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M A G A Z I N E

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& Speeches and panel discussions from Digital InnoTrans:

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ISSUE FOUR 2020

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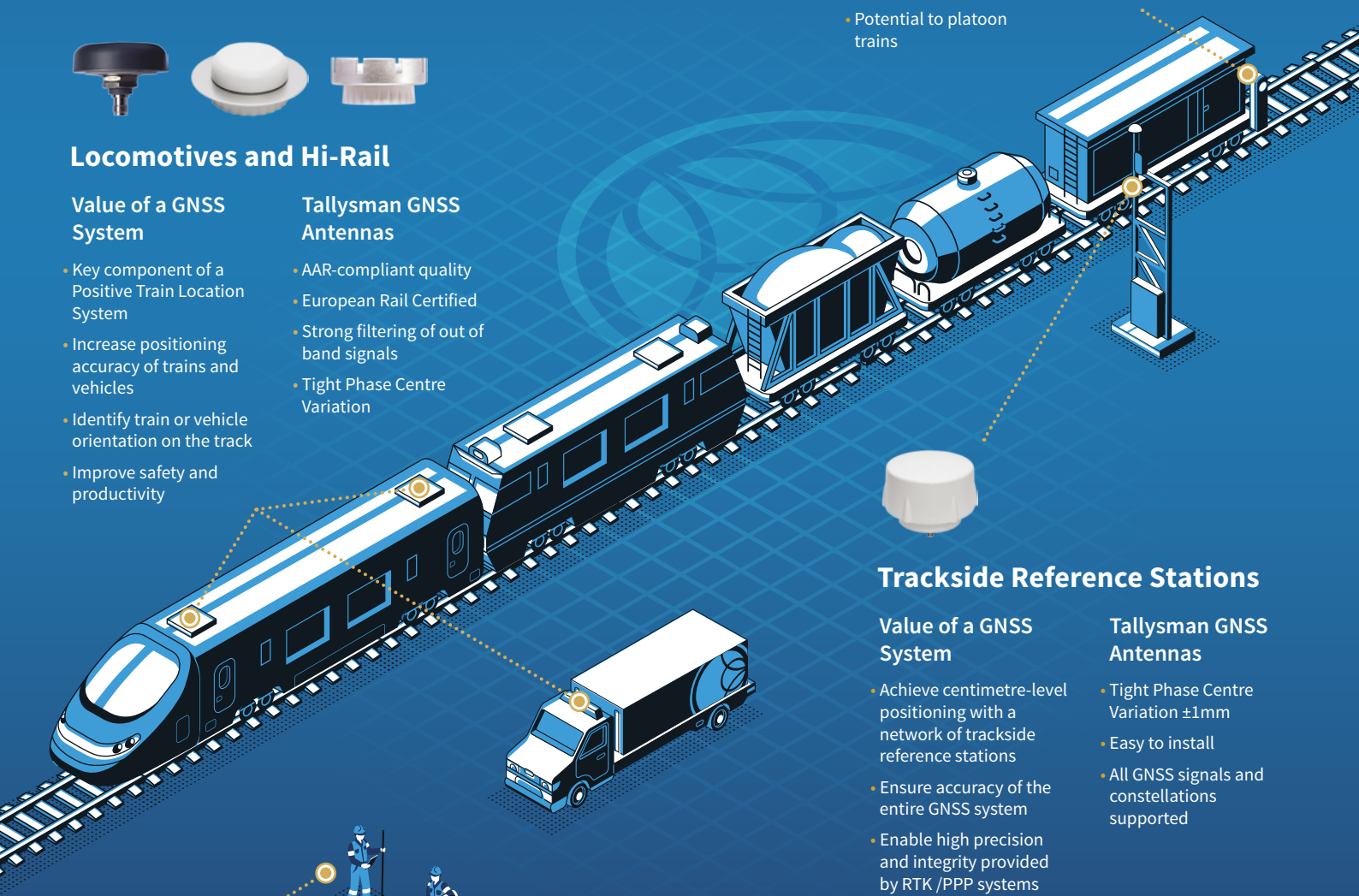

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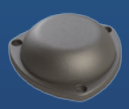

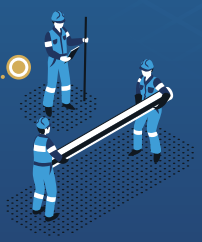

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Letter from the Editor

Josephine Cordero Sapién, Editor-in-chief

Dear Readers,

We are publishing this digital magazine having only recently heard the news that there will be no InnoTrans in April 2021. Instead, InnoTrans will take place again in September 2022. The InnoTrans organisers explained their decision saying there was not enough planning security to go ahead with the show and that they had made this decision in close communication with key players. The news sits amid steep rises in recorded coronavirus cases in Germany and internationally. One of the events that did take place for InnoTrans 2020 was its Convention, which went digital for the first time. And one of the areas of discussion was focused on restoring passenger confidence in rail travel during this pandemic. A study conducted by the Charité hospital in Berlin found there was no increased risk of catching the coronavirus on trains, but it is the perceived sense of safety that needs to be bolstered among passengers.

The other central theme was around climate change. Digitalising our railways, researching alternative traction power, moving forward with digital automatic coupling and digital interlocking, rolling out ETCS to increase capacity and help drive modal shift are all key towards bringing about a mobility that is better for our planet.

The plea from German transport minister to the rail industry was clear: we've got the money – you need to do the work.

In this issue you can hear the voices of major industry players, from Stadler, Alstom, Siemens Mobility, the German Railway Industry Association VDB, and representatives from SMEs.

Whether or not railway exhibitions will be able to go ahead next year remains uncertain. More and more events now have digital capabilities, allowing us to stay in touch. And we too will do our bit to promote the voice of the rail industry digitally – the only certain avenue there is at the moment!

We are publishing our first issue of 2021 in March. If you would like to be represented in our magazine or on our website, please contact Andrew Lush at al@railway-news.com.

