

ERTMS the story of a success

*Jim Morgan - Principal Programme Sponsor
28 November 2011*

- *Why ERTMS?*
- *The Vision for our network*
- *ERTMS System*
- *Cambrian Project*
- *Strategy going forward*
- *Hertford National Integration Facility*

ERTMS – story of a success

- ERTMS is included in Network Rail's plans for CP5 and beyond
- Why?
- It's because it's relatively well defined, cheaper and better value – less track side equipment means lower costs for installation and maintenance
- The Cambrian scheme has demonstrated that it actually works

What are the ERTMS plans?

- Hertford Loop test site by 2013
- Thameslink Core 2015
- Paddington to Bristol and Newbury as an overlay system operational by 2018 until 2026 when signals will be removed
- Kings Cross/Moorgate to Doncaster South by 2018 – first UK mainline installation without lineside signals
- Midland Mainline to south of Derby by 2020 - 2023
- WCML North late 2020s
- South of England late 2030s

Benefits from ERTMS

- Resignalling capital costs for ERTMS are about 60% of conventional resignalling costs
- In cab retro fitment costs are a small proportion of the difference
- Less lineside infrastructure needs fewer site visits by staff/reduces maintenance costs
- Gives ATP functionality – replacing existing installations on GW and then Chiltern
- Quicker implementation of TSRs
- Capacity is easier to enhance on most of the network as balise positioning is much more flexible than signal spacing

In cab fitment

- Adding complex equipment on train needs an understanding of technical and operational implications – will impact on Schedule 8 responsibilities
- Contractual framework-how is this best organised/who should pay? Options include – Network Change, Access Contract Renewal, Competent Authority Change
- Cambrian used conventional Network Change and included the concept in the Fleet Fit Agreement. Experience with GSM-R suggests this would be difficult, costly and time-consuming which it was.
- Who could organise the most cost effective fitment – Network Rail, TOC/FOC, ROSCO, ATOC?
- Which party is the best one to deliver efficient results? Probably not Network Rail

European Rail Traffic Management System

- Constituent parts:
 - European Train Control System (ETCS) – we use this
 - Euroradio (Railway-specific GSM: GSM-R) – we use this
 - European Operating Rules (EOR) – are being developed but may require significant changes in operating practice in the UK
 - European Traffic Management Layer (ETML) – does not exist. There is scope for the UK taking a higher profile role in specifying this, possibly through the FuTRO project which the team are currently developing

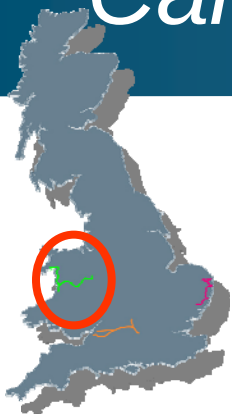
How does it work?

- Conventional signalling
- ETCS Level 2
- ETCS Level 3
- Automatic Train Operation

Cambrian – what did it involve?

- Early deployment scheme to see what problems would be experienced – to give the team some ideas of what they needed to know
- Scheme development started by SRA in 2003 – handed over to NR with the demise of the SRA
- Impact on the remainder of the network if all went wrong – no one expected perfection
- Significant technical developments since then. Cambrian will be version 2.3.0d next year
- Contractual framework was not clearly defined
- Demonstrates real industry commitment

Cambrian Lines Project



Scope

ERTMS Level 2 (no line-side signals)

218 km of track

24 DMUs for passenger service

3 locos to pilot unfitted trains

Upgrade of 4 Level-Crossings

New control centre (Machynlleth)

New axle counters & interlocking



Pwllheli – Harlech became operational in Oct 2010

Remainder of the route will be operational in March 2011

Some world firsts!

