access to onboard data available real time to Avanti systems and staff

Required new API's, VPNs, data flows and ownership to be set up and tested. New interfaces to manage



Train Crew App

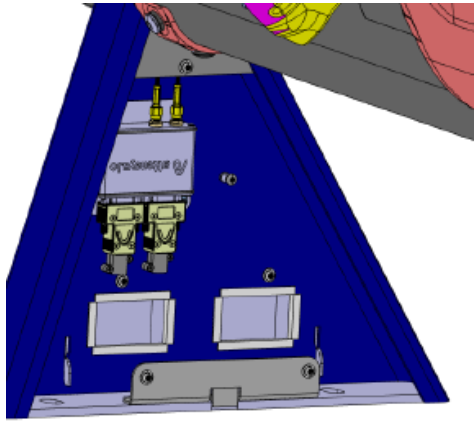
Ability for crew to access and use system using app anywhere onboard

Check CCTV, SRS, Make PIS announcements

Answer alarms

Changes to connectivity – to train or to shore?

IR and new technologies



Seat Occupancy

New System installed in new seat – multiple sub-suppliers

Real time data flow to Avanti to manage reservations with shore side integration and feedback to train

Calibration exercise of both sensor and shore side to avoid false detection

More Wiring

05

Entry Into Service

More than just trains...

WEST COAST PARTNERSHIP DEVELOPMENT

Non-Engineering Challenges

Mitigations
Risk Management
Engagement
Relationships

Push
Project Team Empowerment
Strong Ownership and Vision
Contract Commitments
Supplier Sales Targets
Change Drivers

Pull
Contract Commitments
Senior Sponsors
Business Champions
Business Benefits
Off-lease Old Fleet
Other linked projects

Challenges
Pandemic
Company IR
Industry IR
Business Workload
Surprises
Resource and Skills Availability
Business and Project Structure
Culture and Resistance to Change
Change Requests
Stakeholder Management

WEST COAST
PARTNERSHIP
DEVELOPMENT

Platform Validation for Stopping

Multiple Considerations

- Train Lengths and doors positions
- Wheelchair, cycle, catering doors
- Platform features
- Stepping distances
- Signal sighting and systems
- Car Stop Markers and RIS