Please enjoy our final issue of 2020!

Josephine Cordero Sapién,
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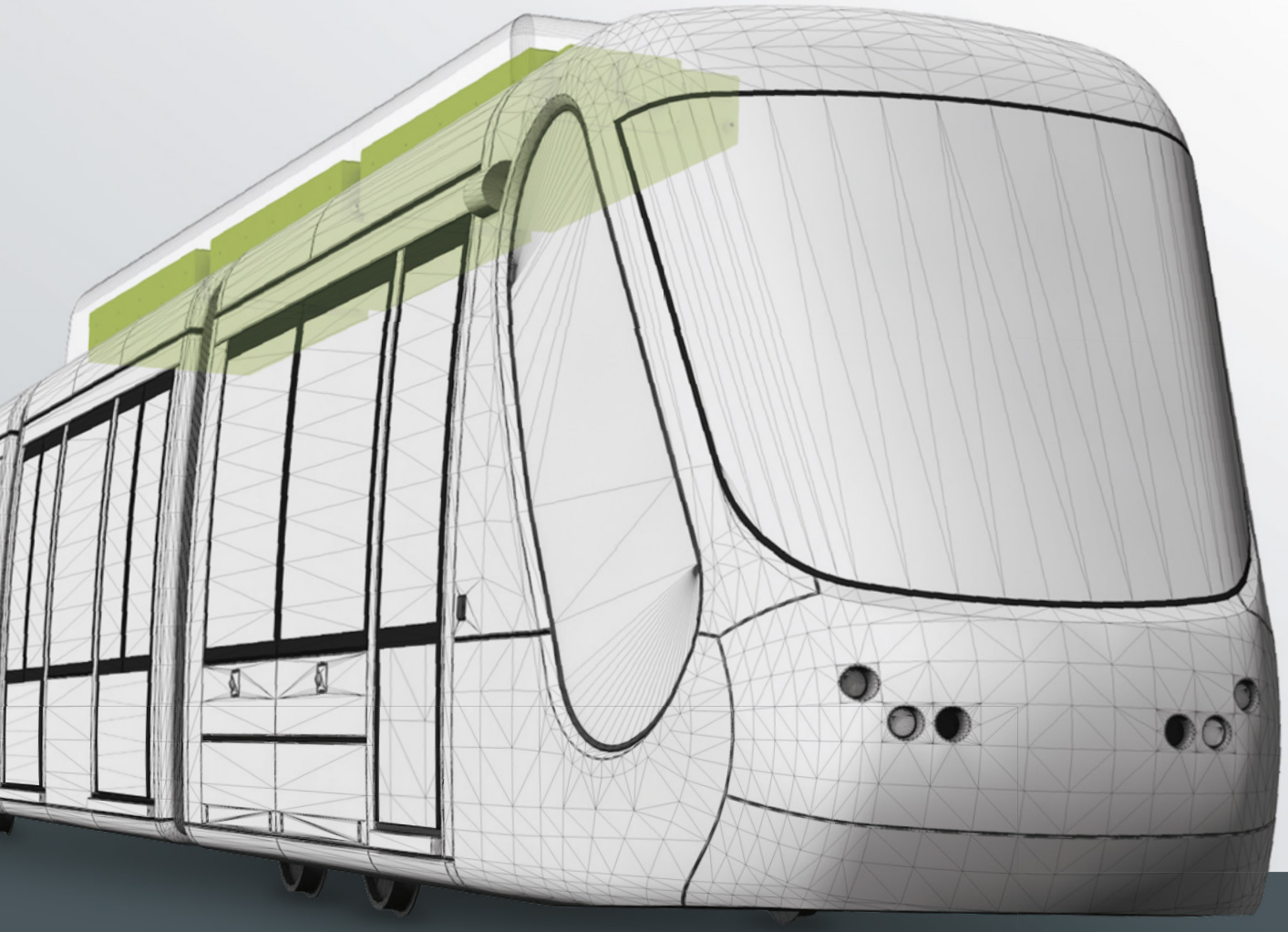

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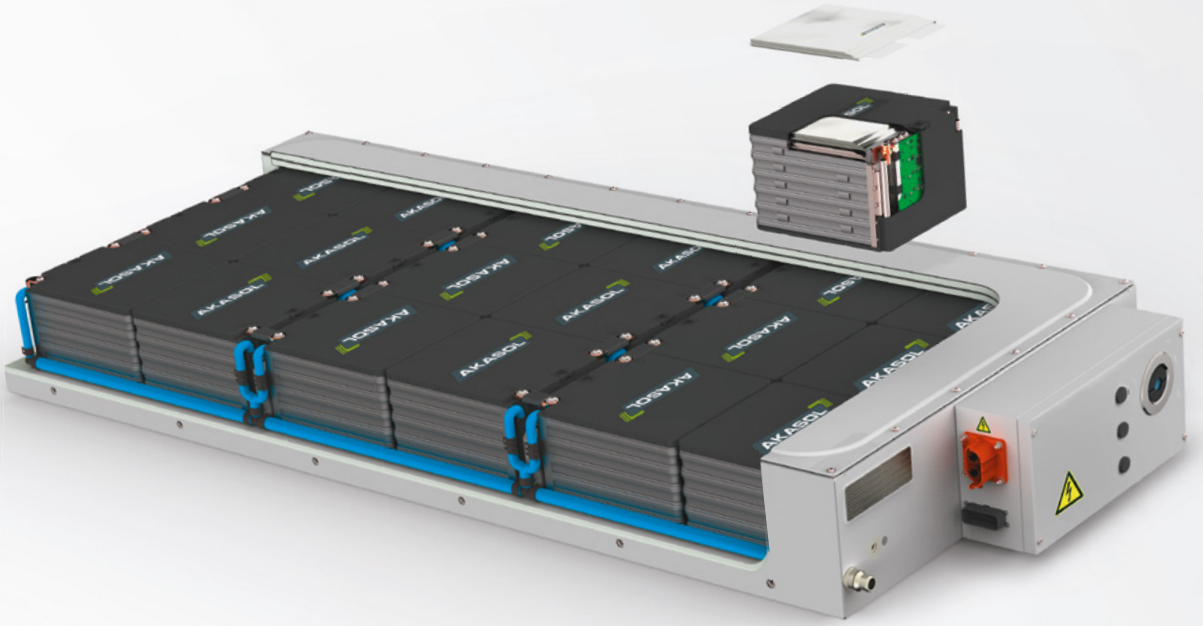

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On the Cover...

