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EU Referendum:

Britain, the EU and the Rail Industry

The B.A.R.R.I.E.R.S. Report

Barriers to Innovation in the Rail Industry

ISSUE THREE 2016

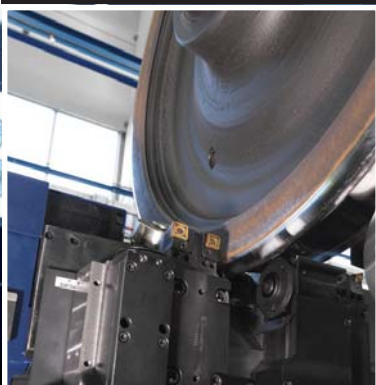


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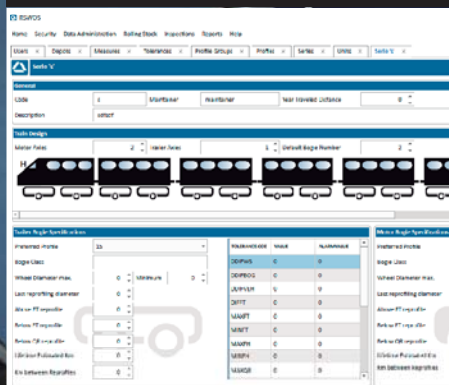
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Letter from the Editor

Welcome to the third magazine issue of 2016 for Railway-News.

In this issue we're taking a look at the upcoming British referendum on EU membership. The Remain and Leave supporters have been making their respective cases in the media, so we wanted to take a look at the voices in the rail industry. How would a Brexit impact business, workers and passengers? We also take a look at the Channel Tunnel, its beginnings and its future now that this rail link between Britain and mainland Europe has been in operation for more than 20 years – in fact, it opened just six months after the Treaty on European Union, the Maastricht Treaty, became effective.

For this issue of the magazine we also have a couple of interviews for you. Our Contributing Editor Naomi Thompson spoke with Adeline Ginn, General Counsel at Angel Trains and Founder of Women in Rail to learn more about the Women in Rail initiative.

I interviewed the founders of HackTrain, River Baig Tamoor and Alejandro Saucedo, about their newly released B.A.R.R.I.E.R.S. report to find out more about what barriers to innovation there are in the rail industry and what recommendations they are making to change this.

As part of our European focus in this issue, the infrastructure project we're looking at this time is High Speed 2 and its role in connecting more of the UK with mainland Europe.

We take a look at ERTMS – the European Rail Traffic Management System – how it works and what its benefits are.

MTM Power write about the new EU fire protection certificate EN 45545. Harmonising the market brings costs down in rail vehicle manufacturing. Parker write about the refurbishment or replacement conundrum and what decision-making needs to be done prior to choosing the best course of action. BT Cables, who already supply the rail industry, explain why they are keen to work in this sector. Goldschmidt Thermit write about their Railstraight system aimed at intelligent maintenance through precision measurement. Multi-Contact present their low-maintenance solutions for the rail industry.

All of us here at Railway-News hope you enjoy this issue as much as the last. Our next issue is due to be published in August in anticipation of InnoTrans 2016. If you wish to feature your company, please email al@railway-news.com. For editorial matters, please email jcs@railway-news.com. We look forward to hearing from you. Please enjoy the read!

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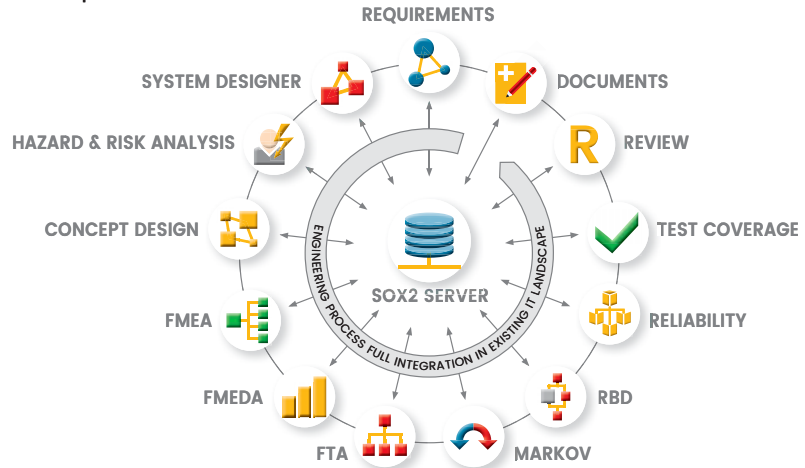
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Britain, the EU and the Rail Industry

In recent weeks, many, many people, politicians, businesses and unions have expressed their views about Britain's membership of the European Union.

By Josephine Cordero Sapién

In recent weeks, many, many people, politicians, businesses and unions have expressed their views about Britain's membership of the European Union. We've heard arguments and wild claims about a gamut of issues, from the economy, immigration and the NHS. However, what about the rail industry? How will the businesses, workers and passengers in this sector be affected?

Of course, the main problem is, there has been absolutely no outline of what strategy the government would pursue in case of a British exit from the European Union. We by and large know what we're getting as an EU Member State, we know what powers and vetoes we have – it's a known entity. On the Leave side, however, things like immigration could go up or down, the economy according to countless experts is most probably going to

get worse, some say irreparably, some are more optimistic than that. And then there are the countless little things the EU does that are far too numerous to mention here. One example comes from the MTM Power article in this magazine:

"The fire safety requirements were particularly complicated for trains used across international borders. Different national regulations had to be taken into account for various European countries."

In 2013 then, an EU wide set of fire regulations was released to harmonise them across all Member States. National fire regulations become invalid in March this year.

Rail Industry Players

So what is the business opinion? Various industry players have

spoken out. Hitachi Ltd said:

"Hitachi, like other multinationals, invested in the UK in order to access the whole of the EU market, and unimpeded access to the EU market is fundamental for our position in the UK."

We have made significant investments here across many of our businesses, in part, because of the UK's strong economic fundamentals, rich access to talent and position as a springboard to other European or EU markets. A potential departure from the EU creates uncertainty in terms of economics, trade, skills and talent – particularly in manufacturing, and would affect the stability that we need for continued investment and long-term growth.

We believe that a strong and

united Europe with the UK in a single, open market will be better for Europe's prosperity, and therefore for Hitachi's business. So, whilst we recognise that this is a decision for UK voters, Hitachi hopes the referendum will result in a positive decision to remain in the EU."

Siemens, who are involved in railway electrification, rail automation, and all manner of trains, from regional to high-speed an intercity, said:

"We see the main benefits of EU membership as: tariff-free access to the UK's biggest export market; a common set of rules between 28 countries that reduce business costs; and access for British businesses and universities to EU-wide innovation and research initiatives, which are helping to shape the industries of the future. These advantages help to make Britain a better place to do business, not just for Siemens, but for companies across our supply chain and beyond."

[...] A new trade deal with the EU could take many years to conclude and it is impossible to predict the terms that will be agreed and at what price. This uncertainty, and threat of increased costs, could make the UK a less attractive place to do business and may become a factor when Siemens is considering future investment here."

Airbus, who also make train simulators, have likewise issued a statement in favour of Remain. Richard Branson, CEO of Virgin, said: *"Leaving would be very damaging for Great Britain."* BT, whose subsidiary, BT Cables, is active in the rail industry as indicated in their contribution to

this magazine, has also come out in favour of Remain.

Remaining neutral on Brexit matters other than the economy, these companies are saying that they choose the UK as a location because it gives them access to the single market. They are multinational corporations. In the EU, workers and goods can move easily between countries, allowing companies to draw on the skills of a much larger EU-wide workforce and giving them the ability to manufacture and sell their goods competitively.

Of course it would be possible for the UK to negotiate access to the single market in the event of a vote to leave. However, even the uncertainty surrounding this issue and the final terms the UK will end up with will cause economic woes, as illustrated by pound sterling falling by nearly 2% to its lowest point since 2009 when former mayor of London, Boris Johnson, announced his support for the Leave campaign.

Uncertainty is, however, the best-possible outcome. Many on the Leave side have stated they do not want the UK to be part of the single market. Arden Leave campaigner and Justice Secretary Michael Gove said quitting the EU would mean quitting the single market.

Economists for Brexit propose that the UK would be better off outside of the EU if it opted for the solution of unilateral market liberalisation. That would mean no import tariffs and no protections for jobs in the UK, as illustrated by the recent events with Tata Steel and the problem of too much steel from China ruining UK steel production. This is obviously bad news. In January 2016, Network

Rail stated: *"As passenger numbers grow and the number of trains running on Britain's railway continues to increase each year, so too does the need for Network Rail to replace worn out track – and it's British steel which does the job. A five-year contract with Scunthorpe-based Tata Steel UK ensures that 96 per cent – or 120,000 tonnes – of the steel rail procured by Network Rail is made in Britain."* Yet, Vote Leave's economist Patrick Minford, writing in the Sun, does not seem perturbed, admitting that a leave vote would "Over time, if we left the EU, it seems likely that we would mostly eliminate manufacturing, leaving mainly industries such as design, marketing and hi-tech. But this shouldn't scare us."

How would workers be affected?

Companies in the rail sector that have gone on record have spoken out in favour of Remain, avoiding uncertainty and giving them access to the single market. In addition, many businesses vital to the rail industry could face ruin.

Obviously, if companies are losing revenue or are even struggling to get by, this is bad news for workers. Indeed, Leave campaigner Michael Gove said: *"I can't guarantee every person currently in work in their current job will keep their job."*

And despite the majority of unions, including Unite, Unison, GMB and Usdaw, coming out in favour of Remain, RMT, the transport union, said in April: *"It's a myth that the EU is in favour of workers."* On 8 April, the Financial Times reported *"The RMT, which has long been Eurosceptic, said that the EU was attacking*

collective bargaining and other workers' rights in countries such as Greece that had been bailed out. It also said that EU rail policies would make renationalisation impossible." (As a side note, this last claim is odd, because other EU Member States have nationalised rail companies, such as France with SNCF, Germany with Deutsche Bahn and Italy with Trenitalia, and Network Rail in the UK is also in public hands.)

The TUC on the other hand commissioned a legal report by Michael Ford QC, in which he said: *"It is easy to contemplate a complete reversal of the gradual increase in social regulation protecting workers, which has*

taken place since the 1960s."

The fear is that the EU is not supportive of workers, as evidenced by the austerity measures put on countries such as Greece and Portugal as a result of the Eurozone crisis. However, it is important to remember that a vote to leave the EU might not alleviate workers' concerns about their rights. The general secretaries of Unite, Unison, GMB and Usdaw wrote a letter to the Guardian in which they stated: *"Throughout the 1980s and early 1990s the British trade union movement worked in solidarity with our European partners and fought hard to secure valuable working rights legislation at EU level,"* adding: *"To this day these rights – including maternity and*

paternity rights, equal treatment for full time, part-time and agency workers and the right to paid leave – continue to underpin and protect working rights for British people."

"If Britain leaves the EU we are in no doubt these protections would be under great threat. Despite words to the contrary from figures like Iain Duncan Smith and Michael Gove, the Tories would negotiate our exit and, we believe, would negotiate away our rights. We simply do not trust this government if they are presented with an unrestricted, unchecked opportunity to attack our current working rights."

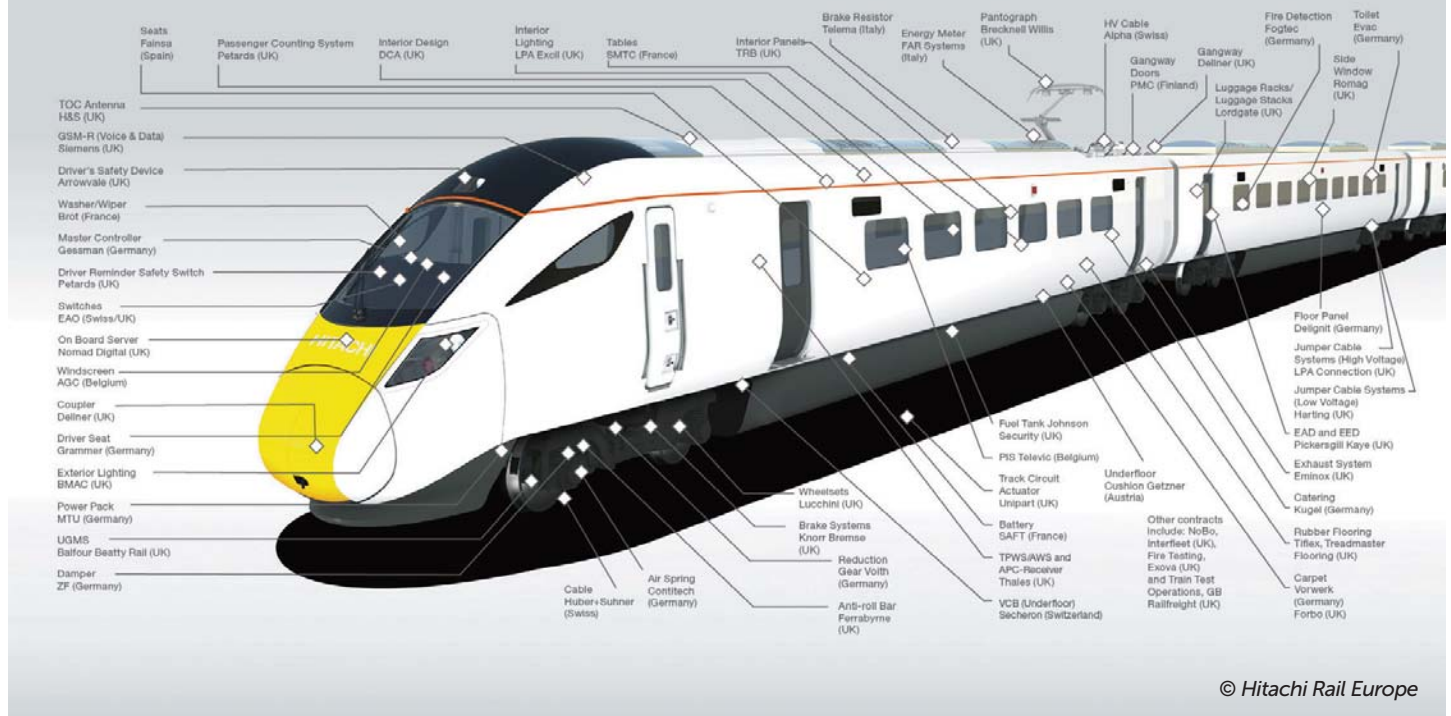
It seems to me that there is a



The exterior of Hitachi Rail's North Pole Train Maintenance Centre, West London © Hitachi Rail Europe

European suppliers selected by Hitachi Rail Europe for the Class 800/801 trains

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safety in not having one national government have the ability to remove such rights.