41 stations, 200+ platforms

- More complex than volume

30 miles of walking and wheeling

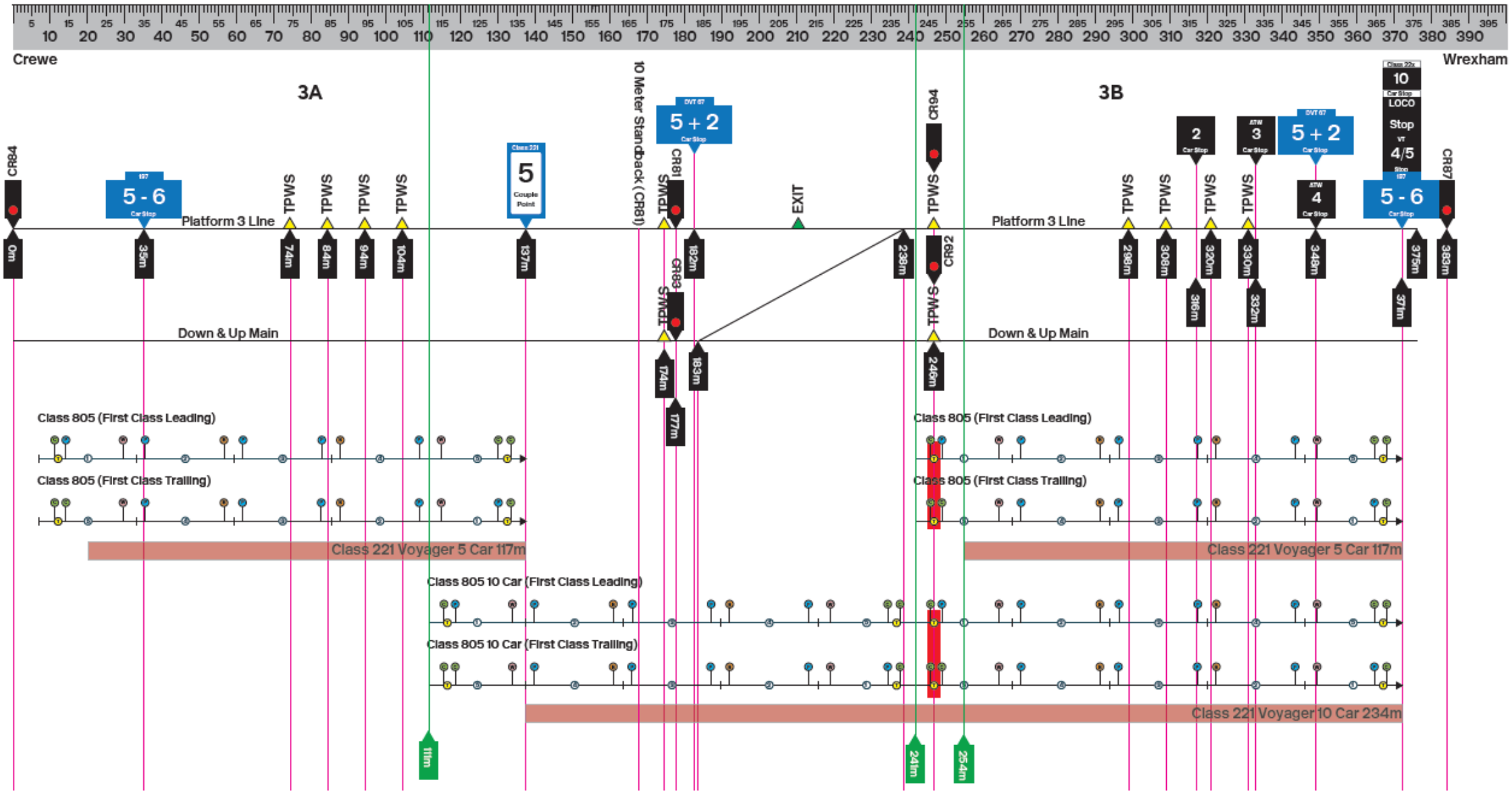
Many shared platforms

- Multiple other new fleets
- Dynamic situations
- Several return visits

T COAST
PARTNERSHIP
DEVELOPMENT

Platform Validation for Stopping

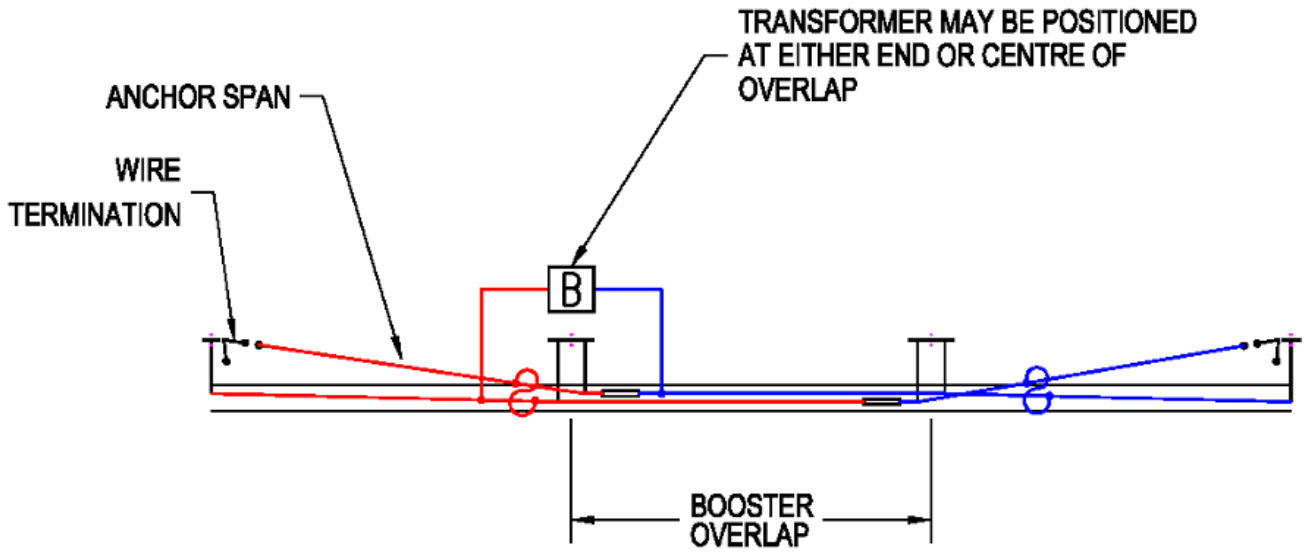
Station	Chester (Platform 3 Study)	Platform	3	Length	375m	Line	Platform 3 Line