From December 2020 DB Regio will gradually introduce 57 Mireo trains made by Siemens Mobility on the Rhine-Neckar S-Bahn network.

DB Regio AG placed the order in the summer of 2017. The regional branch of Deutsche Bahn AG has won the contract to operate the Rhine-Neckar network for a period of 14 years.

Siemens Mireo

Each electric multiple unit is 70m long and have 200 seats with spaces for up to 26 bicycles. They will have a top speed of 160km/h and operate on 15kV AC overhead lines.The construction is lightweight, having a welded integral aluminium monocoque construction. The EMUs are energy-efficient in other ways too: they are aerodynamic, have energy-efficient components and feature an intelligent on-board network management system.

The Rhine-Neckar S-Bahn Expansion

The Mireo vehicles will run on lines S5, S6, S8, and S9. They will operate the Murgtäler Radexpress service. Lines S8 and S9 are new to the S-Bahn network – being added as part of the second phase of expansion.

Exterior of the new Siemens Mireo for the Rhine-Neckar S-Bahn
© Deutsche Bahn AG / Uwe Miethe

The bright and spatious interior of the Mireo © Deutsche Bahn AG / Thomas Henne

Space for wheelchair users © Deutsche Bahn AG / Thomas Henne

The Coradia iLint from Alstom is the world's first hydrogen fuel cell train © Alstom

Case Study with Alstom

Use under the Harshest Conditions

Sensors from ASC ensure both safety and comfort in rail transport

Alstom is one of the world's leading manufacturers of rail vehicles. Among other things, the company tests the running dynamics and bogie strength of new trains at their Salzgitter site in Germany. Capacitive acceleration sensors from ASC GmbH – a leading global manufacturer – provide crucial measurement data during testing

At its German site, Alstom produces regional trains, trams, rapid-transit and underground trains as well as locomotives. Before they can be approved for passenger transport by the German Federal Railway Authority (EBA), however, the trains must pass a host of tests under realistic conditions. "We carry out running tests and other dynamic tests, among other things. This enables us to verify that a train is technically incapable of derailing," reported Tim Michatz, Deputy Director of the test laboratory for Alstom Germany. "Technically" here means that the train cannot come off the track or tip over without an outside influence. In addition to train safety, riding comfort is also a priority.

ASC Sensors Impressed with Their Precision and High Working Stability

The test engineers in Salzgitter test rail vehicles in accordance with the EN14363 (running dynamics) and EN13749 (bogie strength) standards. When doing so, they are reliant on the data recorded by high-precision sensors during testing. Capacitive acceleration sensors from ASC GmbH have been used for test runs since 2013. Until then, Alstom was using sensors from a competitor which became defective after five years in the field. The decision to choose ASC as the new supplier was taken not only thanks to the high precision of the sensors, but also due to their high working stability and impact resistance – very important criteria indeed. "During tests on the wheel pairs and the bogie, impacts with a force of up to 400 g occur," said engineer Tim Michatz about the conditions experienced. Loads like this are harmless to ASC sensors, which are actually capable of withstanding impacts up to 6,000 g.

With the capacitive acceleration sensors from ASC, Alstom tests the running dynamics of the trains, among other things © ASC

DAkkS Calibration an Important Advantage

To Alstom, there was another aspect which played a big role – ASC calibrates the sensors for its customers and has been accredited by the German Accreditation Authority (DAkkS) for this purpose.

ASC has assembled its sensors with special connectors for Alstom © ASC

"This was a good fit, as we are also accredited by the DAkkS (as per DIN EN ISO/IEC 17025) as the Alstom test laboratory, meaning that the sensors we use also have to fulfil these conditions," said Michatz.

It wasn't easy at all to find a manufacturer whose products meet these specifications, though. "Many of them spare the effort and don't have their sensors calibrated with accreditation. Sometimes, they don't even calibrate the sensors at all. In this case, the customer has to do it themselves – a very laborious task."

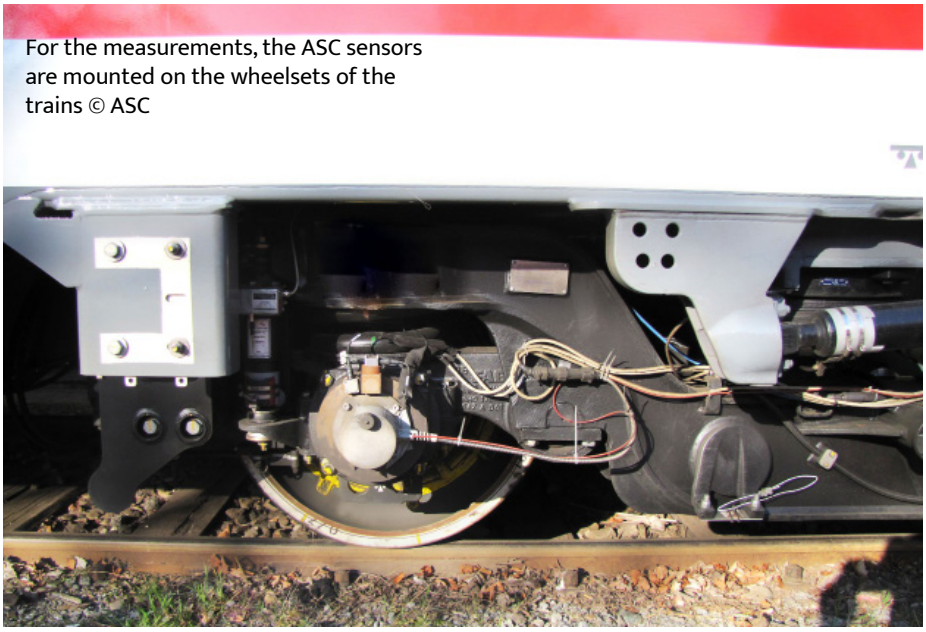
Trains Are Tested on Sections of Open Rail