Vote Leave and the Government Response

Railway-News contacted Vote Leave for a statement regarding their position on the rail industry. A spokesperson for Vote Leave said: *"The UK rail network is suffering from a crisis of overcapacity and under-funding. And our membership of the EU is doing nothing to help either of these.*

'Brussels bureaucrats are planning to create a new international rail freight corridor on the West Coast Mainline, putting even greater pressure on an already

overstretched service. The UK Government challenged this decision but was rejected by the European Court, demonstrating how much control we've handed over to the EU.

'Every week we send £350 million to the EU. After we Vote Leave we can take back control of our rail industry and spend this money on our priorities like investing in our transport infrastructure.'

First of all, the £350 million per week figure has been debunked. The Institute for Fiscal Studies puts the figure at around £150 million per week, when all aspects such as the rebate have been considered. Furthermore, the IFS says that the economic impact of a Brexit would more than offset any money the UK sends to the EU.

In addition, there is nothing stopping Britain from investing in the UK network as a member of the European Union. Indeed, Rail Minister Claire Perry said at a speech given to the Rail Engineers Forum Technical Seminar 2015:

"So, our plan is to invest record amounts in infrastructure. More than £70 billion between now and 2020. On the railways, we are building HS2, Crossrail, and pressing ahead with plans for Crossrail 2. But we are also funding the biggest investment in our classic rail network since Victorian times."

Further, it would seem that if we are currently suffering from overcapacity, then that is good in the sense that there is real demand for rail travel and therefore investment in this area will pay off. Railway-technology

reported in September 2015 that *"Over the past ten years, Spain's railways have been expanding at a rapid pace, thanks to huge national investments and European grants. Currently struggling with feeble passenger demand, the country is trying to reclaim dwindling profits by dedicating millions of euros to construction and improvement works across key sectors of its rail network."*

In addition, the EU is contributing funding to rail projects in the UK. UK rail companies have been awarded more than £80 million in EU funding from the Connecting Europe Facility. Here's a list:

- **DB Schenker UK Ltd: €1 million**
- **DfT and HS2: €39.2 million**
- **Department for Regional Development (Northern Ireland): €24.1 million**
- **Network Rail: €6.5 million (partially a joint application)**
- **Transport for London: €4 million**
- **Siemens PLC UK (joint application): €5.7 million**
- **West Midlands ITA: €0.9 million**

The Department for Transport told Railway-News: *"UK Rail projects also benefitted from the CEF's predecessor, the Trans-European Transport Network (TEN-T) programme. From 1996–2013 over 60 rail projects received around €500 million in funding. HS1 was the largest beneficiary with over €250 million."*

The European Investment Bank (EIB) has also made over 30 loans to UK rail and light rail projects totalling over €10 billion."

Now, the Vote Leave campaign reference an instance where the UK government challenged an EU decision in the European Court of Justice and lost. This is correct. The case in question is case C – 121/14. Essentially the UK government was required by the EU to spend money developing a rail freight corridor all the way to Scotland. Instead, the UK government wanted the extension of the corridor to go only as far as London. It seems odd that Vote Leave say on the one hand they want more investment in rail, and yet the one case they cite against the EU is one where an EU regulation requires the UK government to spend money on rail. This reminds me of something a colleague once said to me:

"Brexiters prefer bad decisions made in Westminster over good ones made in Brussels." Because it seems to come down only to who is making the decisions, not whether they are good or not. A government spokesperson meanwhile told Railway-News: *"Our membership of the European single market makes us stronger, safer and better off. This ruling will have no impact on existing passenger services."*

"Damaging our economy by leaving the EU single market will mean less money for public services and important infrastructure like rail. Rail connections to Europe are vital and the rail freight industry is worth around £1.6 billion a year to our economy, reducing traffic and improving safety on our roads and delivering environmental benefits. We are also investing record amounts to modernise our own rail network to make it fit for the 21st century."

Rail Passengers

And last but not least, what about passengers?

Membership to the European Union currently means the freedom to live, study and work anywhere within the EU and to go on holiday of course. With Britain outside of the Schengen Area, rail travel between Britain and mainland Europe requires a passport, but not more. The EU is also pushing to open up the rail market in the same way it opened up the aviation market. With increased competition come better services and cheaper prices. With a reduction in red tape thanks to harmonised regulations throughout the 28 Member States, it is cheaper for Train Operating Companies to register and manufacture their trains, and therefore rail travel overall is cheaper.

That is not to say that a UK government in the event of a vote to leave would not continue its efforts with the ERA, aiming to install ERTMS and create a Single European Railway Area. But whenever the Leavers are asked about a specific policy and whether they would abandon that one post-Brexit, they say no, we can keep that. Well, if we can keep it all and, more, we want to keep it all, why would we want to leave? The EU is built on four freedoms – the freedom of movement of people, goods, services and capital and the rail industry epitomises those freedoms. It is, ultimately, a very European industry.

Record number of rail journeys

Statistics published by the Office of Rail and Road (ORR) show that the number of passenger journeys on franchised rail services in Great Britain reached 1.654 billion in 2014–15.

This is the highest recorded figure since the series began in 2002–3 and an increase of 4.2% (67.3 million) on the previous year. This is also an increase of 69.5% since 2002–3, when only 975.5 million journeys were made.

In order to keep this amount of rail traffic flowing smoothly it is essential that the rail network can call upon a manufacturer like BT Cables to provide its range of safety critical cables on very short lead times. BT Cables has employed all the resources of its Continuous Improvement team and planning expertise to reduce manufacturing lead times to a highly competitive 4–6 weeks. Coupled with this is a range of items available from stock and delivered to site within 2–3 working days.

Globally there are huge investments being made in rail infrastructure projects at present, and many key people hold the opinion that rail is experiencing the same 'boom' the airline industry did 20 years ago. New investments will help the national rail operators gain a stronger presence within the transport industry in general and optimise efficiency within the rail sector specifically.

BT Cables has selected railways as a priority market segment and is currently combining its development, marketing and production resources to meet the changing demands of the railway industry which now operates on an increasingly global scale.

Network Rail approved

For the future BT Cables will continue to invest in the development of its product range and services with a specific focus on the rail market. BT Cables currently holds Network Rail approvals for:

- **Axle Counter (NR/L2/SIG/30060)**
- **Trackside telecoms (NR/PS/TEL/00015)**
- **SSI datalink (BR1932)**
- **Internal low smoke telecoms (CW1600)**
- **Jumper wires (CW1423NR)**

Supply partnerships

Complementing BT Cables' in-house manufacturing facility is a programme of supply partnerships with high-quality manufacturing companies across Europe and Asia.

This extended supply chain adds strength and diversity to BT Cables' manufacturing capability. The team based in Asia guarantees the highest levels of product quality are assured. A rigorous product inspection and release programme, regular audits and a commitment to work with its partners to continually reduce waste and take cost out of the process, provide further evidence of BT Cables' investment in its global supply chain. BT Cables' experienced technical team can facilitate new product

introduction with its supply partners, which increases the scope of the product portfolio BT Cables offers. The corporate and social responsibility programme is a two-way partnership with suppliers with a similar vision and which is enforced by regular assessments.

Growth

BT Cables is the fastest growing part of BT. This has been achieved through a number of initiatives and none more significant than the company's use of Continuous Improvement techniques. BT Cables introduced its continuous improvement philosophy under the Japanese Kaizen (change for the better) umbrella in 1998, and it is now an established way of life.

Kaizen and the disciplined Six Sigma approach have become fundamental to BT Cables' continued growth and success. By putting these techniques at the heart of strategy, planning and operations, all areas of the business have seen improvements in business efficiency, minimising waste, cost reduction, customer delivery and health and safety. This has helped secure an impressive platform for growth.

For more information on BT Cables and its products and services please visit **www.btcables.com** or call us on **+44 (0) 161 741 2345**.

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Rail Traffic Management Centre

AXLE counter cables (yellow cables)
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CW1600 (telephone cables)
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BT BMS Tec (access control)

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The B.A.R.R.I.E.R.S. Report

Barriers to Innovation in the Rail Industry

By Josephine Cordero Sapién



River (left) and Alejandro (right) - founders of the HackTrain

After having run hackathons to bring innovation to the rail industry, HackTrain have now taken it one step further and have produced a report, the B.A.R.R.I.E.R.S. report, which stands for Bringing Actionable Recommendations to Revitalise Innovation and Entrepreneurship in the Rail Sector. A key part to change is identifying where the problems lie.

A point about rail customers: in all other areas of our lives, we've become used to innovation and progress, so we expect that same level of service from train operating companies and it's not there. Rail needs to make sure it doesn't lose its customers. It needs to win over new customers. The report points to other cases where innovative ideas have simply overtaken an area by being more innovative – such as Netflix and Uber. But why this lack of innovation? After conducting more than 60 interviews, this report has identified 5 key barriers:

1. The franchising system is not designed to drive or reward innovation:

once a franchise is agreed, there is no more competition and hence no pressure to innovate. In addition, investment takes place early on in the franchise to get maximum value for money out of, meaning there is not much change during the final years of a franchise, and customers notice.

2. Procurement frameworks are unfit for entrepreneurs:

The ability to access contracts is difficult and to get non-safety critical technology off the ground is difficult and long-winded.

3. Data is fragmented, siloed and unreliable:

In the rail industry, open data feeds are unreliable and there is no documentation for developers. Technology contracts inhibit innovation in part because they have unreasonable data ownership constraints.

4. The funding landscape is difficult to navigate and is not output driven:

Although there are several funding options in the rail industry, they can be hard to access and onerous in their restrictions, proving to be too large obstacles for SMEs.

5. The culture in rail is resistant and reluctant to grasp innovation:

Mindsets have to change so that rail is seen as a service that needs to keep up with the rates of innovation in other industries to remain viable. It is vital that train operating companies listen to their customers, otherwise they face being left behind.

However, HackTrain haven't just identified these barriers; they've come up with tangible recommendations on how to improve the industry. They want to know if the safety board should really oversee innovation. They want every TOC to have an innovation manager. They want the Department for Transport to commission a 'Data in Rail' report to get an understanding of the state of data in this industry. They say there should be one industry-wide monitor of customer satisfaction levels. Grants should be handed out differently. HackTrain believes there needs to be an innovation centre for rail. They want franchises to be outcome oriented. All TOCs

should have a single place where they post their procurement opportunities. I could go on. These are just a few of their conclusions. It is obviously beyond the scope of this article to address them all.

However, I want to highlight a couple of points mentioned in the report – to whet your appetite to go read the whole thing. They note that competition is key to driving innovation and cite Italy as an example. It has introduced more competition on its important routes. State operator Trenitalia had held a monopoly. But in 2011 Nuovo Trasporto Viaggiatori Italo was founded and has caused an increase in competition, leading to better standards for both companies, such as WiFi and Sky television. Ticket prices dropped by 35% between 2012 and 2014, increasing the market share rail has compared to other forms of transport. In fact, this shift was so noticeable, RyanAir ceased its Milan to Rome flights as a result of the improved rail service.

Another is OptaSense, a British company set up in 2008 that provides real time data that can monitor entire rail networks to deliver information about track condition and detect major incidents such as landslides and more. Despite having won awards for trade and innovation, less than 1% of their business is in the UK. The company struggled not with its ideas but with finding out who in the industry was responsible for providing the approval. We want the benefits of this innovation in this country too so we need to have an open environment to test new innovations.

The B.A.R.R.I.E.R.S. report has thus identified concrete barriers, recommendations and case

studies highlighting systemic errors and opportunities. You can read the whole report at report.hacktrain.com. I spoke to HackTrain founders River Tamoor Baig and Alejandro Saucedo as well as the report's project lead Amber Westerholm-Smyth to tell me a little more about the findings.

What led to the commissioning of this report?



River: After we ran the first hackathon in March 2015 there was a lot of demand from the industry in using the technologies

our participants created. However, not a single prototype made it to the market.

We knew there were barriers preventing innovation from getting to the hands of customers and station staff, but couldn't pinpoint what the exact problems were.

We figured they were not alone in facing these challenges and wondered if anyone had started collecting these barriers so that the industry could work on solving them together. And so the idea to produce a report was born! We shared the idea with RSSB who were excited by the project and offered to fund it. RSSB initially released half the funds; however we soon found various barriers stemming from them. Unfortunately, RSSB declined to recognise these barriers so to ensure the report was as objective as possible we decided to terminate the contract prior to the

release of the secondary funds.

How did you set about this massive task of interviewing so many people? How did you choose who to interview? Was there enthusiasm to participate in this report?