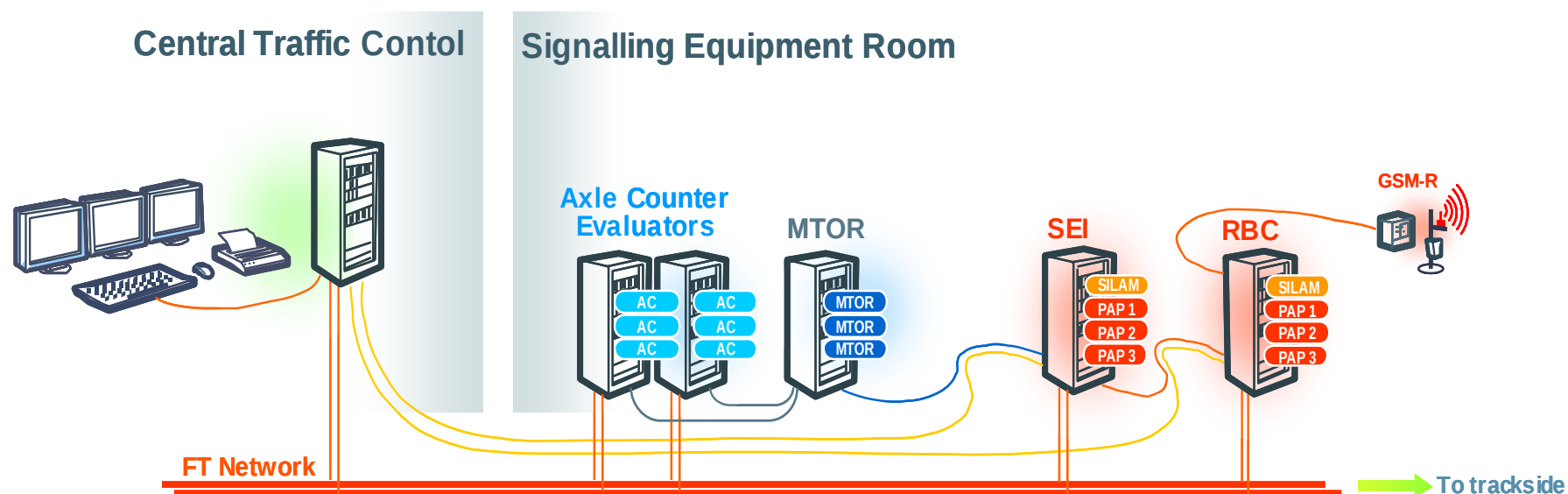
- First passenger terminus signalled on an ERTMS L2 railway – Pwllheli and Aberystwyth
- First train maintenance depot signalled on an ERTMS L2 railway - Machynlleth
- Transition from semaphore signalling to ERTMS L2 on the move at Sutton Bridge also a world first

Cambrian being 'signed into use'