T COAST
ERSHIP
OPMENT

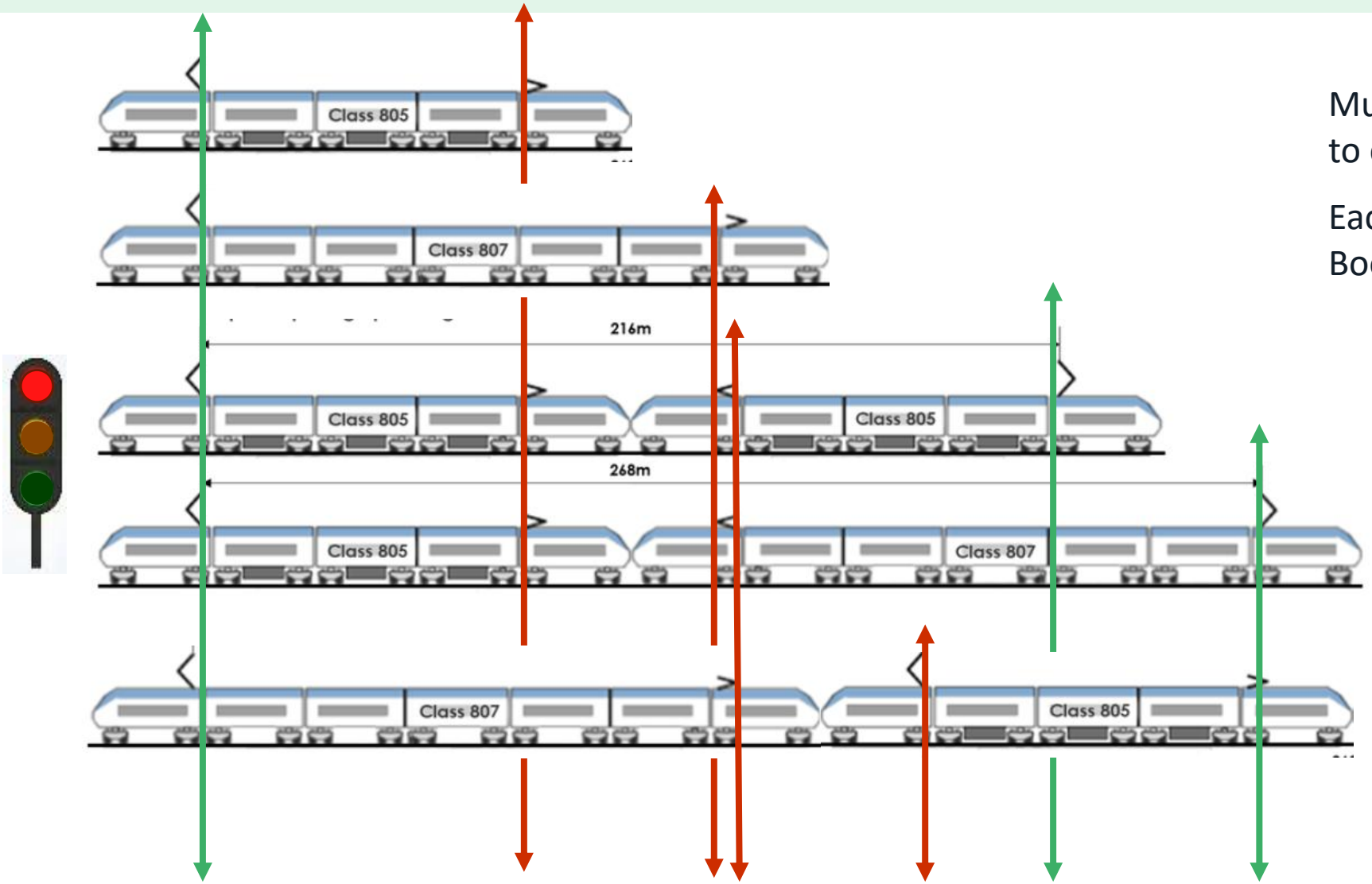
Booster Overlaps

- Booster Overlaps are transition zones between sections of overhead that are fed from separate booster transformers
- Trains can safely pass through at speed
- If a train stops in the overlap, the two sections are connected by the train pantograph and electrical heating will occur, eventually damaging the contact wire.
- Overlap proximity to signals is identified to determine ‘at risk’ locations for further study for each pantograph configuration.