River: Myself and Adam Stead [a rail consultant] introduced the report's Project Lead, Amber, to an initial set of 20 rail professionals from which she was able to extend her network through introductions and referrals. Interviewees were based on their experience and role in the industry. In particular, we tried to speak to people who had attempted to introduce innovation in the rail industry and struggled with the barriers.

As Amber met and interviewed them we quickly knew which ones were supportive of the report and would speak on/off the record and which ones didn't think anything was wrong in the industry and thus weren't supportive. There were a handful of times where we had industry professionals say to us "there are no barriers within the industry and we do not struggle to innovate". We actually met one such person at a conference a week before the report was released who then stated "the industry is rife with problems". All in all, most people were very enthusiastic and wanted to share their story on how they tried to innovate and what challenges they faced when doing so.

Amber, can you tell me a little bit about your background and how you got involved with the

HackTrain initiative



Amber: River and Alejandro approached me to see if I would be interested in project leading the report. I had gathered a fair amount of

research experience during my degree at Oxford University and had been focusing on the impact of social innovation in public services. The UK rail industry caught my imagination as an industry integral to the economy but one that was rapidly falling behind the innovation imperative. I was really interested in figuring out whether it was a lack of incentive or if there were larger issues at play. So when River and Alejandro approached me with this project I was keen to jump on board.

I have outlined the key findings above. Was there broad consensus across the board or were there areas of disagreement among industry members?

River: On the whole there was broad consensus, the only difference in opinion that emerged was over the weight that each industry member apportioned to each barrier. Because the railway is a sum of its parts, there are certain barriers that some members had a wealth of experience hitting but others hadn't come across because that area didn't cross their workstream. The difficulties in trialling technologies is a perfect example of this. For others, a barrier such as the lack of competition within a franchise was more widely

recognised. The lack of visibility of the barriers was one of the things the report aimed to tackle. By collating all the barriers in one centralised point it shone light on to issues that previously may only have been discussed by those they directly affect.

I know you describe for the purpose of this report what can be done within the franchising system, but do you think the rail industry in this country would ultimately be more innovative if that system wasn't in place?

River: The franchising system has good intentions. It's designed to increase competition in a heavily regulated market by getting transport-owning groups to bid for routes... The reason why the system hasn't worked as well as it could have is because we have been line for line specifying what innovation should be implemented within franchises – it's known as input specification. As a result, technology has been too prescriptive and has become fast outdated. In reality, what we really need, and what has worked well in other industries, is outcome-based specification. What's the difference? Well, for example instead of specifying "We want 5Mbps WiFi on all trains" we should and be specifying "We want WiFi that is market standard of that year on all trains" or "We want WiFi that 90% of passengers are happy with".

This approach is more responsive to passengers' needs and ensures that TOCs are continuously improving their services.

There has been progress towards

making this the standard. The DfT has begun moving towards this type of outcome-based specification and we should hopefully see the results of it over the years across various franchises.

In your third barrier regarding data in rail, you say that tenders with ancient specifications are released that are hidden to external suppliers and impossible for SMEs or external companies to find. Are you saying that if I wanted to bid for a tender, I couldn't because I wouldn't be given access to these specifications?



Alejandro: Yes and no. Tenders are accessible online, but the problem really lies with how easy that information is to access, digest and use.

As an industry we are very inward looking, we often assume that everyone understands the structure and endless acronyms. And so, we are also very bad at publically advertising new opportunities to companies outside of rail. Rail is already a very tough environment to succeed in as an SME so why are we making it even harder?

What we need to do is promote tenders outside of the industry, on platforms where the tech companies of Silicon Roundabout and Valley reside. Only then will we have new technology entrants coming to the market and really

shaking up the industry.

I like the comparison with Netflix and Uber to explain how innovative companies have simply overtaken traditional competitors who didn't have the vision or the courage to adapt to the future needs of their customers. Is there some complacency in the rail industry that no one else can compete with it because they won't have access to the rail network? What threats do you see out there?

River: Most definitely. An infinite amount. Just like the local taxi operators and blockbuster! The carpet will be swept out of transport-owning groups' feet if they don't fully embrace innovation and actively address passengers' key issues.

That said, we have started to see a culture change. Some have decided we need to start doing things differently. By working with us on the accelerator and participating in the research for the report, many have shown they are able to, willing and are addressing the needs of customers. The real difference will be made when the rail industry starts recognising innovation as a full time job. Until they devote the resources and time needed – such as having a full time innovation manager in each TOC – innovation will consistently fall to the bottom of the to do list.

There are two biggest threats that will hit the industry hard. First is

when a new bidder enters the UK market and takes a technology service approach towards running the railway rather than what we see today, which is more of an operational approach.

Secondly, driverless vehicles have the potential to create a mass exodus in rail. Being able to be transported straight from your home to any other location in the UK without having to put your hand on the wheel will fundamentally change our idea of travel. The convenience of it will see an increase in car usage in the UK like never before. Rail should be very, very worried about this.

If it doesn't become part of this connected system, it will miss out on a being part of the end-to-end journey experience.

The most surprising thing I learned at the presentation of this report was that the safety board (RSSB) overseas innovation in the rail industry. As you pointed out, innovation and safety are diametrically opposed. What was the most surprising thing you learned while creating this report?

River: It was actually really surprising to learn how many innovation boards there are in the industry. It showed that the rail industry knows it has an innovation problem and that it is trying to do something about it but just not with the collective effort needed. The number of boards just emphasised how fragmented and siloed the industry can be in approaching

challenges. You can talk and talk, write several strategies, make grand announcements, allocate funds but at the end of the day, if the passengers are not seeing the benefits of such efforts, something is going wrong.

What are some of the more positive developments you already see happening in the rail industry?

River: One of the most important things we have seen is the work of the passenger services team at the DfT. They have really recognised the limitations of the franchising system and have focused on working around them by changing their strategy for franchise agreements. Perhaps the most significant change has been the movement from input specification to output specification and increasingly outcome specification. Such efforts are already having considerable impact. The franchise agreement for Essex Thameside for example was output specified and has seen numerous benefits for customers inputted such as automatic delay-repay and free WiFi at stations.

Equally, there seems to be a real desire from the owning groups to connect with entrepreneurs and SMEs trying to bring innovation into the rail industry. This really became clear when we saw 5 out of 6 of the owning groups commit to sponsoring the accelerator. It is really critical that other stakeholders follow their lead and do their part.

The report doesn't just identify the barriers to

innovation but delivers tangible recommendations that various players in the industry can adopt. To what extent will HackTrain work with these players to push for these recommendations to be adopted?

Alejandro: We're very passionate about each of these recommendations and would like to see all of them realised.

For example, there is a critical need for a RailTech Hub. For the new entrants the fragmentation in the industry generates a sense of uncertainty about how decisions are made and where to go for further information. It also inhibits those already part of the industry who wish to push through innovative ideas or have recently been given innovation-based jobs.

Given the numerous other bureaucratic barriers to innovation, it is troublesome that something as simple as support and regular information for those wishing to undertake innovation projects is subject to its own degrees of bureaucracy and is not consistently available from a clear source. We noticed what a difference having a RailTech Hub made during the accelerator as a centralised point for people to meet, talk and discuss the topic of innovation.

What was really the critical difference is that the focus was on innovation happening that week or the following month rather than on the long timescales rail usually operates on. We can't stress the importance of something more permanent being created. However, for such a hub

to be engaged with by the whole industry, we recommend that the Department for Transport and Train Operating Companies jointly fund a new national cross industry innovation centre for rail.

Data has become a bit of an 'elephant in the room' in the rail industry. Rail has neglected data and in doing so it has neglected its customers.

There are multiple barriers that need to be addressed. Open data-feeds in rail are often unusable due to low reliability, inconsistency, and do not have set standards, documentation for developers is poor or inexistent and current technology contracts are monopolistic and archaic, inhibiting the potential for innovation. We would like to lead a data review that assesses the

current data ecosystem in the railway industry. This report should be commissioned by the DfT to review the previous, current and future investments in the core data systems in rail.

At the same time, we recognise that we can't make all of them happen on our own, the industry needs to step up to the challenge and lead some of them too. The HackTrain are happy to help advise on how to implement some of the recommendations and in other areas we would like to lead them.

To what extent do you see this lack of innovation in rail being a UK problem, rather than a problem faced by the rail industry

in other countries?

River: It's a problem in all countries. Even ones constructing new railways are building them using methods and technologies from the 20th century! We as an industry, globally, need to be a lot more ambitious when it comes to delivering services for our customers. I think one of the main problems is that we are too focused on day-to-day operations. As a result, the rail industry globally is busy solving today's problems with yesterday's technology. We need to find a way of devoting resources, time and intelligence to sourcing smart solutions that solve our challenges, not only today but also preempt tomorrow's problems.



River at the HackTrain Conference

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Fire safety on railway vehicles used for railway transportation presents a particular challenge for manufacturers and suppliers in this market segment.

Augsburg Fire Department

The extensive technology in modern locomotives and railway carriages means that these vehicles are faced with a variety of fire hazards, from technical defects to negligence and even arson. Due to the presence of many people in a confined space, often combined with a lack of options for evacuation, e.g. in tunnels, and along stretches of main track where help is a long way away, a fire on a railway vehicle can quickly lead to injuries and death, as well as to extensive damage to property.

For that reason, all the materials, systems and components used in modern railway vehicles must have proof of fire safety features so that the manufacturer can have the fire safety of the entire vehicle certified. The fire safety requirements were particularly complicated for trains used across international borders. Different national regulations had to be

taken into account for various European countries.

In August 2013, after two decades of development time, a new fire safety standard for railway transportation has entered into force, the EU standard DIN EN 45545. Two major European research projects, Firestarr (1997–2001) and TransFeu (2009–2012) were involved in its development. The EN 45545 is harmonising country-specific fire safety regulations in Europe. This combination results in an even closer safety concept for stations, rolling stock and the infrastructure. For new projects, the validity of different national regulations such as DIN 5510-2 (Germany), NFF 16-101 (France), UNI CEI 11170 (Italy) and BS6853 (UK) ended in March 2016 after the expiration of the transition period.

Pan-European Evaluation acc. to EN 45545-2:2016-02

As an established manufacturer of power supplies for use in railway vehicles, MTM Power was faced with the task of equipping all of its product lines for railway technology with the most comprehensive fire safety certifications available in order to offer their customers optimal support during certification of the fire safety of their entire systems or vehicles. MTM Power realised that a certification at the European level makes more sense for comprehensive fire safety certification of all railway products.

That is why MTM Power used EN 45545-2 as the basis for creating fire safety designs for electronic power supplies.

A recent update of the standard was issued in February 2016 and became effective immediately. MTM Power offers fire safety certificates of all railway products according to the current EN 45545-2: 2016-02 to its customers.

The challenge for MTM Power was to develop a universally applicable document as a fire safety certificate for all projects in order to provide its customers with the necessary information for creating their own fire safety certificate when using MTM Power components in a complete system or vehicle.

Unclassified Components

Clause 4.2h in EN 45545-2:2016-02 regarding the use of electrical components specifies that components that are installed in suitable control cabinets are not subject to evaluation and, as a result, do not require fire safety certification. Fire safety requirements are defined for the control cabinets or installation containers, and have to be respected.

- **Either the technical cabinet is made from E10 fire barrier and the enclosed volume is equal or less than 2 m³**
- **Or the technical cabinet is made of a E15 and I15 fire-barrier**
- **Or the technical cabinet is protected by an automatic fire detection and fire extinguishing system**

Because MTM Power products for the railway market are almost exclusively components for installation in a control cabinet, it would usually be sufficient just to

call these components built-in units for use in suitable control cabinets.

Listed and non-listed components acc. to EN 45545-2:2016-02

However, the trend in designing railway vehicles is shifting toward using any available installation space, e.g. in the roof or underneath the floor, to install technology. Electrical components are also being installed more frequently in places in the vehicles that do not meet the requirements of a control cabinet with fire safety features. As a result, the fire safety features of the components themselves have to be evaluated.

The DC/DC converters of MTM Power have been designed as compact built-in power supplies. Both, the installation location and the mounting conditions, have to ensure the protection against hazards such as unauthorized access, unintended touching, environmental effects and fire hazards. Electro-technical equipment in accordance with standard DIN EN 45545-2:2016-02 is named in clause 4.4, table 2,

section E. This electro-technical equipment is defined as 'listed products'. They were added to the request records of the standard directly.

Other electronic parts or components (not named in table 2) are defined as 'non-listed products'. The request records for 'non-listed products' are stated in clause 4.3 and picture 1. These request records depend on size, weight and installation location of the electronic part or component.

MTM Power products were investigated, classified and tested in accordance with DIN EN 45545-2:2016-02. Therefore the classification for fire safety regulations of the products is based on the hazard level HL 1 to HL 3 in relation to the table 1 of DIN EN 45545-2:2016-02. MTM Power DC/DC converters have been designed as compact built-in power supplies with DC-wide input ranges for universal applications. Therefore the classification for fire and safety regulations of the products is based on:



Listed products:

The DC/DC converter can be assigned as a 'listed product' according to table 2

Component	Name	Request	Test Methods
EL 9	PCB <i>(for electronic components mounted on PCB; clause 4.7 applied)</i>	R24 or R25	T01 Oxygen Index or T16 HWI test
EL 10	small electro-technical components	R26	T17 vertical small burner test

Non-listed products:

The DC/DC converter can be assigned as a 'non-listed product' according to clause 4.3 to grouping rules:

- **Due to the size and weight of the converters and with indoor and outdoor application they have to fulfil rules 1–3 of clause 4.3**
- **List of weights for metallic and non-metallic parts of a typical representative of the product family**
- **Testing of all plastic materials with combustible weight of > 0 g (test condition: specimens are realizable)**
- **Remaining components are evaluated again starting with rule 1**
- **Evidence in the form of a certificate from the manufacturer or through testing**

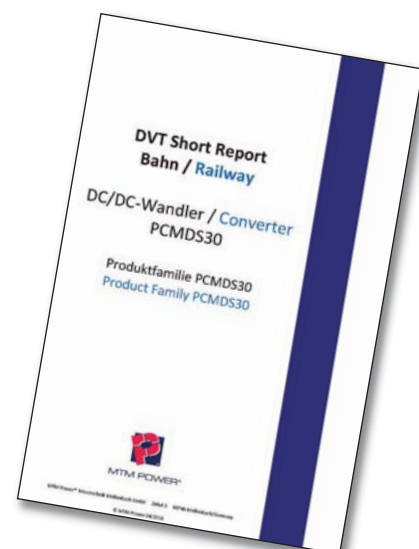
Evaluation of MTM Products acc. EN 45545-2:2016-02

The DC/DC converters of MTM Power are classified as listed components acc. to EL9 and EL10 and fulfil the above mentioned classification of DIN EN 45545-2:2016-02, hazard level HL1, HL2 or HL3.