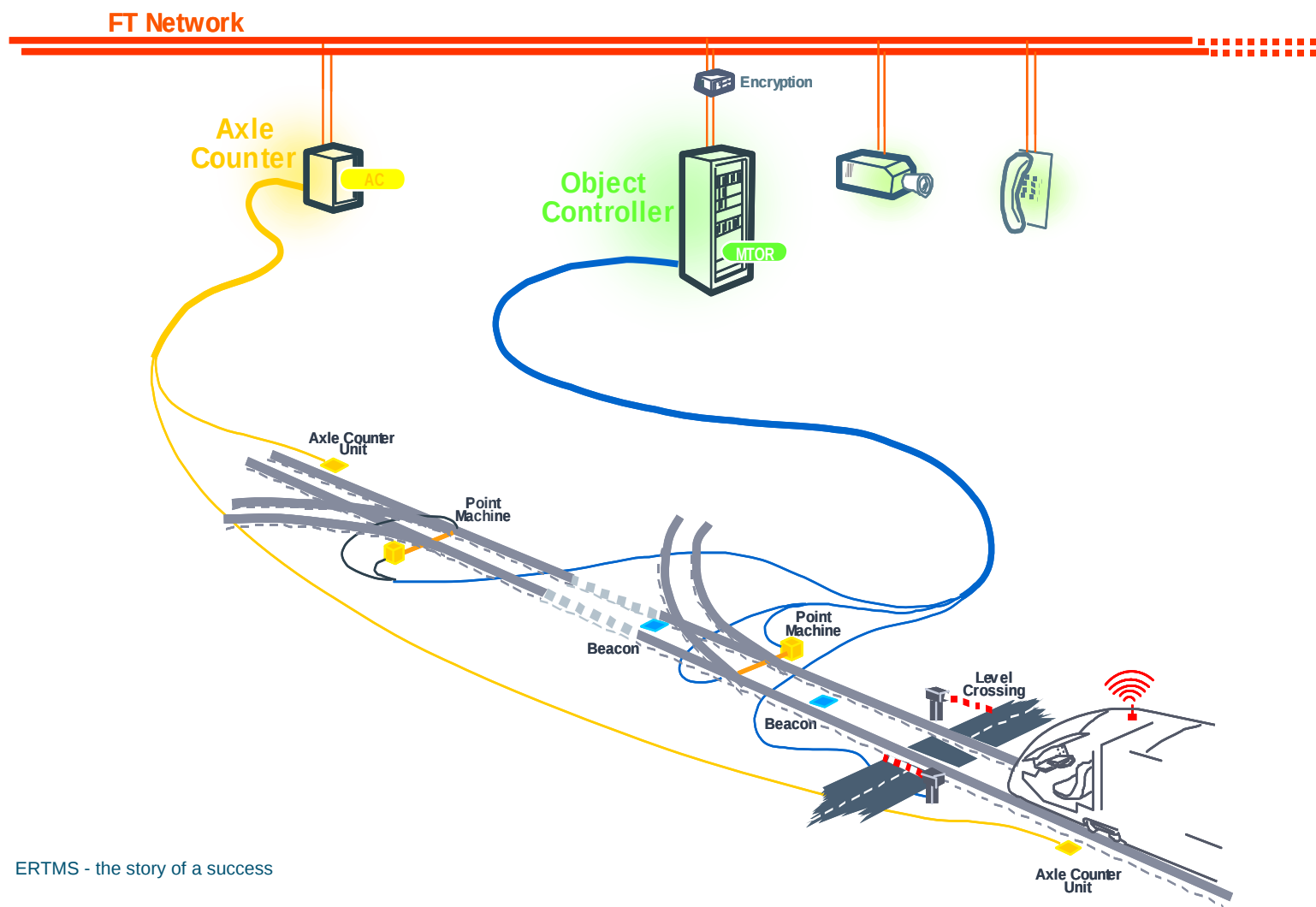
Cambrian Technical Solution

System Design – Control Centre Architecture

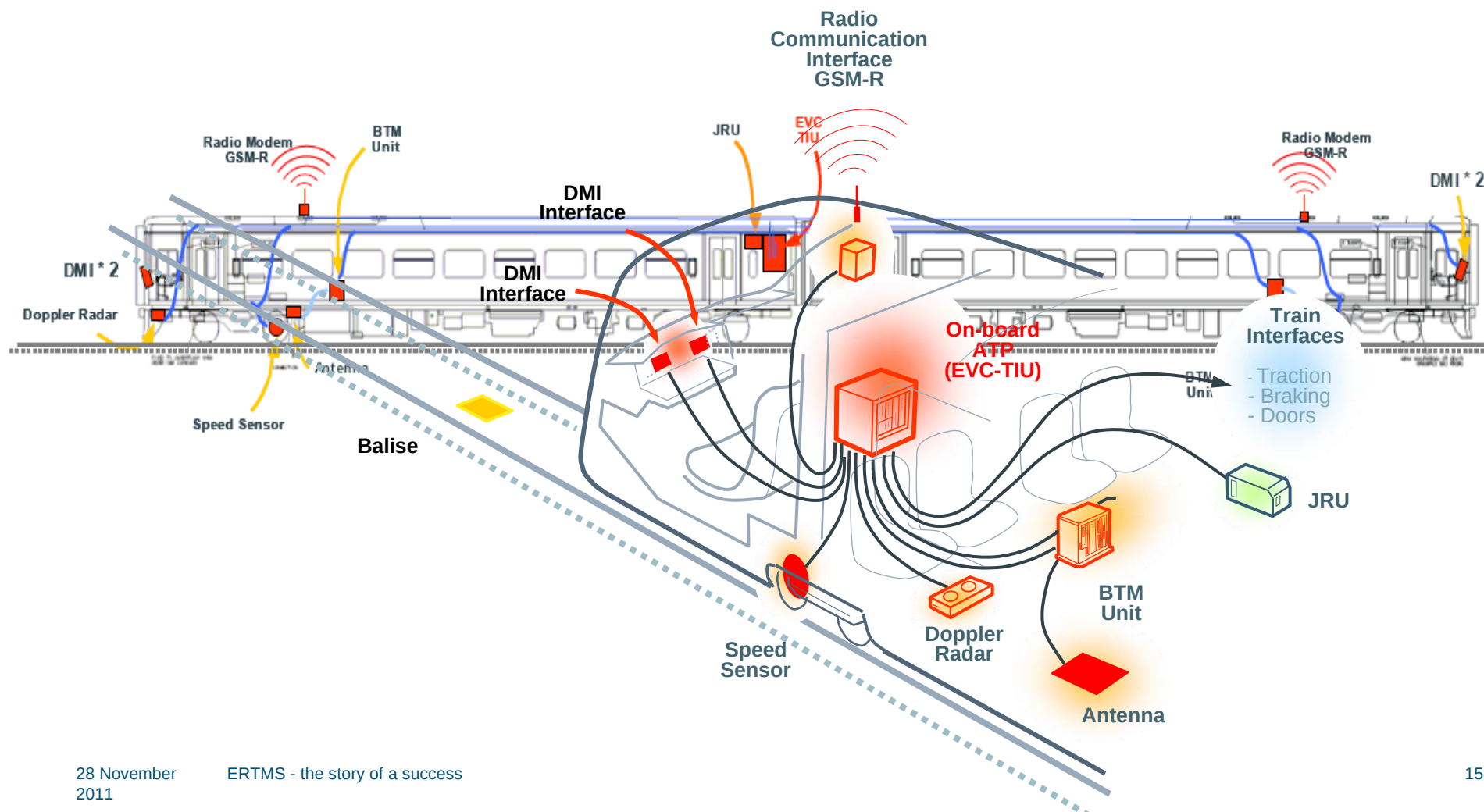


Cambrian Technical Solution

System Design – Wayside Architecture



Cambrian Technical Solution



Class 97/3 & Class 158 on Cambrian



ERTMS equipment on board



Class 97/3



Class 158



Cambrian initial issues

- Contract awarded to Ansaldo – STS in 2006
- Joint project team Network Rail/Ansaldo/ATW/ATOC/RSSB
- Harlech – Pwllheli commissioned October 2010, remainder in March 2011
- Train performance was poor at first
- Several quasi – SPADs in the early weeks