Alstom thus received fully calibrated sensors of type ASC 44211 (uniaxial) and ASC 55211 (triaxial) made with special plug connectors and was able to use them for measurements straight away. Contrary to what you might think, they're only used to a small degree in Salzgitter itself.

The reason for this is the applicable standards, which specify that the tests must be carried out on the public rail network. For these test runs, Alstom uses certain sections of rail with very specific properties. "For running dynamics tests, we traverse the section from Nuremberg to Augsburg and a section near Trier, as the arc radius of the tracks is narrow there, enabling us to easily test how the trains will behave on curves," explained Michatz. These sections are blocked for the duration of the test, as the trains travel 10 percent faster than normal during the test runs, creating a risk of collision.

High Measurement Sensitivity and Broad Frequency Range

General-series capacitive acceleration sensors from ASC are highly suitable for test set-ups like Alstom's thanks to their high measurement sensitivity and stability. They enable precise measurement, even of slight linear acceleration and low-frequency dynamic acceleration. ASC has since included the successor line, the MF series, in its product range. These medium-frequency acceleration sensors are also equipped with a large frequency range from 0 to 7 kHz (±3 dB), which opens up wide-ranging applications, including in the automobile and wind energy fields. The MF acceleration sensors also feature a differential output, measure reliably in higher operating temperature ranges and are able to work with very low voltages.



For the measurements, the ASC sensors are mounted on the wheelsets of the trains © ASC

The Sensors Are Impervious to Environmental Influences

At least as important as the high measurement sensitivity of the sensors is their extreme ruggedness, as they are exposed to rain, snow and mist during the test runs and must function flawlessly within a broad temperature range between –20 and +100 °C. Other than their own housing, the electronics do not have further protection, as they are only screwed to magnetic blocks and then mounted in the position to be measured by the Alstom engineers. This makes the rugged construction of the sensors a big advantage. The sensor specialists at ASC have designed their sensors in such a way that they work reliably and precisely even under these demanding conditions. Not only are they rated protection class IP67, they are also designed for a very broad temperature range from –40 to +125 °C.

Six to Eight Weeks of Continuous Use

Although the running dynamics of Alstom trains are tested on only a few sections of track, the vehicles cover distances of around 2,000km for bogie-strength testing. “To do this, we cover a loop from the Ruhr region through Cologne to Frankfurt, stopping at every station,” said Michatz. “During the tests, we simulate normal train operation in every conceivable operating situation.” Though every test run is concerned with operating safety first and foremost, riding comfort is also “put on the test bench”. This has been expressed in numerical values which are specified in EU standard EN12299 and apply across Europe. The ASC 4421 is predestined for the measurement of the smooth running of trains, as it can also precisely measure slight linear acceleration.

Every train is subjected to tests, but only one train per series needs to undergo full running dynamics and bogie-strength testing. The trains are equipped with the sensors two weeks before testing and then run with them for six to eight weeks. “During this time, we measure eight to ten hours per day at low frequencies under 15 Hz,” said Michatz. The sensors are scanned at 500 Hz, and their signals are recorded by measurement amplifiers.

Rotation Rate Sensors from ASC to Reduce Costs

In order for the test runs to be carried out at all, Alstom requires the line routing data on the test sections. These are precise specifications on the course and location of the tracks. Previously, the company had to purchase these data externally every six months, as they changed slightly on a continual basis due to external influences. To save money, Alstom would like to collect the data themselves in future. In addition to the 70 acceleration sensors already in use, an additional rotation rate sensor which will soon be on board during test runs was ordered from ASC. The results will then be analysed at the Salzgitter test site.

Still Extremely Stable after Five Years

Usable data are only generated during testing if sensors are always in proper working order, however. This is why ASC offers its customers calibration as a service – including for sensors from other manufacturers. Alstom’s sensors are recalibrated every two years, and the values are recorded in an “ageing log”. Even after five years, the sensors are still extremely stable.