They furthermore are classified as non-listed components acc. to the grouping rules and fulfil the above-mentioned classification of DIN EN 45545-2:2016-02, hazard level HL1, HL2 or HL3. If there is the requirement of hazard level HL3, caused by the operating category or design category of the railway vehicles, an additional measure is mandatory: use of a technical cabinet. The technical cabinet must fulfil the requirements of DIN EN 45545-2:2016-02, clause 4.2h.

Certified by accredited testing institutions

With its fire safety certification according to EN 45545-2:2016-02, MTM Power makes a Manufacturer's Declaration to the



user with a detailed list of all the materials and compounds used in each product. A test report from a certified testing institution is included for all materials that can be tested. MTM Power has created a fire safety certificate management system to maintain these test reports and ensure that they are renewed every 5 years to meet requirements and remain up-to-date.

MTM Power's certificates evaluate the test results with regard to suitability for hazard levels HL01 to HL03 when used as individual components. Only the user can ensure compliance with the configuration rules defined in EN 45545-2 for the use of multiple components in the same installation space. MTM Power's fire safety certificates also provide all the necessary data for compliance to these rules.

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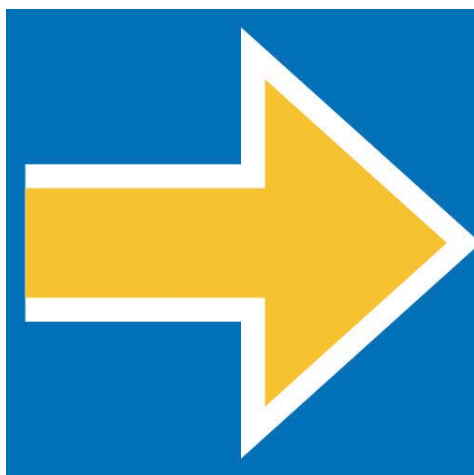
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ERTMS:

The European Rail Traffic Management System

By Naomi Thompson



On 9 May 1950, Robert Schuman said:

"Europe will not be made all at once, or according to a single plan. It will be built through concrete achievements which create solidarity."

There are many projects in Europe which illustrate this ethos, but few so effectively as ERTMS – the European Railway Traffic Management System, a standard which ensures that cross-border railways operate on a unified control, command and signalling system.

ERTMS is the product of numerous studies, Directives, Regulations, initiatives, and the

ambitions of countless industry professionals, academics, engineers and politicians. From its conception in 1989 to its on-going implementation in 2016, the project is European through and through – it has been developed in parallel with other initiatives which are designed to bring Europe closer together and raise standards for all.

The Problem

There are as many as 20 Train Control Systems (TCS) in place across 28 Member States in Europe. They operate different communication systems, use different technology, and have different safety procedures and safety regulations. This means that in order to travel on a train from, say, Portugal to Latvia, passengers often have to change trains and drivers at national borders in order to ensure that the train has the correct receiving/transmission equipment as well as someone on board who is qualified to operate it.

The Paris-Brussels-Cologne and Amsterdam train is fitted with seven different TCSs, so while the

Schengen Agreement (1985) provided for free movement between Member States by eliminating border controls, crossing borders by train has remained time-consuming, expensive, cumbersome and impractical.

The Development of a Solution

On this basis, the European Commissioner for Transport in 1989, Karel Van Miert, set about addressing this situation by launching a study to analyse signalling and train control issues. In 1990, research group ERRI put together a group of experts from the railway sector to develop the requirements of a European Train Control System (ETCS).

By the middle of 1991, an agreement was reached between industry and railway groups to co-operate closely in developing the specifications of ETCS that would serve as a basis on which to develop a system suitable for industry use. In 1996 the Council of the European Union issued Council Directive 96/48/EC on the interoperability of the trans-



Driver console with ERTMS screen. © Network Rail

European high-speed rail system. By 1998/99 UNISIG, a consortium of European signalling companies, was formed at the specific request of the European Commission to develop the specifications.

The final specification of ERTMS, the Class 1 SRS, was delivered in 2000, more than ten years after its conception. Further review would follow, with the addition of functionalities as technology developed and the adaptation of existing features as further needs were identified. The technical specifications of ERTMS continue to be maintained by the European Railway Agency (established in 2004), working with the signalling industry and railway industry stakeholders in order to

continuously meet the railway's needs.

Alongside the specification work, the ERTMS/ETCS projects had to be financed. Memorandums of Understanding were signed by the European Commission in 2005, 2008 and 2012 to deploy ERTMS across Europe. Priority corridors were identified and financial incentives devised to encourage take-up by Member States.

A milestone for ERTMS came about in 2009 with the adoption of the European ERTMS Deployment Plan, which makes retrofitting ERTMS on to a number of lines (the initial six ERTMS corridors plus additional freight lines) mandatory by 2020, and in 2015 with a report on its longer-

term future; an ERTMS Breakthrough Programme was recommended to speed up the deployment; it specifies the various challenges faced and recommends how they can best be overcome.

The Modern Political Landscape

The European Union is quite possibly a more successful experiment in international co-operation than any of its founders could have anticipated in 1950. In recent years and with the advent of intuitive technology, rapid innovation and social media, the world is smaller, and Europe smaller still. The barriers between



ERTMS ready Thalys trains

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How Does ERTMS Work?

ERTMS is comprised of two components, ETCS – a European Train Control System, which is an automatic train protection system (ATP) that will replace national ATP systems. The second part is GSM-R (Global System for Mobile communications – Radio) – a radio system which enables voice and data communication between the track and train and control centre. The system is based on standard GSM, on frequencies reserved for rail applications with specific functions.

nations are ever more arbitrary. As such, the determination to create ever closer co-operation between Member States has been redoubled.

The Connecting Europe Facility (CEF, established in 2013) is multi-billion euro fund to bring down the barriers which hamper energy, transport and telecommunications at the European level. The rail network has benefitted greatly from this fund, as well as the Horizon 2020 fund, which supports the development of information and communication technological innovations that will enhance the cohesiveness of the European Union.

As part of this, a project in 2013 was launched relating to the interoperability of the European railway network. This was the Single European Railway Area; a standardised rail network that operates on uniform lines, signalling and control systems to create a railway network to span the continent, and in turn enhance European cohesion.

The Fourth Railway Package, as project is dubbed, is intended to foster competitiveness and growth. Increasing competition from China and Japan puts the success of the European railway industry in jeopardy. It is essential that European players continue to innovate and evolve in order to remain competitive.

European initiatives such as Shift2Rail have taken the dramatic step of pooling the collective talent of top industry players, including Thales, Bombardier, Ansaldo, Siemens, Alstom, Network Rail, Trafikverket and CAF in order to remain at the cutting edge of technology and innovation. Protocols relating to intellectual property, individual investment and risk-taking have been discarded. There is a very clear sense that for the European rail industry, we progress united or we fall away divided. ERTMS is the cornerstone of that philosophy.

ERTMS replaces line-side signals with a computer in the driver's cab that controls speed and movement, whilst constantly communicating with other trains on the network. Trains therefore operate, without being exposed to the risk of human error, at an appropriate speed, taking into account the movement of other trains. The train also communicates with the track at signals and interlocking systems in order to avoid collisions at junctions. This, in turn, increases not only safety, but efficiency of service as well as energy efficiency, capacity and frequency of service.

It is intended that ERTMS is an adaptive and intelligent train management system, with real-time traffic management and decision support systems. It utilises GPS, high-speed, high-capacity data transfer and voice communication systems, increasingly it relies on automation technology and real-time data collection, processing and communication systems.

Europe and Beyond

The original European Deployment Plans have been revised in accordance with Member States' intended level of investment. The centralised role ERTMS will play in the creation of a single European railway area was reaffirmed as a key part of the Commission's Transport in Europe strategy, and since ERTMS has come of age in terms of its usability in commercial operations, the rollout has begun.

The six rail corridors identified in the ERTMS Deployment plan are:

- **Rotterdam – Genoa**
- **Stockholm – Naples**
- **Antwerp – Basel – Lyon**
- **Valencia – Budapest**
- **Dresden – Prague – Budapest – Constanza**
- **Aachen – Berlin – Warsaw – Terespol**

However, deployment on these corridors is not on schedule. The project was too ambitious, and because it was new technology, there was no one experienced enough to set out a realistic timetable. In addition, the 2008 financial crisis stalled many infrastructure projects. Despite funding from the EU, deployment has thus far been haphazard and unco-ordinated.

In the ERTMS Coordinator's view, Work Plan of May 2015, it was stated that:

'The EDP needs to be adapted to the reality and create an ambitious and pragmatic plan with clearly defined priorities within the Corridors with a definite time limit of 2030.'

Therefore, although new high-speed routes in Europe are fitted

with ETCS Level 2 as standard, as are new metros and tram systems, retrofitting existing infrastructure and rolling stock is more costly and complex than anticipated. The Netherlands recently announced that it was redirecting funding which had been set aside for ERTMS to other projects, and France and Germany had hit roadblocks (so to speak) in adapting their rail corridors.

However, ERTMS has become a global standard – more than 29,000km of track, and around 2,900 vehicles are equipped with ERTMS globally. ERTMS is the signalling system being invested in by China, India, Libya, Saudi Arabia, Mexico, New Zealand and Australia.

ERTMS, then, is not perfect. But it is ambitious, both in principle and in practice. It will become a reality, though later than originally anticipated, and when it does it will make railways not just in Europe, but the world over, safer, more efficient and more frequent. This in turn will increase energy efficiency and a modal shift from cars to rail and enable countries to meet their COP21 carbon emission targets.

ERTMS has been more than twenty years in the making, piece by piece, it has been developed, one concrete achievement after another. When the rollout is complete, it will enable travellers to board a train in Lisbon and disembark in Riga; it puts into practice the principles of the Schengen Agreement. There have been setbacks, but they will be overcome in a uniquely European way – by innovation and co-operation.



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- EN 45545-2
- NF F16-101
- IEC 61373

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- Meets IEC spacing requirements
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- UL489, UL1077, CSA & VDE



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- 1-3 Poles
- Ratings: 100-700A, up to 125VDC, 277VAC
- UL489, CUL Certified & TUV



Upcoming Railway Events

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More info: <http://www.terrapinn.com/exhibition/africa-rail/index.stm>

28–30 June

RSSI C&S Expo 2016

Texas, USA

The 57th Annual Railway System Suppliers C&S Expo 2016, in conjunction with Railway Interchange, exhibits products and services in transport and rail, and all things railway and railroad, along with the latest advances in logistics. Railway System and Suppliers Inc. specialises in trade for the communication and signal sector of the rail transportation industry with over 260 member companies.

More info: <http://www.rssi.org/2016-portal/index.html>

25–26 July 2016

4th Annual Malaysia Rail 2016

Kuala Lumpur, Malaysia

Supported by SPAD, the 4th Annual Malaysia Rail to be held 25–26 July 2016, will focus on some of the major on-going and upcoming railway projects in Southeast Asia. The conference will ideate on next generation policy, procedural and regulatory initiatives needed to attract investments in the railway sector. Associates will delve into the state of

development and trends in bench marking for the Malaysian railways in operational parameters. The conference will provide participants with an update on technology up-gradation and joint ventures with equipment manufacturers. More info: http://infraoutlook.com/events/kuala_lumpur/index.html

27–28 July 2016

Rail Depots and Maintenance Facilities 2016

Washington DC, USA

Rail authorities exchange case studies for running maintenance facilities in the most cost-effective manner and will be given a unique glimpse into how other rail authorities optimally run and maintain their rail depot and maintenance facilities. From safety performance to maintenance scheduling and from throughput to configuration and equipment layout, rail authorities will find out all they need to know about how to improve operations.

More info: <http://www.rail-depots-maintenance-facilities.com>

28–31 August 2016

AREMA 2016

Orlando FL, USA

The American Railway Engineering and Maintenance-of-way Association is a four-day Annual Conference and Exposition in Orlando, Florida, that exhibits products and solutions within the railway engineering industry. The exposition features railway engineering professionals from a variety of sectors including track, structures, maintenance, engineering services, communications and signals and more. The event opens doors to networking providing potential business development.

More info: <https://www.arema.org/meetings/2016/expo.html>

Protecting the Railways in the 21st Century

Nigel Davies, Head of Secured Navigation at QinetiQ, argues that, as we move towards satellite-guided train traffic management, trains could be vulnerable to a variety of threats.



The railways are set to undergo a radical transformation that will see satellite navigation systems such as GPS and Europe's upcoming Galileo becoming fundamental to many aspects of train traffic management, from capacity planning and locating track repairs to creating 'right time timetables'. A Royal Academy of Engineering report into the use of GNSS (Global Navigation Satellite Systems) by CNI (Critical National Infrastructure) notes that railway applications already include "the management of rolling stock, passenger information, preventing doors opening unless they are alongside the platform, cargo tracking signalling, train integrity and level crossing approach." The Rail Safety and Standards Board forecasts that GNSS will be in use this decade for railway signalling and train movement control and monitoring.