Lessons from Cambrian Project

- Industry ability to manage technically complex projects – infrastructure and rolling stock. NR performance was variable
- Lack of detailed understanding of operational scenarios – operation under RETB was more complex than thought
- Contracting strategy – despite initial issues the contractor continued to work on solutions
- Interoperability Regulations – UK interpretation of requirements differed from those of European NOBOs
- Unexpected technical problems (cab display visibility)
- Understanding the way GSM-R works – data card interface and diverse routing

Lessons from Cambrian

- The power of working together - what an integrated team can deliver. This was demonstrated through the joint performance improvement workshops at Machynlleth and Walsall
- Determined and flexible project team
- Steam locos are more difficult than you might think!
- Benefits of a DRACAS system

Summary of performance /1

Daily performance

	22334000 Aberystwyth - Birmingham	22335000 Machynlleth - Pwllheli	Reason for Drop in Performance
Wednesday, 14 September 2011	90.5%	100.0%	
Thursday, 15 September 2011	95.2%	94.1%	
Friday, 16 September 2011	90.5%	100.0%	
Saturday, 17 September 2011	90.0%	94.1%	
Sunday, 18 September 2011	94.4%	100.0%	
Monday, 19 September 2011	95.2%	94.1%	
Tuesday, 20 September 2011	71.4%	94.1%	
Wednesday, 21 September 2011	90.5%	64.7%	
Thursday, 22 September 2011	100.0%	94.1%	
Friday, 23 September 2011	85.7%	68.4%	
Saturday, 24 September 2011	100.0%	100.0%	
Sunday, 25 September 2011	94.4%	50.0%	2J23 Balise reader failure MCN-DJ
Monday, 26 September 2011	85.7%	100.0%	1G07 BTM Subsystem Failure Forden
Tuesday, 27 September 2011	90.5%	100.0%	
Wednesday, 28 September 2011	95.2%	88.2%	2J15 BTM Subsystem failure 1G55 3 engines revert to idle.
Thursday, 29 September 2011	90.5%	70.6%	2G45 Trespassers on line Porthmadog
Friday, 30 September 2011	85.7%	94.7%	2G75 Barrier Button Harlech 1J03 BTM Subsystem failure 1J31 Brakes dragging
Saturday, 1 October 2011	85.0%	82.4%	Saturday 1st October 2J27 Lighting fault. 1G07 BTM Subsystem failure
Sunday, 2 October 2011	100.0%	100.0%	
Monday, 3 October 2011	75.0%	70.6%	MTOR power failure Merllyn