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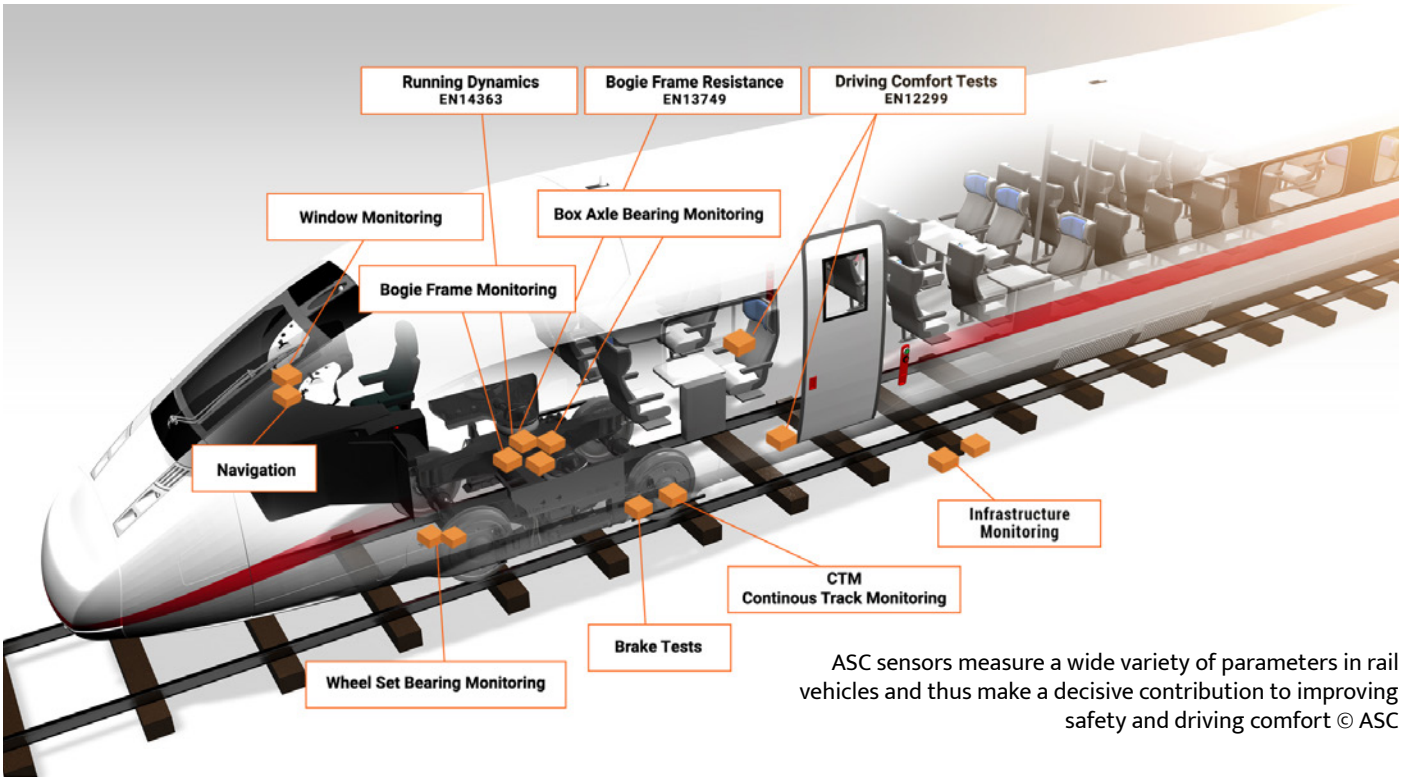

ASC sensors measure a wide variety of parameters in rail vehicles and thus make a decisive contribution to improving safety and driving comfort © ASC

A Eurostar in France – hydrogen trains are unsuitable for high-speed operations

Hydrogen Is a Distraction

By Josephine Cordero Sapién, Editor, Railway-News

There is a lot of buzz about hydrogen trains and hydrogen technology at the moment. Hydrogen trains are already in commercial operation in Germany and are being tested in the Netherlands and the UK. And they have their place. However, their contribution to decarbonising transport is tiny and the danger is that by appearing to be doing something, we are not actually focusing on the real solutions: a rolling programme of electrification and modal shift. They might not be sexy, but they're far more potent.

Hydrogen trains are marketed as 'green' because the only emission they produce in operation is steam. No dirty pollution in our cities and in stations. That's a plus. But – and it's a big but – the vast majority of hydrogen currently produced is made by splitting it from natural gas, which, other than being expensive, emits large quantities of carbon dioxide. That's not really progress. 'Green' hydrogen is made by electrolysing water to split the hydrogen from the oxygen using surplus renewable energy and fuel cells. This is turning electricity into a gas and back into electricity and is expensive and inefficient.

But if we manage to make hydrogen in a clean, efficient, cost-effective way and we build all the associated new infrastructure required, how much of an impact will hydrogen trains have to decarbonising transport?

Well, hydrogen trains also have their limitations. Their current commercial operating speed is 140km/h (90mph) so they're not suitable for high-speed operations. And it is always less efficient to make a train carry its fuel on board than to externalise the source as electric trains do. Hydrogen storage takes up roughly eight times the volume of diesel. and the energy consumption of fuel cell trains is around three times that of conventional electric trains.

So if we actually deploy hydrogen trains everywhere they're suitable, what impact will they have on decarbonising transport?

Some figures (from EuroStat and Network Rail):

- The modal share of passenger rail by distance travelled (excluding tram and metro services) for the UK (2016) was 8.8% – the rest is basically road vehicles

Wind power already fuels all electrified passenger rail services in the Netherlands

- The same modal share for Germany was 8.6% (also 2016)
- In the Netherlands the modal share of passenger rail in 2016 was 11%

Of course, hydrogen trains are not useful for all of these journeys. For instance, they are not needed for lines that are already electrified. They are being touted as a solution for lines that are not (yet) electrified.

- The United Kingdom has 15,800 route kilometres of railway lines, of which 6,000km are electrified (38% electrified), 9,800 route kilometres unelectrified
- Germany has a rail network measuring 34,000km of which 20,000km are electrified (59% electrified)
- The Netherlands has a rail network measuring 3,200km and 2,300km of these are electrified (72% electrified)

It is not a 50-50 split between the use of electrified and non-electrified lines. Busier lines are naturally prioritised for electrification so that – using the UK figure – more than half of that 8.8% takes place on electrified lines already. The West Coast Main Line and the East Coast Main Line, two of Britain's busiest rail arteries, are electrified for example.

Let's continue to look at the UK, as it has the lowest percentage of electrified track of the three countries cited, all of which are trialling or running hydrogen trains.

The British rail infrastructure manager Network Rail recently published its Traction Decarbonisation Network Strategy, which contains recommendations of how best to proceed with the unelectrified tracks in the country. It identifies 15,400 Single Track

Kilometres that are unelectrified (1km of a twin track railway counts as 2 Single Track Kilometres – 2STKs – which is why this figure is higher than the 9,800km listed above). Of these 15,400STKs it recommends that 13,000STKs are electrified and hydrogen trains are the best solution for a mere tenth of that, i.e. 1,300STKs, meaning that of all the unelectrified track in the country, 8.4% should see the introduction of hydrogen trains.