WEST COAST PARTNERSHIP DEVELOPMENT

Booster Overlaps



Multiple different Pantograph layouts to consider

Each gives a different risk zone for Booster Overlaps

WEST COAST
PARTNERSHIP
DEVELOPMENT

Booster Overlap Analysis

<< WEAVER Jn	ELR	**CGJ1**	Signal Booster	**CY122 UP FAST & CY124 UP SLOW G163/32U/F:163/32 BT0024**	Overlap Start	**249m**	Overlap end	**295m**	**CREWE >>**

End of Overlap – 295m

Start of Overlap – 249m

06

In Service Experience

PIS Software Development

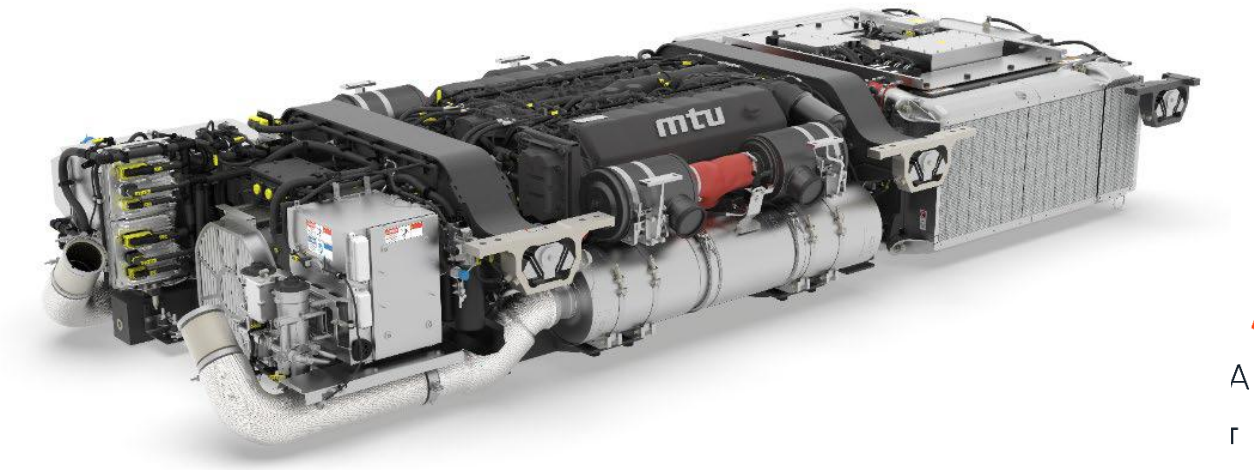
- Entered Service with a relatively immature but legislatively compliant system.
- Some early complaints:
  - “PA Echos”
  - “PA volume too loud”
  - “PIS Scroll rate to slow”
  - “Live journey feed not active”
- Dynamic software improvements have seen continuous improvement.

  (some might call this Agile Project Management, but not by design)
- Discussion point – When is ‘good enough’ for non safety critical software to go into service. Certain issues don’t get discovered until stress tested in service.
- Evolving PIS software has been coupled with continuous development of TCMS (Train Control Management System) software at a rapid rate.
- Lack of development and end user testing and validation between Train and Shore systems, such as Seat Reservation, trip calling patterns, live journey updates etc and CCTV downloading. Therefore solving issues remains an ongoing challenge.