Summary of performance /2

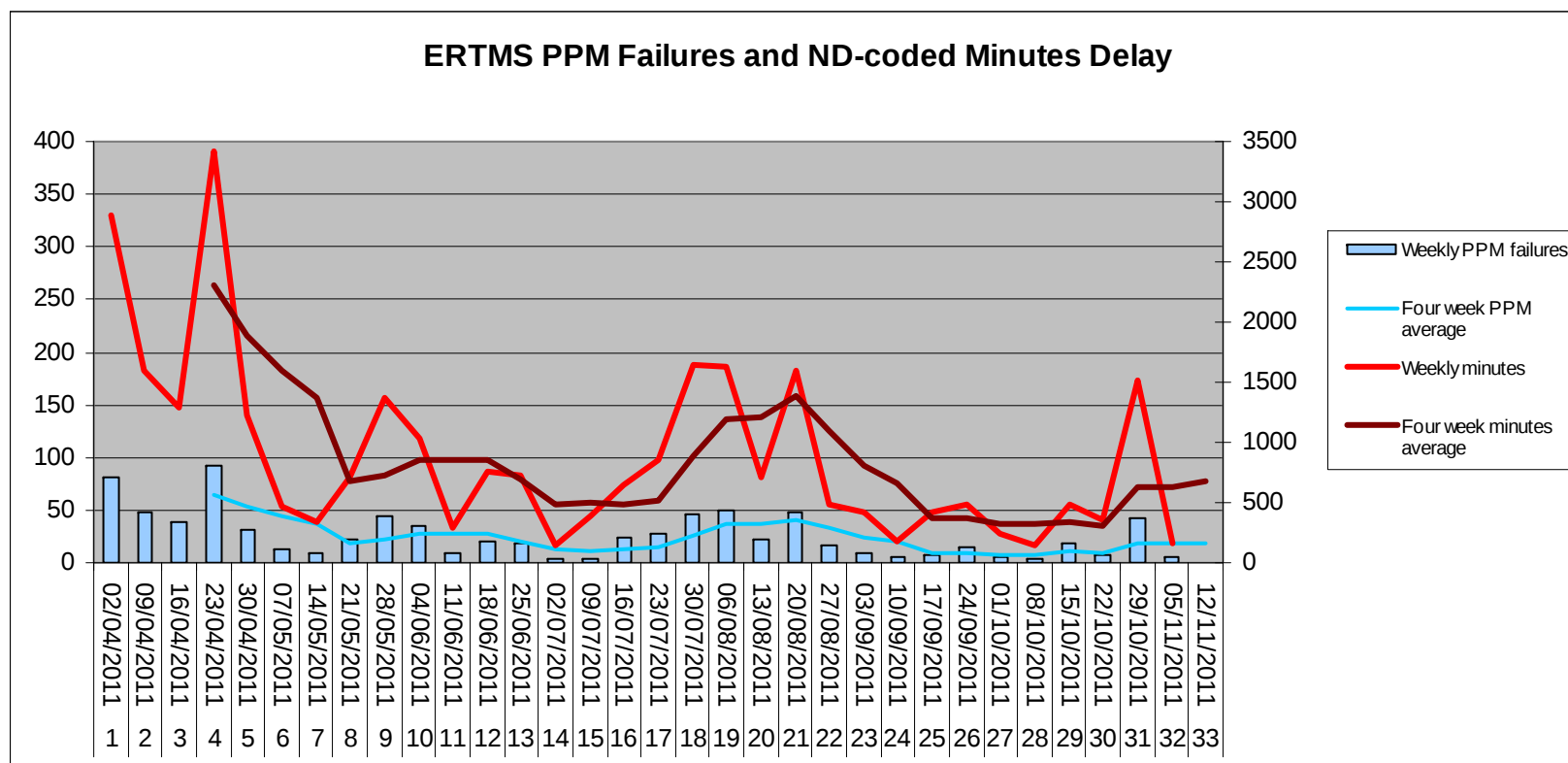
	22334000 Aberystwyth - Birmingham	22335000 Machynlleth - Pwllheli	Reason for Drop in Performance
Monday, 3 October 2011	75.0%	70.6%	MTOR power failure Merllyn
Tuesday, 4 October 2011	89.5%	94.1%	
Wednesday, 5 October 2011	73.7%	100.0%	Two cabs open at Machynlleth
Thursday, 6 October 2011	100.0%	94.1%	
Friday, 7 October 2011	85.0%	100.0%	No ERTMS related issues, late arrival of Birmingham train
Saturday, 8 October 2011	85.0%	94.1%	No ERTMS related issues.
Sunday, 9 October 2011	100.0%	100.0%	
Monday, 10 October 2011	66.7%	82.4%	Barrier stuck (high wind), RHTT in SR, Children nr line (Cemmaes), Broken gate
Tuesday, 11 October 2011	90.5%	94.1%	No ERTMS related issues
Wednesday, 12 October 2011	95.2%	64.7%	Odo failure cab 2J03, lack of Guard for 0645 Pwllheli train (dept 0720)
Thursday, 13 October 2011	76.2%	100.0%	TRUST Reporting system down. 2 minute delay at Talerdigg points
Friday, 14 October 2011	90.5%	100.0%	
Saturday, 15 October 2011	100.0%	100.0%	
Sunday, 16 October 2011	100.0%	100.0%	
Monday, 17 October 2011	95.2%	100.0%	
Tuesday, 18 October 2011	90.5%	94.1%	
Wednesday, 19 October 2011	52.4%	52.9%	MA granted to Newtown, relay issue caused MA to be changed. EBA
Thursday, 20 October 2011	90.5%	94.1%	
Friday, 21 October 2011	95.2%	100.0%	
Saturday, 22 October 2011	100.0%	100.0%	
Sunday, 23 October 2011	75.0%	100.0%	no ERTMS issues

Summary of performance /3

Week	Aberystwyth - Birmingham (HL040001) - PPM	Machynlleth - Pwllheli (HL040002) - PPM	Incidents (ERTMS)	PPM Failures (ERTMS)	Delay Minutes (ERTMS)
1 (27/03/11 - 02/04/11)	55.6%	49.1%	41	69	2468
2 (03/04/11 - 09/04/11)	71.3%	61.3%	37	49	1594
3 (10/04/11 - 16/04/11)	83.5%	69.4%	32	38	1293
4 (17/04/11 - 23/04/11)	56.8%	35.2%	45	93	3426
5 (24/04/11 - 30/04/11)	78.6%	71.7%	34	32	1227
6 (01/05/11 - 07/05/11)	86.3%	84.1%	24	14	488
7 (08/05/11 - 14/05/11)	97.7%	87.7%	19	8	362
8 (15/05/11 - 21/05/11)	85.0%	83.0%	17	22	703
9 (22/05/11 - 28/05/11)	79.7%	82.7%	34	44	1364
10 (29/05/11 - 04/06/11)	64.6%	55.5%	21	34	1036
11 (05/06/11 - 11/06/11)	92.3%	86.4%	17	10	285
12 (12/06/11 - 18/06/11)	84.5%	80.0%	21	20	756
13 (19/06/11 - 25/06/11)	82.8%	75.5%	27	20	721
14 (26/06/11 - 02/07/11)	83.8%	83.6%	20	3	153
15 (03/07/11 - 09/07/11)	90.4%	79.1%	19	4	146
16 (10/07/11 - 16/07/11)	86.8%	78.2%	22	25	640
17 (17/07/11 - 23/07/11)	90.9%	77.3%	17	28	853
18 (24/07/11 - 30/07/11)	77.2%	61.8%	27	46	1646
19 (31/07/11 - 06/08/11)	75.1%	50.9%	17	50	1621
20 (07/08/11 - 13/08/11)	88.4%	73.6%	18	21	716
21 (13/08/11 - 20/08/11)	70.2%	61.8%	23	47	1595
22 (21/08/11 - 27/08/11)	92.3%	71.8%	20	17	480
23 (28/08/11 - 03/09/11)	89.0%	80.9%	20	10	425
			572	704	23998