The passenger rolling stock fleet in the UK comprises 14,000 vehicles. Of these 70% are purely electric (9,800 vehicles). A calculation then: let's say 70% of the 8.8% modal share that rail has is electric, so that the remaining 30% is diesel. That means the current modal share of diesel passenger rail transport in the UK is 2.64%. That 2.64% takes place on the aforementioned 15,400STKs. And if 8.4% of those STKs are suitable for hydrogen trains, then 8.4% of 2.64% will be the modal share of passenger transport hydrogen trains can have and that equates to 0.22% of passenger transport and that's being generous as the 8.4% deemed suitable for hydrogen trains are among the least busy branch lines and will get less traffic overall than the as yet unelectrified main lines.

Furthermore, that 0.22% is only for passenger transport. Hydrogen trains are not suitable for freight operations so the total modal share capacity of hydrogen trains for transport overall is smaller than this figure still. I've made some assumptions with my calculations, but they suffice to demonstrate the scale of the solution hydrogen trains can provide. Hydrogen trains have their place, but they are as much the solution to decarbonising transport as abolishing plastic straws are to solving plastic pollution – it is a drop in the ocean and at the moment it's not even a clean drop.

Of course, it isn't the only strategy being deployed but hydrogen trains must not be presented as an alternative to electrification, as a justification for cancelling electrification programmes, as Grayling did. A rolling programme of electrification will have a much bigger impact, especially if the traction electricity is sourced from renewables, as it is in the Netherlands where a full 100% comes from wind power for passenger operations. In the UK 30% of the current diesel fleet operates on electrified lines and hybridising these will also contribute. But the biggest driver to transport decarbonisation, however, is modal shift and for this the UK and other countries must build new railway lines and, crucially, de-incentivise the use of road transport.

Quadruple electrified track on the West Coast Main Line

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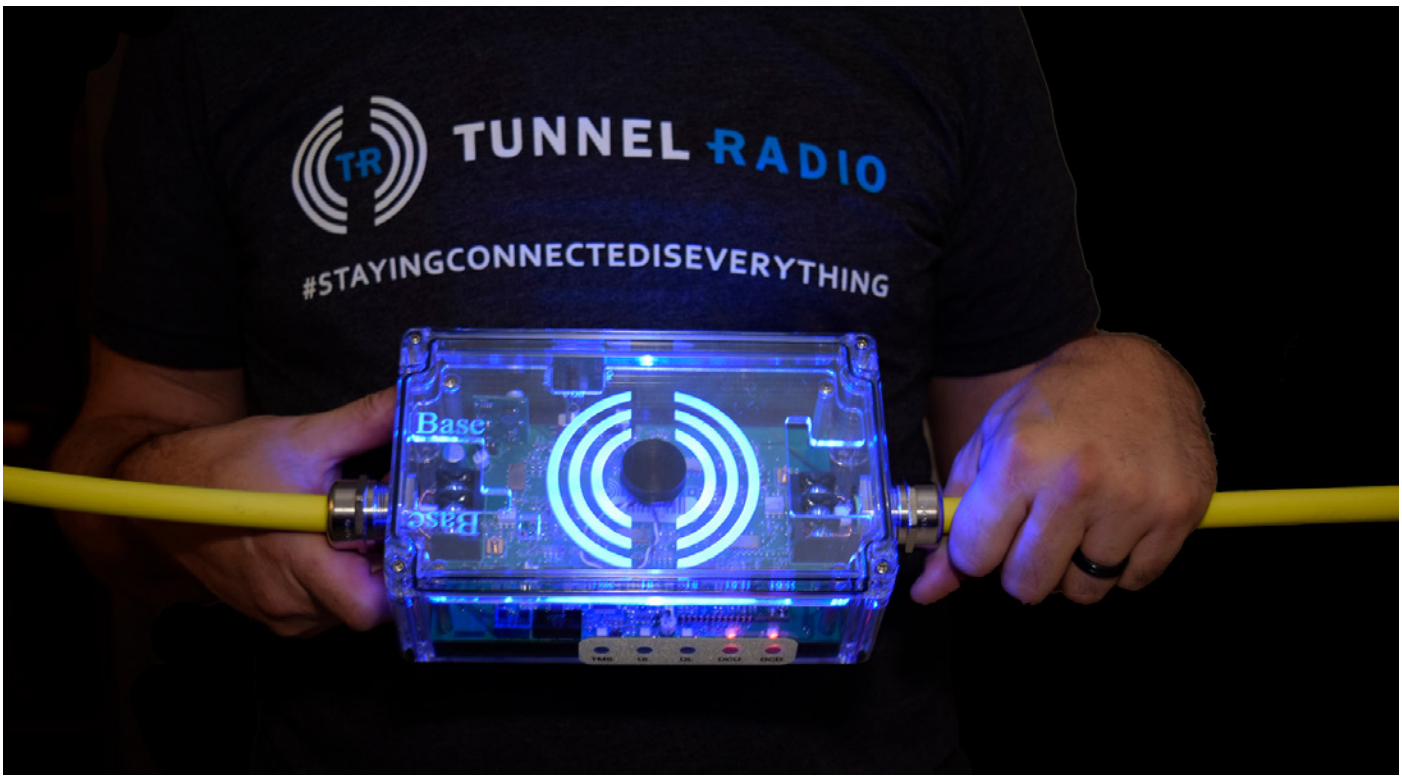

Radio Frequency Challenges for Underground Railways

Wireless underground communication is more reliable with Tunnel Radio's TRCentral™ software

The wireless communications landscape is fraught with RF challenges. Safe and reliable technology solutions entail more than just an antenna and a wireless communication device. This is especially true in today's world of rail transportation. As trains become longer and faster, better data and voice communication becomes ever more important to safety and efficiency.