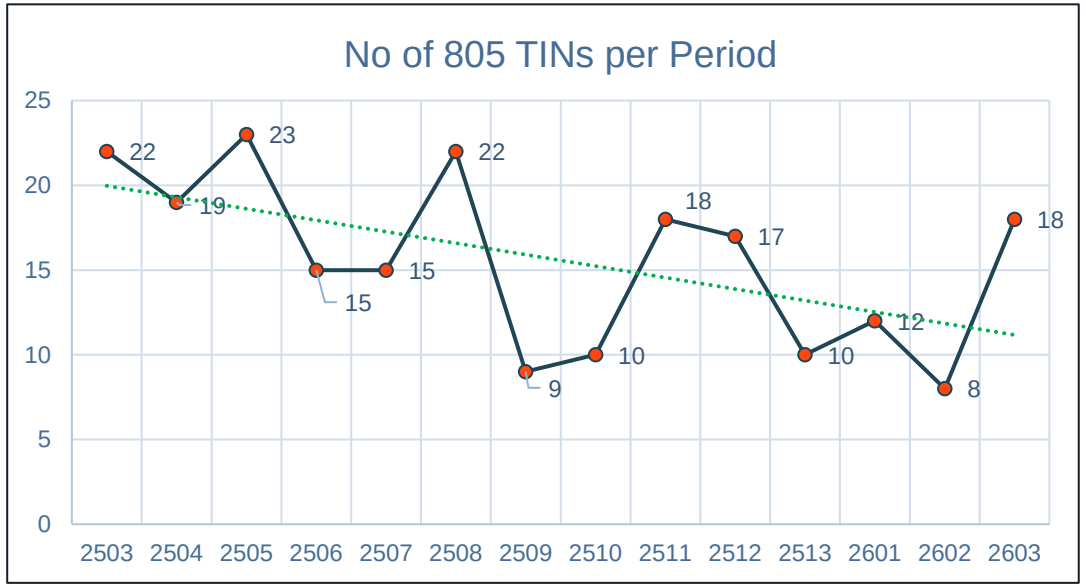
WEST COAST
PARTNERSHIP
DEVELOPMENT

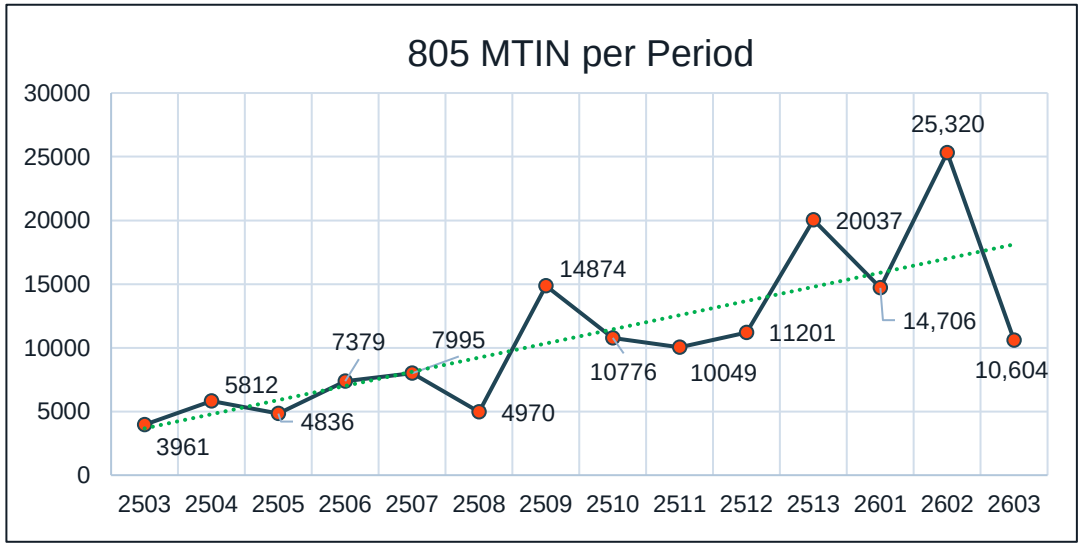
Generator Unit (GU) Reliability Issues

- GU and Traction software has also needed to develop as a result of service experience.
- Radiators cracking due to rapid thermal loading stresses.
  - Replaced fleet with stock ultrasonically tested
  - Modification to replace fleet again with new manufacturing process
- Change in drive from hydrostatic to electrically driven cooling system created a different control requirement. Early performance resulted in Engine shutdowns.