- Week 20 Significant delays of 467 minutes due to axle counter failure at Welshpool
- Week 21 Significant delays of 1293 minutes due to axle counter failures at Welshpool (81%)
- Week 22 Significant delays of 130 minutes due to axle counter issues at Welshpool (27%)
- Week 23 significant delays of 172 minutes due to loss of power from 57 car at Pwllhelli

Summary of performance to date/4



Summary:

- Trend now heading in right direction, recent poor performance has been due to damage to FTN cable and Axle Counter Evaluator failure at Shrewsbury

Early Performance Problems

- GSM-R reception at Aberystwyth – interference and station roof
- Lengthy temporary speed restrictions from new trackwork
- DMI went blank along coast – frequent and rapid contrast changes
- DMI unreadable in sunlight
- “Rollover” issues as the RBC system shut down because of unexpected events -
- Installation problems with power points and equipment rooms

Early actions to improve performance

- Additional GSM-R mast at Aberystwyth restored reception
- Outstanding track issues completed
- DMI screen visibility – software changes slowed down the reaction time to changes in brightness
- DMI changed to one which is successful in Spanish cash machines/screen shielded from excessive sunlight
- Software changes planned to increase the range of events the RBC should expect
- Agreed rectification plan with contractor for power points and equipment rooms

Ongoing Performance Problems

- Interface between axle counter data card and FTN caused ongoing failures – biggest individual cause of delay
- Cab opening/closing remains an issue
- Coupling remains an issue but the electrical connection is always vulnerable with MUs
- Speed profiles can be difficult to drive – especially for 97s