By 2019, Network Rail will be close to its target of implementing 'right time' timetabling which uses on-board GPS equipment to monitor and control every train in real-time, creating a hyper-efficient and centralised rail network where trains move in harmony and on-schedule. It is already pioneering Plain Line Pattern Recognition (PLPR) where GPS co-ordinates are used to automatically direct engineers to the site of faults that may need repair identified by thermal imaging cameras.

First Group is harvesting detailed GPS train movement data from its Driver Advisory Systems to analyse train headways at key junctions and build a central pool of big data which can help analyse and optimise its rail services.

Meanwhile, the United States is going even further, with Metrolink introducing GPS-aided positive train control (PTC) which uses satellite signals to monitor the proximity of the train to approaching switches, speed-restricted areas or maintenance work and automatically activate the brakes if the driver fails to respond.

The European Rail Traffic Management System (ERTMS) and European Train Control System (ECTS) will replace traditional trackside signalling with on-board computers on every individual train. The EU notes that "the introduction of satellite navigation within the ECTS/ERTMS will... contribute to increasing the performance on high-density line[s] and lowering the cost of low density and regional lines". Such a fully interoperable system will mean a move towards autonomous driving and automatic train traffic regulation made possible by satellite

positioning across Europe's railways.

This mirrors similar moves in other transport sectors, such as 'e-navigation' at sea which integrate maritime data, such as weather updates, with location and timing information, to increase the speed and efficiency and improve safety across our sea lanes.

The business case is clear; increased automation based on accurate position and timing data could improve the passenger experience, while dramatically boosting the speed and efficiency of global trade flows.

The Hidden Threat:

These future technological advances could create efficient, harmonised and responsive digital rail networks across Europe, where everything from track repairs to train journeys is assisted by satellite signals.

Yet increasing over-reliance on remote signals from individual constellations of satellites carries inherent risks; GNSS signals are beamed from satellites orbiting 20,000 kilometres above and the signals are consequently very weak and virtually indistinguishable from a cacophony of background noise by the time they reach Earth, so that they require complex algorithms to identify and track them. This renders GNSS highly vulnerable to electronic interference, attempts to 'echo' the signal with counterfeit signals and manipulation of the computer algorithms by cyber-attackers. Thanks to the widespread availability of cheap and increasingly powerful wide-band electronic jammers, it is now easy for even ordinary consumers to jam these satellite signals.

Electronic jammers are used by lorry and taxi drivers to go 'off-route' or by people-smugglers and car thieves to evade detection.

The SENTINEL Project – a nationwide government-backed UK investigation of GPS/GNSS signal jamming – has tracked the growing power of jammers and has already noted incidents of GPS jammers used aboard trains in the UK. Powerful wide-band jammers can disrupt multiple GNSS signals, including GPS and Galileo, over a wide area, causing position, navigation and timing data to become temporarily unavailable. Large-scale 'electronic jamming' incidents can even 'knock out' signals over a protracted period. The investigation has found that GNSS jamming incidents across Britain are dramatically increasing in frequency, scope and power. North Korea's recent use of powerful electronic jammers against the South has affected over 1,000 aircraft and 700 ships, demonstrating the potential impact of large-scale GPS jamming on civil transportation systems that are reliant on GNSS. This could have serious implications. Once traditional trackside signals are obsolete, a jamming incident affecting the GPS data fed to the train computer could leave it unable to calculate position and timing data from other trains or transmit its own position accurately. As trackside signalling begins to be replaced by computerised position and timing data fed by satellite signals, an electronic jamming attack could hamper efforts to improve the performance of rail networks via such data.

Even worse, because the specification for the commonly

used GNSS services is openly published, it is quite easy for an attacker to emulate or “spoof” the signals sent by GNSS satellites. A GPS spoofing attack – where counterfeit signals are sent to deceive a receiver – could cause trains to unwittingly transmit a false location, otherwise known as Hazardously Misleading Information. This could have a long-term reputational impact on train operators that use GNSS-guided PTC to adjust the speed of the train as the transmission of Hazardously Misleading Information could cause delays, disruption or incorrect timetabling information, impacting on the service operators provide. Alternatively, a GPS spoofing attack on ‘smart’ track-maintenance systems such as PLPR (that rely on GNSS-provided co-ordinates to locate and record track faults) could see companies log track defects in the wrong place or send repair workers to the wrong location.

Recent UK maritime trials have shown that ships on autopilot can be unwittingly led off-course by spoofing signals that cause the ships to transmit a false location. These tests also demonstrated the extent to which seemingly independent maritime systems, such as radar and communications, are in fact heavily interdependent. Interference with the GNSS data can have a domino effect across the whole ship. As GNSS inputs become a key part of the operation of our rail networks, a fault across one aspect of the system could have a ripple effect across other parts of the rail ecosystem.

The Hacking Threat:

An even more severe threat comes from the increasing connectivity of trains. The move towards digitised and ‘connected’ rail networks means that the systems that run them, including those involved in position and timing, are more vulnerable to hacking.

For example, the pool of GPS information harvested by companies like First Group to optimise the performance of its fleet could potentially fall into criminal hands and be manipulated or used for malicious purposes. Location data could be used to enable robbers to track freight trains and pull off a cyber ‘train robbery.’

Similarly, as GNSS receivers are components interlinked with other systems and devices such as on-board computers or wifi, they are also vulnerable to such hacks. An attacker could hack into a GNSS receiver system and cause it to transmit a false time or position. This would mislead the on-board computer so that the automatic train control system might ‘think’ it can speed up, for example, when it is in fact approaching another train.

With the ERTMS rendering drivers dependent on ‘connected’ on-board computers to instruct them on the appropriate speed at any given time, any manipulation of the location data that feeds these systems could confuse the onboard computers and disrupt the service.

Worryingly, recent research has shown that most components of a modern train are vulnerable to hackers because bugs in on-board applications could be used to access the modem and then

attack services or applications supporting the rest of the train.

A Solution

A major collaboration between QinetiQ, the European Space Agency (ESA), the European GNSS Agency (GSA) and UK government has begun to develop a new generation of multi-frequency, multi-constellation satellite receivers to counter these threats. When installed on trains, these receivers will be able to process data from a range of different sources, including a wide range of regional and global satellite navigation signals, adding redundancy and error detection in the event of a jamming or spoofing attack.

Thanks to radical recent advances in anti-interference processing, anti-tamper technology and intrusion protection, including these receivers in future GNSS-guidance systems will also make them highly secure against interference, spoofing and cyber-attacks.

The receivers – currently in prototype form – are compliant with the highest levels of government security accreditation and are immensely resilient to cyber-attack.

As such technology comes online over the next few years and the Galileo project progresses, Europe’s rail infrastructure could be protected from the growing vulnerabilities in GNSS, helping to move towards a hyper-efficient, fast and secure transport network for the 21st century.



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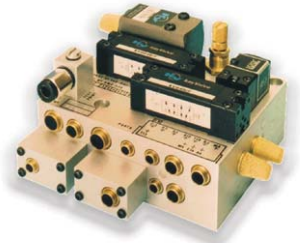
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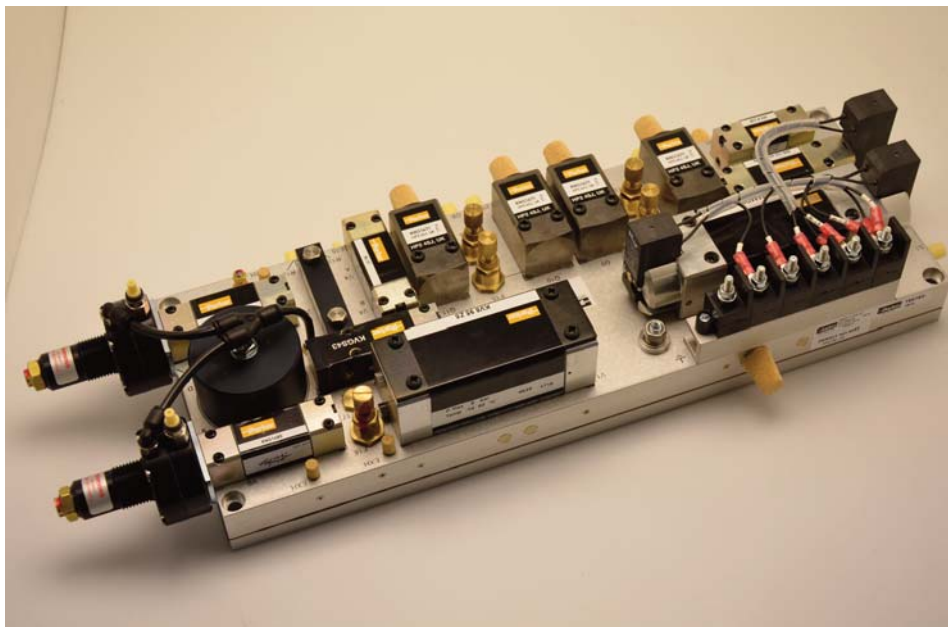
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The Refurbishment Conundrum – Repair or Replace?



The essential decision-making process before vehicle enhancement through refurbishment and upgrade



In a world where trains must function on time, every time, pressure is on railway operators to ensure regular upgrades and repairs of their infrastructure, all driven by the needs and expectations of the customer.

When it comes to the components and control systems of rail carriages, the pneumatic door controls and locking systems are often some of the most complex and costly items to refurbish. Safety, long-term reliability and cost-effectiveness

are three elements of paramount concern when planning such an undertaking.

There are a number of issues that need careful consideration when investigating and planning such a refurbishment, however, to ensure the best cost solution is achieved both for commercial and technical purposes.

Baselining

Baselining has proven to be a tool always recommended as the first stage of a refurbishment project. Establishing the accurate current operating condition of the equipment ensures an understanding of the true operating environment and can also give an indication of other areas of the complete system and how they impact upon the equipment under consideration.

An assessment of the

contamination levels present within the existing pneumatic components and system manifold can help identify issues down the line with filtration and dryers, which if not also addressed will immediately negatively impact on any refurbished equipment.

Baselining is therefore a critical part of the process in ensuring that the true state is identified and all relevant issues are addressed in the planning stage of refurbishment activity.

Required outcomes

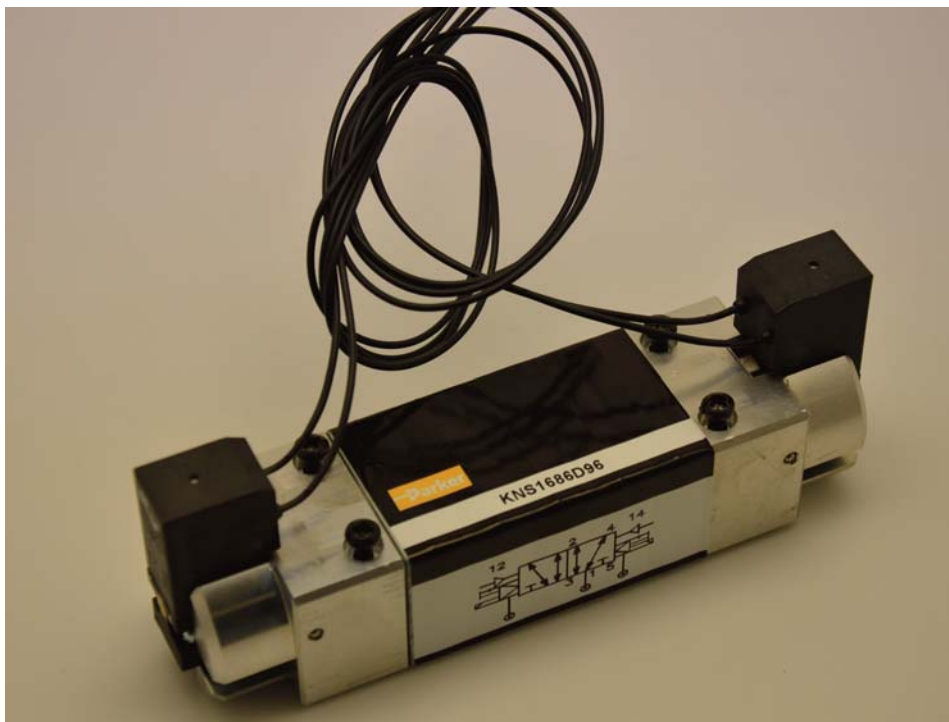
While it may seem a bit of a leap to move directly to defining the desired outcomes straight after the baselining exercise, it is worth remembering that it is after all vital to identify the destination of any journey before commencing travel!

Having clearly defined objectives and agreed key deliverables will enable a full definition of the project's key requirements and hence the activities required to satisfy and deliver the required outcomes.

Key deliverables such as warranty, life and reliability of the delivered refurbishment activity will all need clear definition and agreement. The impact of these issues on the actual scope of work undertaken is key to the decision-making processes in deciding not only what is undertaken, but also how it is undertaken and what the impact is on the project costs, and hence defining best value both technically and commercially.

Value assessment

The two activities of baselining and outcome definition will hopefully have provided a clear picture of the scope of works



involved, but further work on analysing costs to establish the best methods to achieve both technical and cost requirements will define the final proposition.

In refurbishment projects involving a pneumatic system, the costs of manpower for the predominantly labour-intensive processes involved with any potential rebuild of a system retaining the original manifold must be weighed up against the relative cost of supplying a completely new manifold with the benefits of all new warranted parts.