Reliability Growth – Class 805

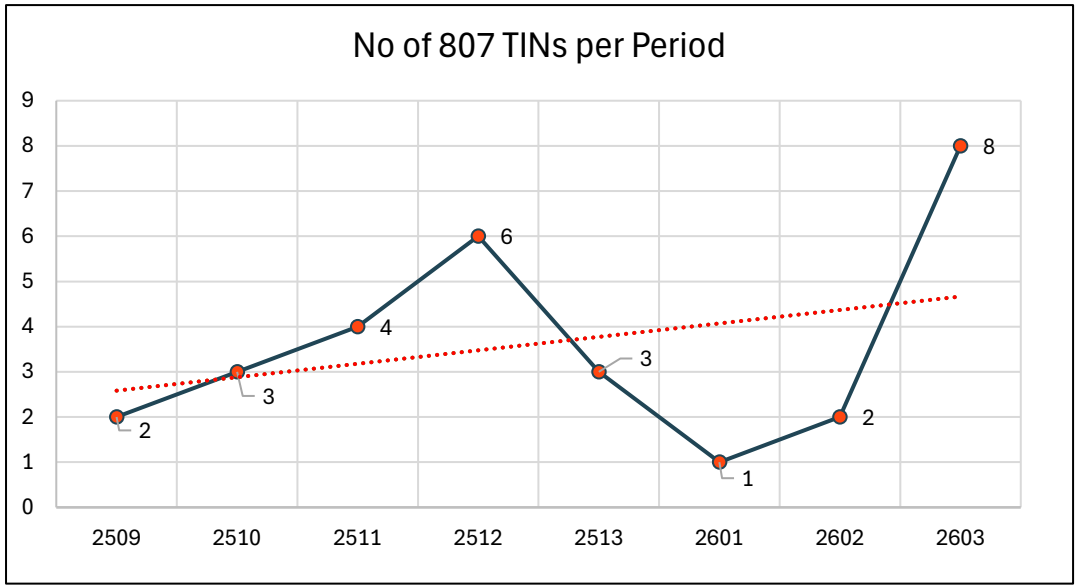


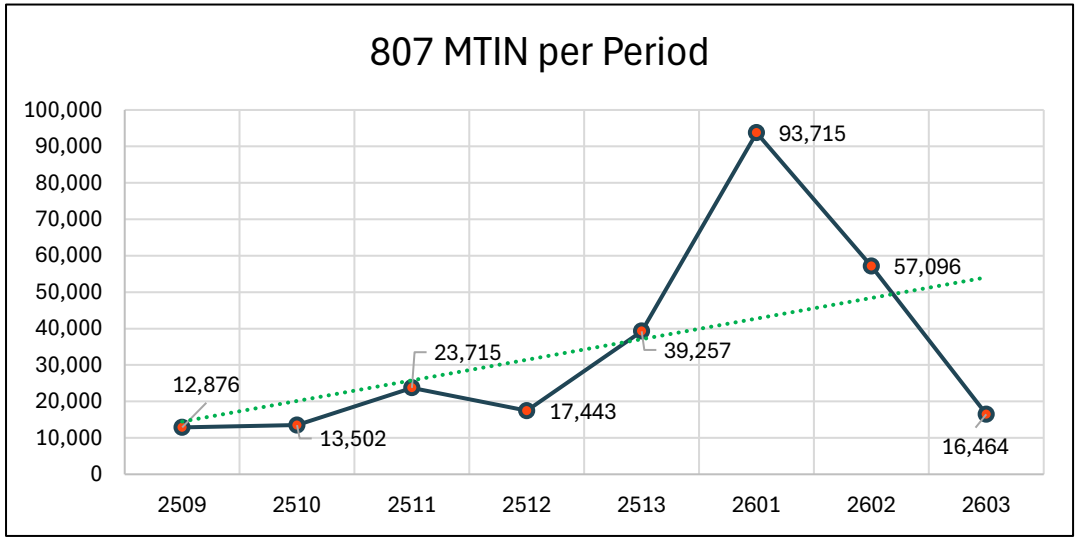


Class 805 Measures	Period 26 01
Mileage	190,872
Technical Incidents	18
MTIN	10,604
MTIN MAA	10,894
Total Delay Minutes	368
Delays>30 min	0
Cancellations	6 Full / 7 Part

WEST COAST
PARTNERSHIP
DEVELOPMENT

Reliability Growth – Class 807





Class 807 Measures	Period 26 02
Mileage	131,708
Technical Incidents	8
MTIN	16,464
MTIN MAA	34,258
Delay Minutes	480
Delays>30 min	1
Cancellations	3 Full / 1 Part