The development of railway RF system components, including radios, base stations and antennas has made great strides over the past decade. The implementation of these advances has allowed trains to continue and improve their mission-critical communications. Tunnel Radio expertly manages these complex systems with its exclusive TRCentral™ software.

Features of TRCentral™ Software:

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- 24/7 technical support

Tunnels Aren't the Only Obstacles

Going underground isn't the only source of problems for wireless connectivity. The increasing length of trains creates connectivity issues too. Dual-power communications enable HOT-EOT connectivity, ensuring safety and improving locomotive efficiency.

Additionally, dense foliage abutting the right-of-way and tight turns on narrow canyon passes can cause low to zero propagation areas. In locations ranging from the heavy vegetation of the Brazilian jungle to the steep canyons of the Tehachapi mountain range in California, extending RF-based coverage is a necessity.

Leveraging a Modular Leaky Feeder Foundation for Other Critical Functionalities Is Key

A modular and reliable communication system is a key building block to future-proofing the system. Modularity gives the railway operator the option to leverage their existing installation towards later needs. For instance, personnel proximity and location tracking can be installed as an overlay to a comms-only system. Back-office monitoring systems

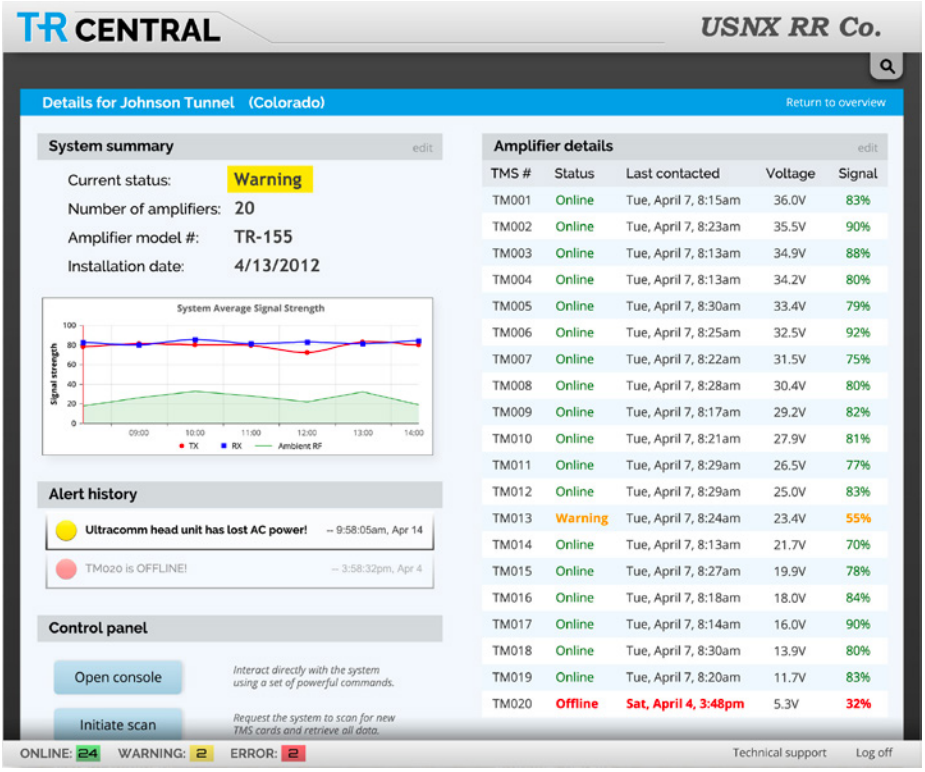
that provide real-time alerts about equipment location and maintenance crews allow the railway operator to identify potential conflicts between operating trains and active work zones. TR systems even have the capability to support various SCADA control signal connectivities. All of this is monitored with TRCentral™ software.

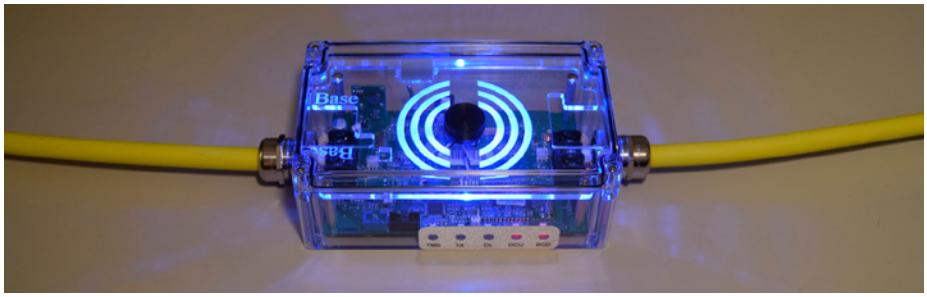
High Reliability and Connectivity Does Not Always Mean High Cost

While difficult challenges create a need for adaptive and comprehensive solutions, new or cutting-edge technology isn't always the best answer. Proven and established technologies often provide a better, more cost-efficient approach.

Leaky feeder has been around for decades. By combining it with digital data and voice radios, railways can reduce the cost of implementation and maintenance. Today's leaky feeder technology also offers modularity options that expand its reach even further. The result: lower budget requirements for new installations, and reduced maintenance costs for existing installations due to longer maintenance cycles and fewer deployed devices per kilometre than other technologies.

Tunnel Radio's Tunnel Link™ system employs a distributed antenna system, consisting of a radiating coaxial cable and digital amplifiers that provide a signal extension. Tunnel Link's unique design handles high-speed asynchronous data in simplex mode at very low distortion figures, suitable for use with FSK or phase shift complex modulation schemes used in today's modern





digital communications. This design also negates any need for multiplex equipment. The amplifiers are ruggedised, and component count is low. The built-in diagnostic and monitoring system allows local and remote use.