The cost differential between these two options is frequently minimal, especially in projects with a significant quantity of units requiring refurbishment, so when the total cost of the project is considered, including the benefits of 'soft' elements such as maintenance and warranty, it often works out to be more economical to replace the entire system with a newly manufactured unit.

Expertise in refurbishment solutions

Parker Hannifin has been actively supplying the rail market for many years with a range of components and control systems for use across a wide range of applications where reliable motion and control technology are required. Some of the technologies used include pneumatics, hydraulics and filtration and also products such as hoses and connectors.

It is with this extensive background of supply and application experience that an expertise in refurbishment and enhancement in these technology areas has developed to support on-going rail vehicle operation and life extension projects.

In addition to supplying components to support other partners involved in refurbishment projects, we have also refurbished existing manifold systems, re-used manifolds to rebuild systems and provided newly manufactured

complete systems, depending on the particular requirements of the specific project and considering the points raised above.

Introducing new technologies

When analysing any refurbishment, vehicle modification or upgrade project we are also continually on the lookout to ensure the latest developments in technology are applied when suitable to do so.

This could be as simple as a material change to a seal or diaphragm or as wide-ranging as reviewing the system performance and proposing new solutions. Whichever the case may be, our engineering teams are there to fully engage with and support our customers through the process with all of the expected supporting documentation to mitigate risk.

When considering vehicle improvement projects as opposed to refurbishment, we are also actively engaging in the application of new technologies into the rail market with a range of electromechanical and hybrid technologies.

There is the potential to investigate the application of new technologies to many areas of motion and control on rail vehicles and our focus is to work in partnership with our customers to ensure we are engineering your success.

Could you benefit from working with Parker's dedicated transportation team; ready to respond to your performance, application, cost, weight and space challenges? Contact us to discuss your solution needs on rail@parker.com



Application Example - Networker vehicle door control system

Parker supplied the door control system as part of the fleet refurbishment programme on networker vehicles. In this particular example, Parker supplied new control systems as the technical and financial case supported this approach versus taking the refurbishment route.

There were two main components that were updated during the engineering review process, where full engineering change support documentation packages were supplied to support the work. The first was a material change to the diaphragm in the door obstacle detection valves. This new material used offered an improvement to the life characteristics of the valve. Full documentation to support the reasons for the change, the benefits and an assessment to ensure there was no risk associated with the change was supplied.

The second change was to a valve end cap on the interface to the piloting solenoid valve; this change came as a result of the baselining activities carried out where the potential for damage to the solenoid during handling and maintenance had been identified. Once installed and in use, there was not a functional issue, so there was no requirement to change the product function, just to ensure the interface could not be affected by mishandling or inadvertent contact. A design review was carried out and the end cap design was modified providing flanges either side of the pilot solenoid ensuring protection. Again, this was fully supported by comprehensive documentation.

About Parker Hannifin

With annual sales of approximately \$13 billion in fiscal year 2015, Parker Hannifin is the world's leading diversified manufacturer of motion and control technologies and systems, providing precision-engineered solutions for a wide variety of mobile, industrial and aerospace markets. The company employs approximately 55,000 people in 50 countries around the world. Parker has increased its

annual dividends paid to shareholders for 59 consecutive fiscal years, among the top five longest-running dividend-increase records in the S&P 500 index. For more information, visit the company's website at www.parker.com, or its investor information website at www.phstock.com.



Women in Rail

Adeline Ginn, Founder of Women in Rail, Speaks to Railway-News

By Naomi Thompson



The proportion of women in the UK rail industry today is the same ratio as 1918. Women make up around 16% of the total workforce, and of this, they represent only 4% of engineers and 0.6% of executives and directors.

However, two factors – the increased attention feminist issues are receiving in the media, and the increase in spending on infrastructure and supporting education – have come about at the same time. The point at which they met was Adeline Ginn, General Counsel for Angel Trains, and founder of Women in Rail.

The Female Experience

Adeline Ginn's professional experience in the rail industry is typical of the experience of most women in the industry. She originally practised as a barrister practising family law. She describes the training she received

as helpful since it gave her universally applicable skills. However, she always had an interest in transport. Coming from a family of mercantile sailors, she completed a masters in Air & Space Law at McGill University in Quebec before joining the Bar, where she discovered that, as she observed, *"crime doesn't pay when you're on the right side of the fence"*, so she made the decision to go in-house.

She joined a firm of solicitors in their litigation department, who sent her to Airbus Industries in Toulouse in order to assist the general council there. She found she enjoyed the experience of being part of a team and seeing a project from beginning to end. Upon her return to the UK, she wanted to carry on that way of working, ideally in transport, so she was lucky enough to land a job at Angel trains, where she has stayed for 17 years, first as counsel for international business until 2005, when she left briefly to start a family. When she returned, and

her family commitments meant she could no longer travel and so worked entirely on UK projects. In 2009 the position of General Counsel became available, she applied and was successful.

"99% of the women around me say that they got into the rail industry by accident not by choice. But once it happened, once they were in the sector, there was no chance of them leaving it, they absolutely love it. The same is for me."

Filling a Void

She founded Women in Rail in 2012 following a conversation with her male CEO who, she says, is very supportive of the cause. As he has two daughters himself, he understands how hard it can be for a woman to find her place within the corporate environment. On a business trip they were discussing the rail industry and the fact that it's male-dominated. This is not by choice, but has historical

roots, harking back to a day when railway engineering was an exercise in brute force and dirt. This remains for many the perception of the industry.

It was about the time that the Lord Davis Report, *Women on Boards*, was published, which found that only 12.5% of board members of FTSE 100 companies were women in 2010. The rate of increase was slow (it would take 70 years to achieve gender balance in boardrooms at the current rate of progress), and the factors which caused it are numerous and complicated. It advised against introducing quotas in order to avoid tokenism, and instead advocated a number of other measures to combat them.

One of the problems that Ms Ginn and the Report identified, is that in the rail industry, women did not have many female peers to reach out to for support and networking opportunities. The rail industry is spread out across the country, and with a low density of women in the first place, the practicalities of meeting other women to connect with had to be overcome. So that was the original purpose of Women in Rail when it was created – to give women the opportunity to network with other women.

A Nurturing Environment

The launch of Women in Rail took place in April 2013 and was attended by women and men from all over the industry, from all grades and all roles. Initially, the group used LinkedIn to connect; networking events were organised to great success, where the issues affecting women in the industry

were discussed, and this evolved into ideas to solve them.

It might have remained an idle chat in a bar among colleagues, but for the drive, passion and competence of Ms Ginn, who said, *"I didn't have any massive plans, I was doing it out of a pure willingness to bring women together."*

Nuanced points, such as the self-confidence of women, were identified as an issue, as was an absence of opportunities to network in order to learn from other women's experiences. In response, workshops were set up, events to support women in the sector, and from these events it was evident that the gender imbalance had to be addressed at a more fundamental level.

Women in Rail work closely with an organisation called Young Railway Professionals, who run an Ambassador Programme for which volunteers go to colleges and schools to teach children and young people more about the careers available in the railway industry. Challenging perceptions in young people was a key issue to be tackled, particularly among girls.

A Network Rail survey carried out in 2015 called Switch On Switch Off found worrying misconception about careers in the railway industry. It showed school-age girls pictures of railways and engineering and found that girls between the ages of 7 and 9 described the industry as dirty and messy, girls aged 10–12 described it as physically strong and dangerous, and girls aged 12–15 thought it was unglamorous and socially isolating. The study confirmed what Ms Ginn believed. It also confirmed that school visits

by volunteers, although effective, were not large-scale enough to tackle the problem.

With this in mind, Women in Rail opened up a discourse with the Department for Transport and other like-minded organisations, reaching out to connect and work together to close the skills gap.

"The rail industry is undergoing expansion, with resources most industries would die for, billions of pounds invested in infrastructure, there's a huge wave of recruitment to replace people who are either retiring or needed to work on new projects. Parts of the country are being regenerated, new homes are being built, new jobs. You can't deliver on this project unless you have a balanced workforce."

Moving On

Along with the data provided by Lord Davis, the business case for gender parity in the industry was impossible to refute, and the conversation was very well received. With increased awareness from above, there is more attention being focused also from the ground up that there is a necessity to improve gender balance and improve the skills gap.

The situation is not much better in much of Europe. In Sweden, with gender equality promoted in the workplace, flexible working as a norm, and a higher opinion of engineering among the general public, there are marginally more women in the rail industry, but it is a global issue that girls and women do not have a high uptake of STEM subjects and STEM careers.

"The government is very supportive, the process has started, it's going to take some time, but awareness has really been brought to the skills gap and gender imbalance. We have the DfT initiative in respect of apprenticeships, Transport for London has launched its '100 years of women in transport' campaign, so it's really snowballing. The rail industry has taken ownership of the issue and is doing things to address it which I think that is absolutely fantastic."

Many companies and organisations seek out Women in Rail to ask how they can best accomplish this. The advice is uniform and simple. The first element is to utilise the huge numbers of talented women in their organisation. They need to foster that talent and help women realise their career potential, to give them the confidence to push themselves forward for the job they want.

"Anyone can do it, get yourself out of your comfort zone, apply for the job you want, not the job you think you should be doing."

The second element is to help women on a practical level to have fulfilling careers by introducing flexitime for men and women, giving women the confidence to ask for flexible working hours. The third element is that as often as possible they portray the railway sector to people outside it for what it is – a dynamic and modern industry.

Less obvious issues are things like job adverts, which are read differently by women; they should feature career plans set out from entry level so women can plot a career trajectory not dependent on their self-esteem but their successes. Finally, there must be an improved awareness of unconscious bias against women when filling roles.

Rail Minister Claire Perry meets women working on Crossrail © Crossrail Ltd

What's Next?

Over the coming 12 months, the 20 most Influential Women in Rail will be announced and celebrated, because by promoting the successes of women and celebrating the achievements of women, the next generation of achieving women will be encouraged to reach higher.

Also in 2016, Women in Rail will ask organisations and companies to identify women in their ranks to become rising stars, further promoting the achievements of women to serve as an example to existing and potential employees in the industry. Women in Rail is hosting the Big Rail Diversity Challenge at the end of September 2013 – giving teams of men and women (in equal numbers) mental and physical challenges. It is also hosting the Big Pink on 30 October, which is a campaign to raise money for breast cancer care – an issue which affects men as well as women. Women in Rail asks all grades in the rail industry to demonstrate solidarity by wearing pink on that day.

Women in Rail will also become a charity this summer, which will lead to scholarships and grants to support young women into STEM subjects to embark on successful careers in the industry.

"The sector is fantastic and filled with people who deeply care about the railways. I am absolutely passionate about the railways, and before I created women in rail I was acutely aware that many women felt isolated and resulted that they didn't realise their full potential, or even worse, they left the industry, and I wanted to change that. We have had a very positive response since the beginning of the campaign."

Low-maintenance Solutions for the Railway Industry

Rolling stock contains several consumers of electricity, such as doors, heating, climate control systems and even traction motors, which must all be supplied with the correct electrical power supply.



Multi-Contact fork plugs transmit high levels of power with hardly any loss of power and heat

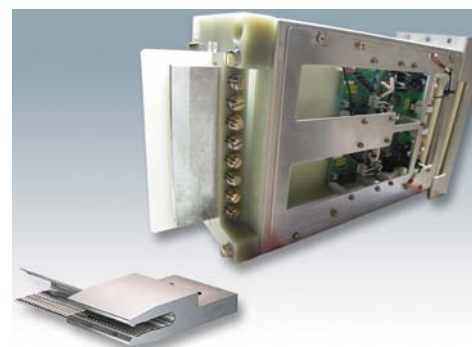
Transformers and inverters change the high voltages coming from the overhead cables into the required power supply voltage. Power electronics that can be exchanged during maintenance are used in many of these inverters.

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Multi-Contact (MC) is a leading international manufacturer of electrical contacts and system solutions for industrial applications: connector systems and modular connectors, customer-specific contact solutions, assembled connectors, and fully tested assemblies, all from a single source.



Printed circuit board units for slide-in systems with customer-specific fork plugs from Multi-Contact

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The Powerline connector in its sturdy cast aluminum housing provides a reliable technical solution for the electrical connection between railway carriages, ensuring excellent performance and safety.

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The Channel Tunnel: Britain's Fixed Link to Mainland Europe

Here at Railway-News we seem to have become quite excited of late about tunnels and the sheer vision and engineering ability needed to build them.

By Josephine Cordero Sapién

In our Infrastructure segments in the previous two issues, we looked at Crossrail and the Gotthard Base Tunnel. In this issue we're looking at HS2; however, as we're taking a special look at Europe and the rail industry in this issue, we thought we'd use the

excuse to look at another tunnel, namely the Channel Tunnel, which had its 20th anniversary just two years ago.

It opened in 1994, the same year, a Wikipedia search informs me, China joined the internet, the

Church of England ordained its first woman priest, and Nelson Mandela became the first black president of South Africa. It is also the year Sweden and Finland held referendums in which voters in both countries decided to join the European Union, while



the people of Norway decided they would not. And just two years earlier in 1992, the members of the European Communities signed the Maastricht Treaty, which established the European Union as we know it today. Now, 43 years after Britain first joined, and 41 years after its first referendum, the United Kingdom is set to vote on whether it wishes to remain in the European Union or not. With Britain questioning its relationship with the EU, we wanted to take a look at the Fixed Link that connects the UK to mainland Europe.

Construction and Design

The Channel Tunnel actually consists of three tunnels, all 50km long, two single-track tunnels for the trains running in each direction and a service tunnel between them. 38km of the total length is under the sea, making it is also the longest undersea tunnel in the world. However, there are also two places under the sea where trains can switch from one tunnel to the other, which is a useful feature for continuing smooth operations during maintenance for example. At its lowest point, the tunnel runs 75m below the sea. Every 375m there is a cross-passage connecting the train tunnels to the service tunnel. The service tunnel, a road tunnel operating maintenance vehicles, also has important safety features such as a higher pressure than the train tunnels – and there have been three big enough to close the tunnel, in 1996, 2008, 2012 and 2015.