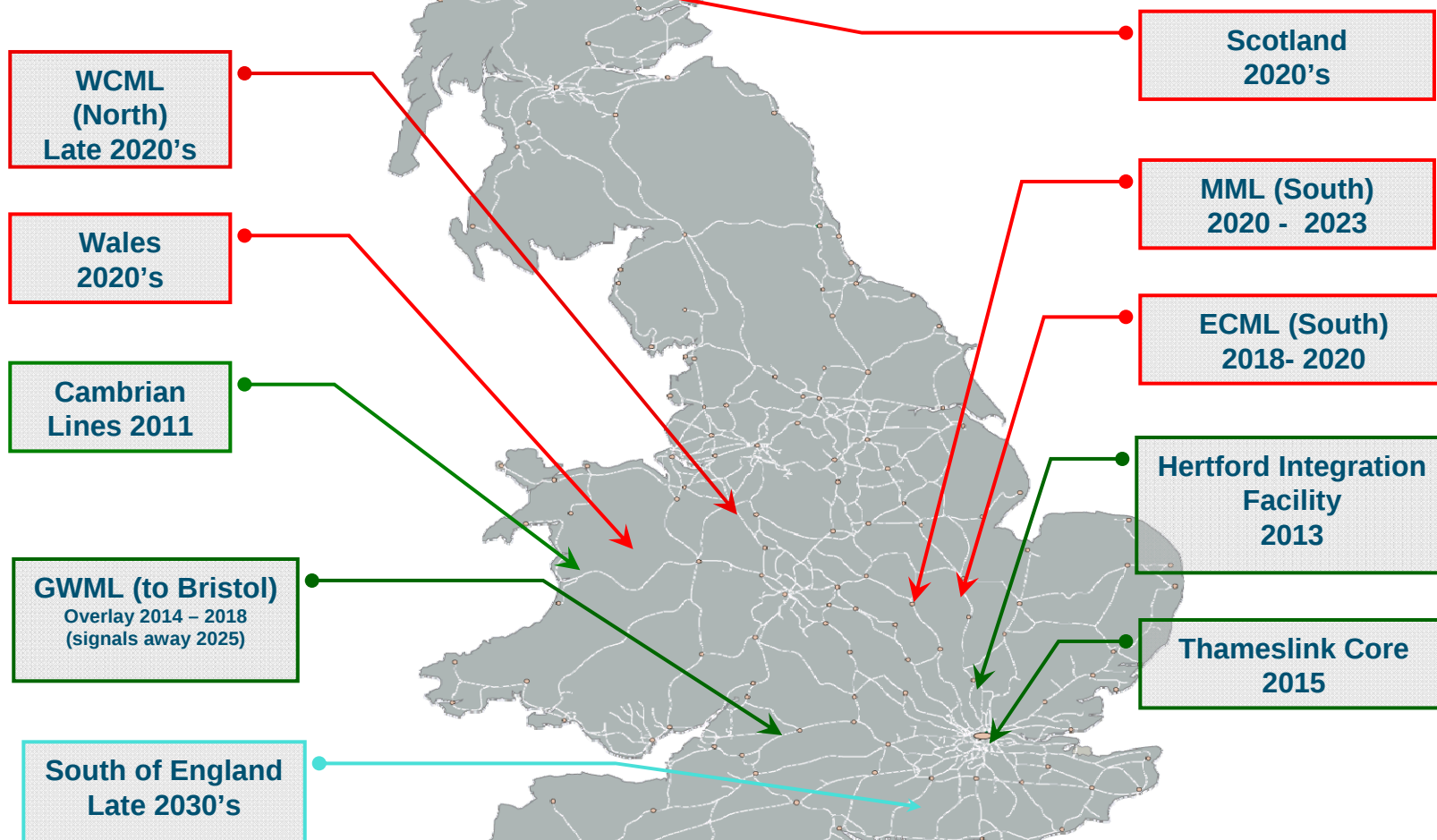
Summary of other progress

- ASTS are progressing the development of software and data changes instructed end of June and are maintaining program for software changes later this year.
- Data change on programme in France, Scheme plan work in UK behind plan, mitigation action in hand to recover
- Test Plans carried out for auto odometry – results are being fed back to France for prototype modification
- Workshops completed for:
 - Machynlleth 22 September for Performance with ATW and Route
 - Walsall training centre to review axle counter & FTN link data
- Successful meeting with ORR, way ahead for Technical file review discussed
 - Updated issues log will be submitted by 7/10/11
- V1.2.5 onboard Eurocab software tested on Cambrian last week, awaiting feedback

Safety overview

- All SPAD events have stopped within SvL, risk ranked as 0
- ERTMS SPAD breaching SvL is almost impossible
- Do we need a new SPAD category?
- Needs a different approach to driving – ERTMS is more cautious than humans
- No system fault has been a wrong-side safety fault (but does delay trains!)