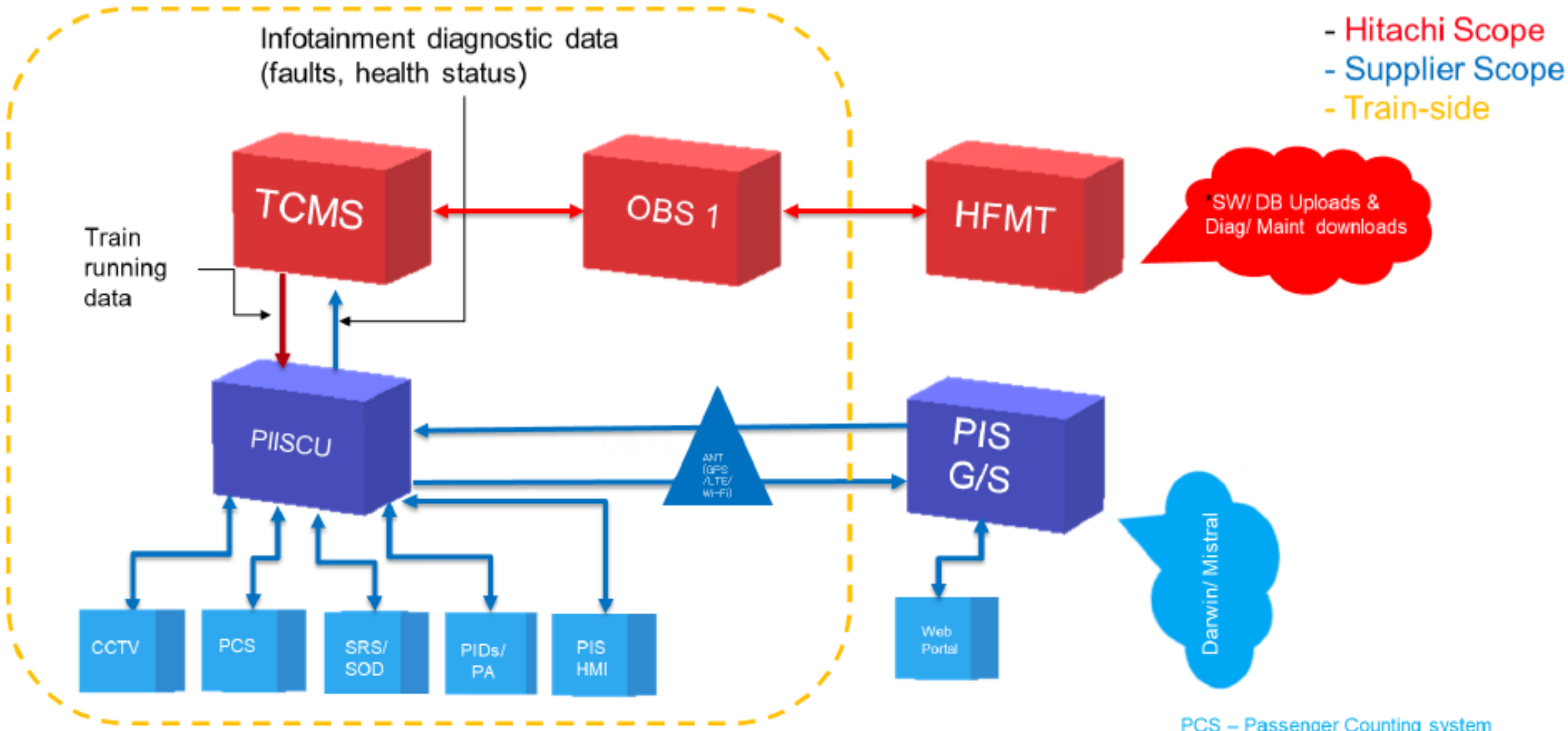
WEST COAST
PARTNERSHIP
DEVELOPMENT

Return on Experience from Validation

- Euston platform structure clash (Platform 13) – Relocated SCM (Stop Car Marker)
- Similar issues at Flint on North Wales route. Station building works at time of validation masked some ramp compatibility issues – Again solved by relocation of SCMs
- Despite efforts to engage other TOCs to agree combined SCMs, certain locations required revisiting and fine tuning.
- Some minor improvement to SDO (selective door open) patterns (Lichfield Trent Valley Bridge Structure).
- Staff Seat to be installed in Shop following feedback from onboard staff.