But let's take a step back. The agreement covering the Channel Tunnel is the Treaty of Canterbury,

which was signed in 1986 by British Prime Minister Margaret Thatcher and French President François Mitterrand. Construction began two years later in 1988 and was to last six years. Eleven tunnel boring machines were used for the project, many built specifically for this job. Tunnelling took place from both sides. Then, on 1 December 1990, the two sides met under the sea. All of the tunnel boring machines were removed and dismantled bar one from the British side, which remains in situ. The construction work was completed in 1994 and the Channel Tunnel was opened by Queen Elizabeth II and François Mitterrand on 6 May that year. The Fixed Link is now operated by Groupe Eurotunnel SE.

The Channel Tunnel Trains

The Channel Tunnel sees the operation of both passenger and freight trains. The passenger trains are operated by Eurostar, which is majority-owned by the French state-owned rail company SNCF. The Shuttle service, which carries road vehicles by rail, is owned and operated by Eurotunnel. Just one such Eurotunnel shuttle is 775m long. Eurotunnel Freight transports lorries.

In 2015, almost 1.5 million trucks travelled through the Channel Tunnel with an equivalent of 19.3 million tonnes of freight carried. More than 10 million passengers took the Eurostar through the tunnel, while the same amount again used the Shuttle service. Eurotunnel says that since the commencement of services in May 1994, more than 366 million passengers have travelled through the Channel Tunnel – that's the equivalent of five times the population of the UK. Since the

start of the Truck Shuttle in July 1994, more than 23 million trucks and 300 million tonnes of freight have been transported by the service, along with 38 million tonnes on rail freight trains. In 2015, the average daily number of passengers was 57,000. 85% of car passengers are British.

The Channel Tunnel in a Political World

The Channel Tunnel has been at the frontlines of a changing world. The UK border forces are currently located on the French side. As a result of the migrant crisis many hundreds have tried to jump the border and make their way through the Channel Tunnel on foot. In addition, many migrants tried to enter the terminal and get on to trucks, causing significant disruption when Eurotunnel had to suspend its services. With the migrant situation in Calais as desperate as it was, many passengers were intimidated by migrants trying to enter their cars. As a result, many passengers opted not to travel via this route. This has led Eurotunnel to seek £22 million in compensation from the British and French governments. Spokesman John Keefe said: ***"The French and British governments are clearly responsible for the security at the border, and also for the public order security on site."***

"During last year we were severely disrupted by the migrant crisis - people trying to break on to our terminal and break into trucks on the motorway - and so we suffered quite a loss of revenue during the early part of the year."

The migrant crisis hasn't been the only thing to make passengers cautious. Eurostar recently noted that ***"Travellers remain cautious***



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following the terrorist attacks in Brussels and demand is dampened.

The impact has been particularly evident in international markets with Eurostar reporting a slowdown in travellers from the

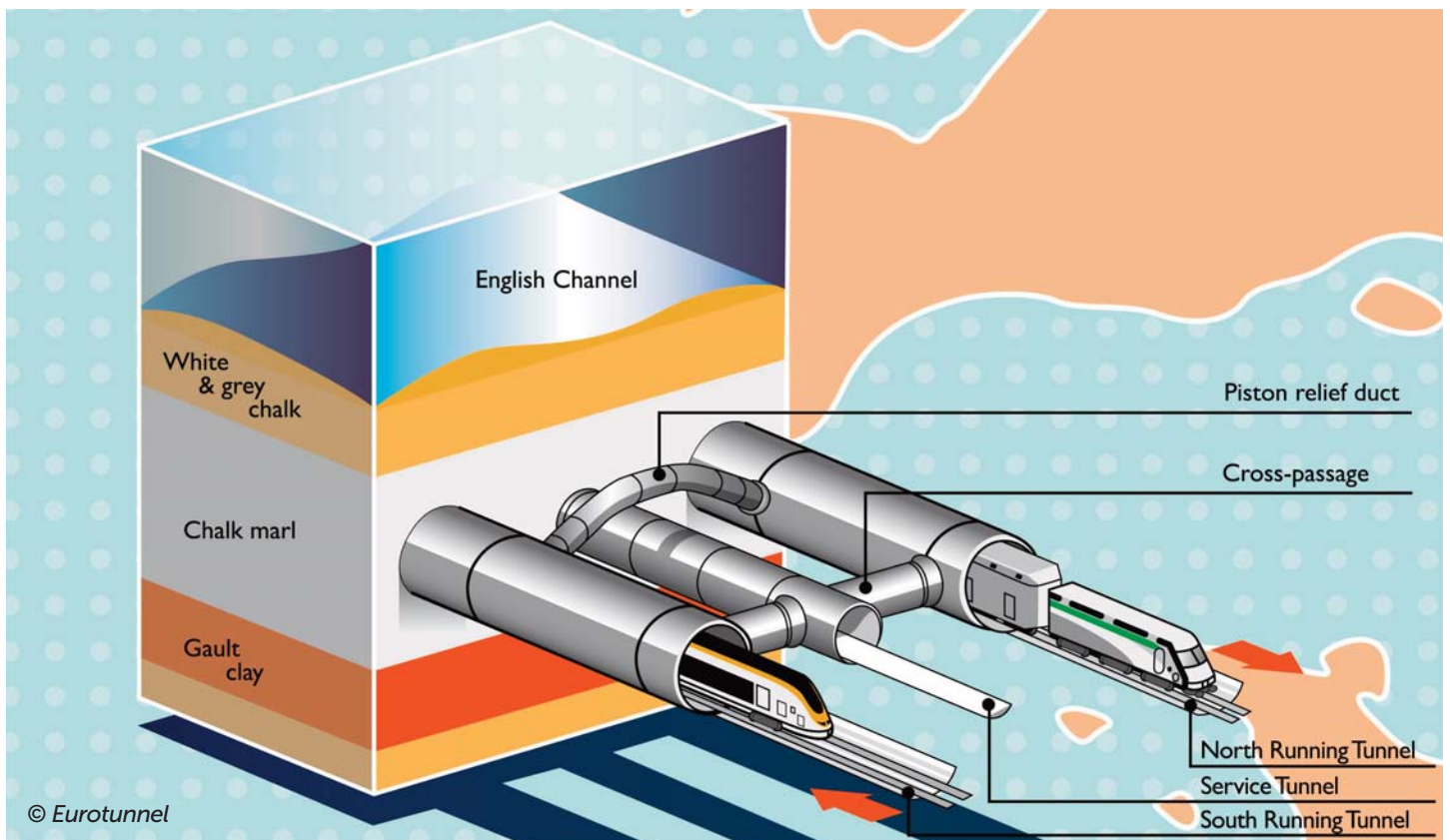
US and Asia. As a result, passenger numbers in the first three months of the year were 2.2 million, a 3% reduction on the same period last year (2.3 million: Q1 2015) and sales revenues were 6% lower year on year (£201 million Q1 2016: £215 million Q1 2015)."

New Routes

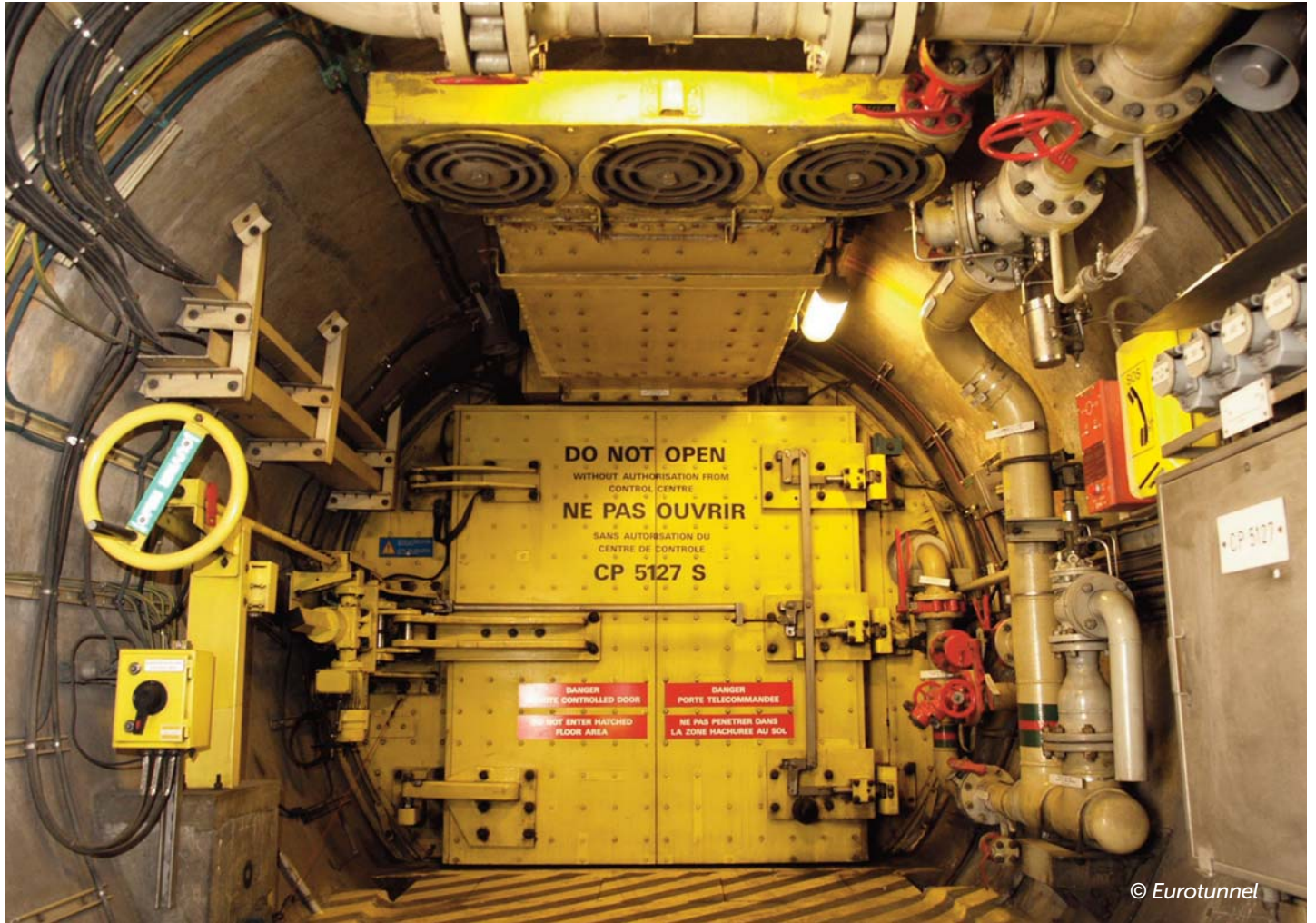
However, there are positive developments as well. Eurostar intends to run a London-Amsterdam service, a very popular route, and has begun testing its e320 on the Dutch network. This route currently sees 3 million airline passengers a year and with a four-hour service from city centre to city centre, this one will be popular.

The European Union: Channel Tunnel Must Open for Competition

The European Commission has been keen to open up rail freight and passenger services to competition, laying the groundwork for this move in 2010. In 2013 asked both the UK and French governments to comply with EU regulations. In a statement issued in June 2013, the



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European Commission said that "Excessive track access charges mean higher prices for rail passengers and rail freight companies when using the Tunnel. It also discourages new railway operators from entering the market." *They go on to say that "The current track access charges for use of the Channel Tunnel infrastructure do not appear to be based on direct costs or the long term investment costs of building the Tunnel."*

Several rail operators in the market have expressed an interest in running services through the Channel Tunnel. In 2010 Deutsche Bahn announced it wanted to run services through the tunnel in the next three years and ran an ICE-3 train through the tunnel. In 2013 the Tunnel authorities finally

granted DB permission. DB wanted to run services from Amsterdam and Frankfurt via Brussels to London. However, the plans have been shelved because of technical issues pertaining to the DB fleet as well as the high access charges on the French network.

With the European Commission forging ahead with its goal of creating a Single European Railway Area and its desire to see increased competition in the European rail market, the Channel Tunnel will surely continue to face challenges and opportunities, giving other modes of transport a run for their money and hopefully giving passengers and freight companies the ever-improving services they expect.

Precision Measuring Devices – High-end Rail Measurement For The Digital Work Site

Modern technology is increasingly finding applications in the area of railway engineering to enable railways to handle ever higher loads and meet the challenges of the future.

Increasing passenger levels and higher cargo volumes lead to higher speeds, higher average axle and wheel loads and tighter schedules. This results in three challenges: the network is subject to considerably more wear; in



addition, the time slots available for maintenance are continually becoming smaller; finally, the regulatory authorities require more and more digital documentation of the maintenance and security status of the railway networks. The RAILSTRAIGHTS from Goldschmidt Thermit offer the perfect solution to check the straightness of rails. This can be for both new rails and maintenance where the straightness of the welded joints, insulated joints or fishplate joints has to be checked. Over the course of the maintenance work the formation of corrugations can also be analysed before and after grinding work.

As well as highly precise electronic measurements, the devices also impress with their easy handling and innovative control via an app.