Indicative Infrastructure Programme

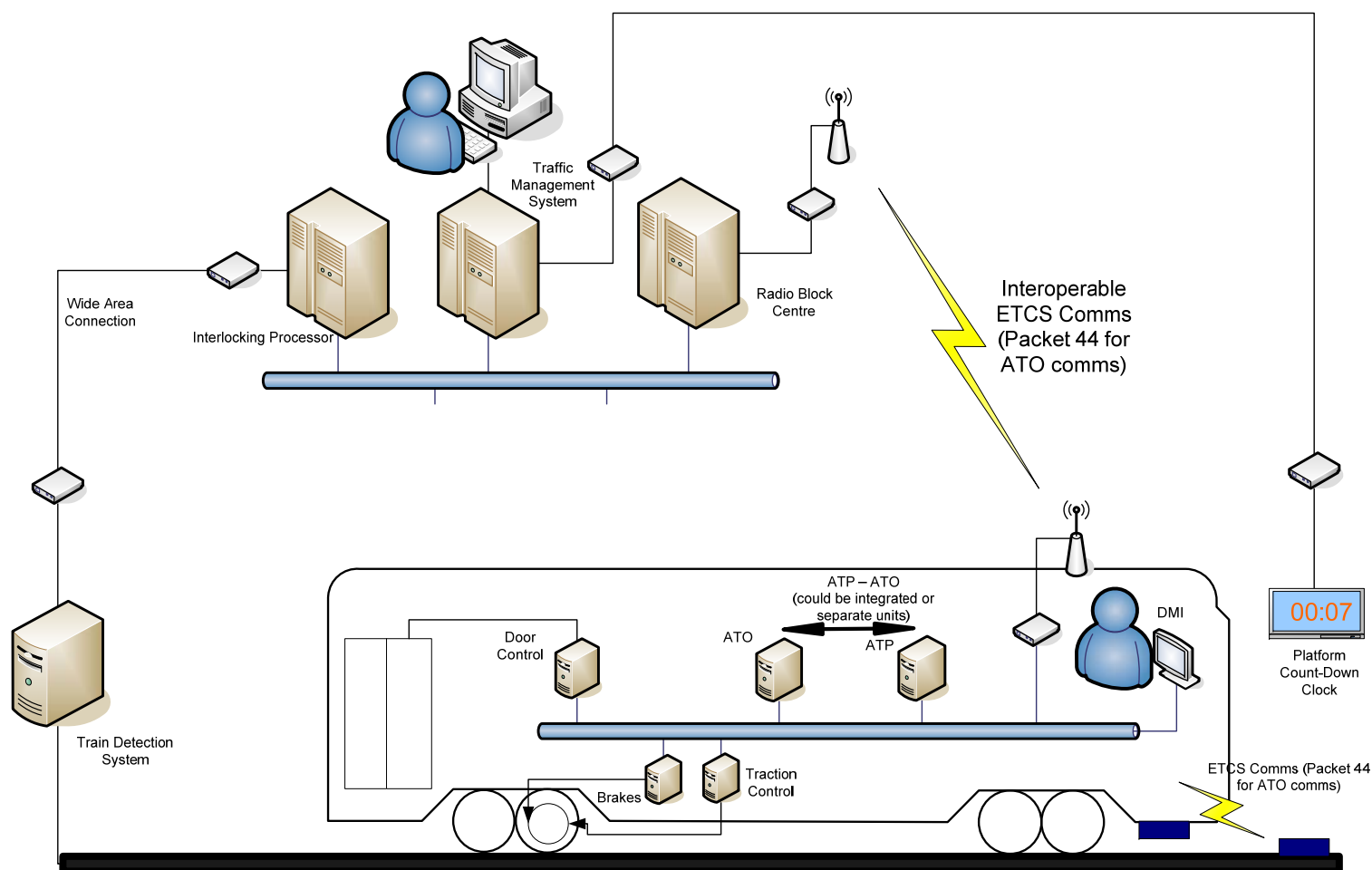


Challenges

- Technology development
 - ERTMS Level 2 Baseline 3.0.0 specification
 - ERTMS Level 2 with packet switching GSM-R communications
 - ERTMS Level 3
- Cross Industry Commercial arrangements
 - Rolling Stock Release and Train Fitment
- Industry change
 - ERTMS Trainborne equipment
 - Driver Training
- Integration with other major programmes
 - Great Western, Crossrail, Thameslink, Electrification, IEP

Automatic Train Operation (ATO) Concept

Train-Control Conceptual Diagram



ATO Progress

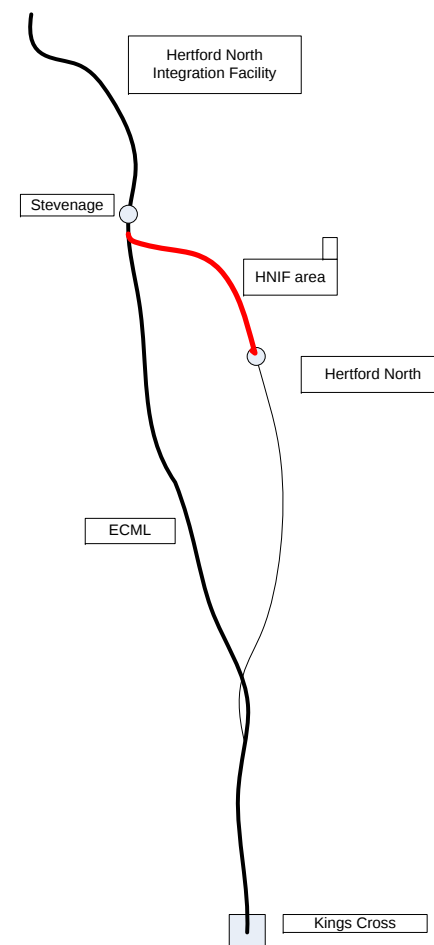
- Three contractors asked to carry out development work – how compatible is their ETCS with ATO in a number of scenarios?
- Positive responses from two of the three so we can be relatively confident that ATO will work in a slow urban scenario and a fast urban scenario. Alignment with platform edge doors not a problem
- ATO will be installed over a very limited area – no plans to abolish drivers
- Key to Thameslink is now getting the trains in the right place at the right time – next phase of traffic management

Hertford National Integration Facility

- HNIF is an integration facility for the testing and evaluation of European Rail Traffic Management System (ERTMS) equipment and systems comprising integration laboratory and track
- Purpose - to enable integration of component parts of ERTMS systems, allow components and assemblies to be evaluated in isolation and as a complete system, capture performance data, and support decision making for application designs for parts of the Great Britain railway ERTMS systems rollout.
- Location - A part of Hertford Loop has been selected for the track, and the laboratory is expected to be housed in existing accommodation at the Hertford North sidings.
- Programme - All to be operational April 2013

Hertford Loop

- Controlled from Kings Cross panel
- FCC commuter service (every 20 minutes off peak) Hertford North to Moorgate
- Linespeed of 75mph in both directions, W10 gauge cleared
- Hourly service from HN - Stevenage
- ECML diversionary route
- 25kV AC Electrified throughout



HNIF - Benefits

- De-risks the delivery of ETCS and possibly ATO for Thameslink and subsequent applications.
- Provides Network Rail with further experience in designing, delivering, operating and maintaining ETCS infrastructure.
- Provision of a facility which allows both signaller and driver familiarisation with ETCS operations.
- HNIF can be used to validate operational rules and procedures prior to application on the live railway.
- The provision of a national facility will provide passive provision for subsequent ETCS fitment, minimising the potential for abortive works, rework and subsequent commissionings.

What do we need to do differently?

- Key point is understanding the scale of the changes needed
- Resources will need to be brought in and trained – little possibility of an early accelerated programme

***Thank you – any
questions?***