WEST COAST
PARTNERSHIP
DEVELOPMENT

Complexity of Systems harmonious performance



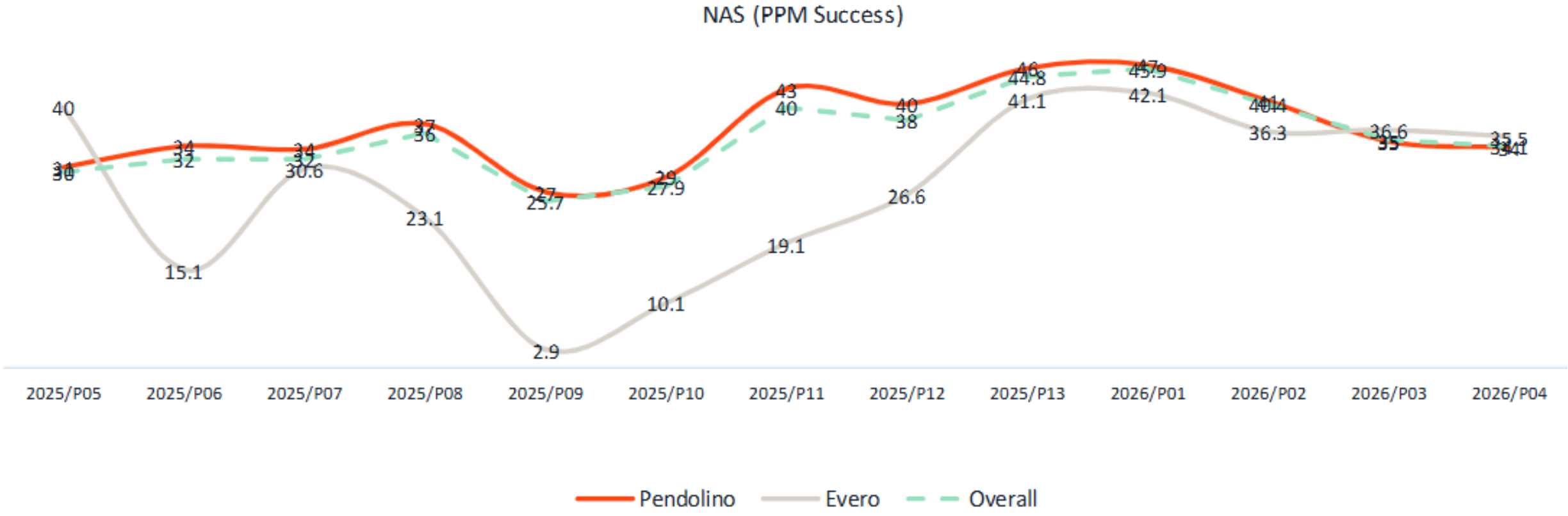
- Web interface to perform remote software/database uploads & Remote data (diagnostic & maintenance logs) downloads will be Supplier's scope.
- Web interface will be hosted on Hitachi groundside server

PCS – Passenger Counting system
SRS – Seat Reservation System
SOD – Seat Occupancy Detection
PIDs – PIS Displays

AST

Any Customer feedback – NAS NRPS etc

NAS (Net Advocacy Score) for trains within PPM Success for Evero follows the same trend as Pendolino now that the Fleet is complete. For the last two periods, NAS for Evero has been slightly higher than for Pendolino



WEST COAST PARTNERSHIP DEVELOPMENT

Any Customer feedback – NAS NRPS etc

Very comfortable new Evero train with good leg room

Beautiful new train, clean and well equipped

Tannoy announcements are not as unbearably loud and unceasing as they were when the new 'Evero' trains were introduced.

seats were comfortable

Carriage was smart modern and clean

Impressed with the new carriages, the coffee shop and the punctuality

I find the new 7 carriage trains more modern and roomy

New train much better than the old ones. Plenty of table seats in a return to the more traditional open carriage layout”

The train was new, clean, provided digital timetable advice and had chargers on the table

New Evero train v smooth and Standard Premium seats comfortable; plenty of space to work; wireless charging in the tabletops

WEST COAST
PARTNERSHIP
DEVELOPMENT

Thank you.

WEST COAST
PARTNERSHIP
DEVELOPMENT

Sustainability means the world to us. Only print if you really have to.