RAILSTRAIGHT APP: excellent precision measurement using your smartphone

Using our award-winning RAILSTRAIGHT APP we can offer our customers even more comfort in the measurement process using our RAILSTRAIGHT measuring devices. It takes just two minutes to install the diagnostics software which runs on the Android operating system – be it on a smartphone or a tablet. The app offers an intuitive user interface with on-screen help texts. The app, which is free for customers, enables the display of test reports of longitudinal profiles of the running surface and running edge with the support of user-defined specifications and the creation of PDF reports, excel or csv files on a tablet or smartphone which can be sent by email. Furthermore, remote maintenance per log file

and mailing and GPS position definition is possible. This means that it is possible to record the condition of the track in a short time, depending on the local conditions, and also without track possession. The track condition can also be documented electronically without delay. Individual measurements can be grouped together for projects and the results sent directly by email to the monitoring body or the ordering party.

The right measuring device for every requirement

Naturally, RAILSTRAIGHTS meet all the prevailing standards for the electronic measurement of welded track and corrugations, including all the regulations of the DB, EN and the Netherlands quality index. The devices are not limited to straight rails; they can also be used on curves. Measurements are possible in areas that are particularly important to maintain, such as switches and intersections.

Advantages of the RAILSTRAIGHT measuring devices:

- Highly precise measurement of the straightness and with WAVE also the analysis of corrugations with different wave lengths on the surface of the rail up to a distance of 5 metres
- Robust design for daily use on rails with silicon end covers to protect the devices from shock damage and for maximum non-slip



1. **RAILSTRAIGHT COMPACT:** straightness measurement to check welding work, fishplate joints and insulated rail joints with alteration-proof electronic documentation of the acceptance results.
2. **RAILSTRAIGHT DUAL:** simultaneous measurement of the running surface and running edge for even quicker straightness measurements when inspecting the status of the rails, or for example for quality assurance with a flash butt welding device.
3. **RAILSTRAIGHT WAVE:** in addition to straightness measurement also measurement and documentation of corrugations in co-ordination with the required grinding or milling work or for the final acceptance.

- Compact, light design with ergonomic handle, delivered in practical neoprene carrier bag for easy transport
- Designed for operation by a single person, without the need for a long familiarization process
- High performance internal lithium ion battery, rechargeable via micro USB from the main power system and from the car with additional alternative power supply using AA batteries for a longer operational time
- Adjustable stoppers allowing adjustment to different rail profiles and correct measurement of the running edge
- Innovative RAILSTRAIGHT APP to control RAILSTRAIGHTS via Bluetooth with an Android device and automated data transfer for immediate documentation of the measurement values and clear presentation in the form of a graph
- Creation of individual PDF reports, excel or csv files through input of specific data such as the rail profile, speed class, direction or name of the welder, also with own company logo
- Possibility of immediate wireless transfer of the report by email
- Optional accessories:
 - o Digital rail thermometer which automatically transfers the rail temperature for each measurement to the RAILSTRAIGHT APP
 - o Magnetic holder for improved hold on the rail



HS2 – En Route to Europe

As part of an on-going awareness of the need for a cohesive rail network throughout the European Union, a series of Community Guidelines were adopted in 1996 relating to the development of a trans-European transport network.

By Naomi Thompson

The guidelines, since modified, also provide for the eligibility criteria for EC funding for transport projects. Other funds, including the Cohesion Fund and

the ERDF (European Regional Development Fund) are available to finance eligible projects.

There evolved from this the Trans-

European Transport Network, or TEN-T. This new transport infrastructure policy, with a budget of €24.05 billion from 2014 to 2020, aims to “lose the



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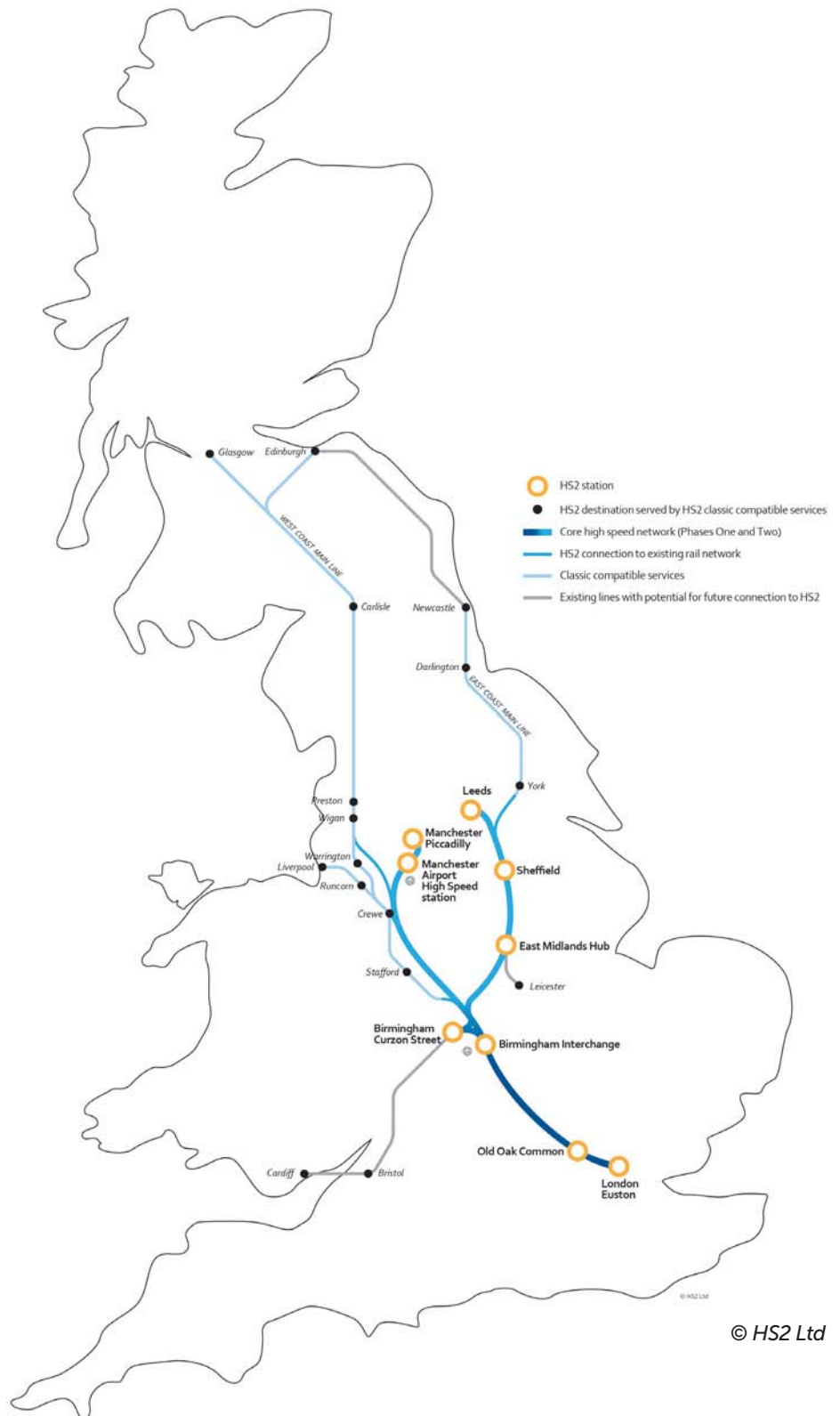
gaps between Member States' transport networks, remove bottlenecks that still hamper the smooth functioning of the internal market and overcome technical barriers such as incompatible standards for railway traffic. It promotes and strengthens seamless transport chains for passenger and freight".

TEN-T Corridors

The Core Network Corridors are intended to enable the co-ordinated implementation of the core network, bringing together public and private resources and funding to build cross-border connections where they are lacking and promote modal integration and interoperability.

The corridors focus particularly on the integration of rail freight corridors and the promotion of innovative technologies as they relate to environmental sustainability and safety. It is also intended that urban areas will be integrated into TEN-T. Nine core corridors have been identified as eligible for European funding. Further "comprehensive networks" may be proposed by Member States. A core network line in the UK includes the West Coast Mainline and Phase 1 of the HS2.

Of the nine corridors, the North Sea-Mediterranean Corridor is the only one which passes through the UK. The corridor runs from Ireland and northern Britain, through the Netherlands, Belgium and Luxembourg to the Mediterranean Sea in the south of France. It is a multi-modal corridor incorporating sea ports and inland waterways. Its secondary purpose is to better connect the UK to mainland Europe.



Part of the UK segment of the North Sea-Mediterranean Corridor is the proposed route for the High Speed 2 (HS2), a high-speed rail link between London and the West Midlands, which will in its later phases extend to the North of England and up into Scotland. It

will be Britain's second high-speed rail line, the first being HS1, also known as the Channel Tunnel. In 2014, recognising its importance as part of the TEN-T network, HS2 was awarded €39.2 million by the Connecting Europe Facility (CEF).

Technical Specifications

In order to be truly interoperable, the whole TEN-T network is required to run on the same technical specifications, with the exception of Northern Ireland which is classified as an “isolated network”. Therefore, in addition to operating on the same signalling system (ERTMS), other technical specifications are required to be uniform.

Ironically, as the pioneer of railways in the 19th century, the UK is hobbled in adapting existing lines to meet European standards in terms of technical specifications. Much of the UK’s rail network is antiquated, with curving tracks that do not allow for very high speeds or long trains, and low bridges which do not allow for overhead power lines.

Trains in France, the Netherlands and Luxembourg operate freight trains that are 740m long. In the UK, only parts of the West Coast Main Line (linking London and the North West) and on HS1 allow for trains up to 775m long. Half of the core corridor networks in the UK do not allow for a 740m standard, as compared to 20% which is above that standard, and 30% which is unknown.

Track gauge must also be uniformly 1435mm gauge as standard, which the UK satisfies. Electrification, because it is not only faster but also more environmentally sustainable (a key objective in the development of the TEN-T network) is essential, but by no means standardised. In the UK, a third of the core corridor is not electrified, and of the two-thirds that are, 160km rely on rail electrification rather than

overhead lines. Installing overhead electrification lines in the UK is a costly and inconvenient process, requiring bridges to be rebuilt along the whole route.

High-speed is defined as 200km/h by European standards, but for the purposes of TEN-T high-speed is allowed at 100km/h. In the UK, 68% of the West Coast Main Line allows for trains to run at 100km/h, while on the rest of the line, speeds vary widely from 64km/h to 170km/h. Therefore, adapting the existing West Coast Main Line to meet European standards is not necessarily a pragmatic option. Already full to capacity for both passenger and freight trains, the case for the brand new HS2 is a strong one.

HS2

HS2 is a two-phase plan to build a brand new high-speed link from London to Birmingham and then to the North of England, running a 225mph train up to 14 times an hour in each direction. Phase One will operate between London and Birmingham, and will reduce the journey times from 1 hour 24 minutes as they are currently, to only 49 minutes. This phase of the project is set to be complete by 2026.

The second phase is a two-pronged line, known as the Y-route, one from Birmingham to Manchester, the other from Birmingham to Leeds. It is proposed that there will be a third phase taking the line up to Edinburgh and Glasgow, but it is hoped to get as far as Leeds and Manchester by 2033.

In addition to the nine core corridors which have been identified by TEN-T, further

“comprehensive networks” may be proposed by Member States. A core network line in the UK includes the West Coast Mainline and Phase 1 of the HS2. Phase 2 is not included in the network as it will not be operational before 2030. As such, Phase 2 is included as a comprehensive network.

With a focus on intermodal transportation – namely sea port to rail, HS2 will not cater to the key ports of Felixstowe and Southampton, both in the southeast of England. However, HS2 will eventually link up close to Liverpool, where a docklands container terminal is currently being developed. The core corridor therefore lays the groundwork for better connectivity from the north to the south for freight, which will in turn connect to HS1 and enable smoother intermodal freight transport to mainland Europe.

HS2 Built to European Specifications

The current outline for the technical specifications of HS2 are based solidly on European technical specifications for interoperability (TSIs). A key part of this is safety, from design and construction through to operation and maintenance. Because HS2 will be the fastest train to have ever operated in the UK, safety and reliability will be key issues.

However, the safety of the train was called into question in February 2016 by an expert report written by Professor Peter Woodward, Atkins Professor of High Speed Railways at Heriot Watt University, who found that the soil quality on much of the



proposed HS2 route would not sustain the top speeds of 400km/h, which have been proposed, without creating structural instability along the line.

BIMBY-ism

HS2, as a new tranche of railway, will create yet another physical barrier between areas of wildlife protection, blocking migration corridors, and creating noise and light pollution, as well as air pollution.

The EU initiative the 'European Cooperation in the Field of Scientific and Technical Research' (COST) recommends that an ecologically sustainable transport infrastructure requires innovation and adaptability to various landscapes, and that it must be addressed at a policy and planning level in order to create an interdisciplinary approach to solve the problem. Accordingly, HS2 has

worked closely with organisations including the Wildlife Trust and the Woodland Trust to improve protection measures for wildlife along the route.

In addition to the impact on wildlife, there is also an imperative to preserve the beauty of the English countryside. The UK heritage organisation the National Trust has worked with HS2 to solve issues relating to the protection of the countryside as part of its BIMBY campaign (beauty in my back yard).

Working with the National Trust, HS2 has agreed to create a natural landscape of banked earth where it runs through parkland, which will negate any visual eyesore, as well as noise pollution. Compromises have been reached; where the National Trust campaigned for a tunnel beneath the Chilterns (an area of outstanding natural beauty), which is now two thirds in tunnel

through this part of the route and the rest in cutting.

HS2 is the most ambitious project on the UK's railways since the Victorian era. Per kilometre, it will be the most expensive railway in the world. However, the UK also boasts the most established railway in the world, forming the basis on the railways of Europe and the rest of the world. It is therefore ironic that it must construct a completely new line in order to meet European specifications.

Much of the objection to the controversial line is that it is London-centric, but that is to miss the point. It is not that the north of England will be connected to London, but that all of the UK will be connected to Europe, and will operate on a par with its European counterparts. In this instance, it is not a case of adapt to survive, but rather, build anew to connect.

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