Planning for the Future When Buying Today

Designing systems that are adaptable to future technology requirements is one way of ensuring usability for the long term.

Well-designed RF systems are integrative and interoperable now and in the future. Conforming to EN, FRA, IEEE, IRIS and other recognised conformity specifications adds insurance that products will be safe for end users.

Technology with Customer Support

Finally, having qualified technical support available 24 hours a day, 7 days a week is the keystone to a successful RF-challenged remediation. Many OEMs and suppliers forget that railway operators do not have time for scripted call centres with 9–5 hours. Immediate-need customer support via voice, video and email, minimises downtime for railway operators, thus reducing negative cost impacts and operational delays.

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Monika Jones & Andreas Becker

Rail Revolution 4.0: Picking up Speed after the Crisis

Monika Jones: Good morning, ladies and gentlemen, representatives of the rail industry, a very cordial welcome to the VDB Dialog Forum Digital: the association of Germany's railway industry is glad to welcome you during this COVID-19 year remotely, and we talk about the future of the railway industry within the framework of InnoTrans.
My name is Monika Jones, I'm an economic moderator at Deutsche Welle and I'm glad to be your host through this digital programme today.

Today's motto is Rail Revolution 4.0: Picking up Speed after the Crisis. And I wanted to get a little bit of information during the preparation and I looked at the VDB climate report 2020 and I saw that the future of mobility is not a renunciation but a promise, which sounds very promising, but it also brings about questions: how will climate protection and growth be brought together? Is climate mobility, what could a green restart look like? What is the role of European or global partnerships and how can the mobility revolution 4.0 be achieved together?

Andre Rodenbeck President of VDB

"Thank you very much Ms. Jones. Good morning, minister, ladies and gentlemen, secretaries of state, members of parliament, excellencies, and colleagues.
A very warm welcome on this German Railway Association VDB InnoTrans Dialog Forum. It's a traditional event of the railway industry in a new digital form. The last month we completely had to face new challenges – all of us. The very many great relationships of the German rail industry, our esteemed partners all over the world have proven to be reliable. It is said that character is forged in a crisis. Our sector has shown its character in the corona crisis. I would like to thank our business partners for their trust and the co-operation with them. The crisis has also shown us that mobility and logistics are system-relevant. The plants of the railway industry still produce in a reliable way, under strict measures, because rail is the backbone of the economy and society. You can rely on the railway industry. It seems a bit abstract but it is really dear to me because our employees work for our company, for society and our customers. And I would like to express my warm thanks on this occasion today. There were many impressive encounters with employees and especially one overhead line technician impressed me. He said: 'If the railway doesn't go anywhere anymore, nothing goes.' I think it is expressed in a really precise way. It is now time to look forward, to think of our ambitious targets. We have to be successful in the economic restart. It must be a restart to a digital and climate-friendly future. Climate protection and economic growth are no longer antagonists. A climate friendly industry, such as the railway industry, can make its contribution. Often traffic gets to its limits now, individual traffic gets to its limits. Some say we need a different form of mobility, a modern one. During this pandemic it is even more important to create trust in our passengers so it is correct to say that we need a real mobility revolution.

The railway industry is a driver of mobility revolution 4.0 like no other: digital, emission-free, safe. The railway industry can do a lot. Our mission: re-invent mobility. Without emissions, we really push further the limits of what is feasible. The Future of Mobility, the motto of InnoTrans, is perfect to express this.Rail 4.0 is capable of efficient climate protection.

Imagine blue sky over the planet's mega-cities, instead of congestion and smog. The next subway station is maximally 500m away. There's no waiting, no crowding. Rail 4.0 can do that. Automatic trams and metros, made in Germany, operate flexibly, to the rhythm of the city. They grow to become landmarks for their cities, thanks to creative designs. Smartphones provide passengers with their tickets. Intelligent systems display how full trains are as they approach stations. That too is a protection from corona because it ensures distances and seats.
And imagine, high-speed trains connect cities as fast as planes, all while being more comfortable and with zero emissions. That's all doable. Thanks to digital control and predictive maintenance high-speed trains exhibit near-100 percent availability. On-board wifi gives passengers a productive or relaxed travel experience.

Also imagine that growth doesn't get stuck in endless lorry queues. Instead, rail will take on the lion's share of logistics in the future. That too is doable. For example, thanks to intermodally connected data platforms and digital automatic coupling. If we create the best services, then the market will follow, and with it growth and environmental protection."

Excitement All around India for IGW

IGW is extending its global manufacturing footprint with excitement all around India, especially in their local Indian plant in Pune.

The biggest change that happened recently is that their Indian colleagues are now fully able to produce and assemble entire railway gearboxes locally.By means of a celebration, IGW has just won three new Indian projects, with a delivery of more than 1,350 gearboxes over the next years!

Exploring a New Market

Up until now, IGW mainly produced railway gearboxes in its manufacturing plants in the Czech Republic and China, and these have delivered tens of thousands of gearboxes over the past 18 years. Also, since 2013 a number of projects have been delivered by IGW US for the local US market.

Our Indian colleagues are now able to join them in providing the production of full gearboxes in addition to their vast experience in making gears and other parts. This development is a great competitive advantage as they can now operate as a full local supplier for their customers in India.

The railway market in India currently offers exciting possibilities for ambitious companies such as IGW.

As it stands, many rail networks are being expanded which of course increases the demand for railway gearboxes. This is already reflected in IGW's portfolio as it has won three major projects all around India.

The first project is for 272 one-stage helical gearboxes which will be delivered over the next two years for Pune Metro. Recently, tests have been carried out on the prototypes. Subsequently, these prototypes have received the green light meaning that production has now begun in earnest. An equal number of IGW's gear-to-gear input couplings will also be provided for this project. Needless to say, the IGW employees in Pune are very excited to get going on this project as manufacturing the gearboxes will happen in the same city as the gearboxes will be used, a real honour if you ask IGW.

The next project IGW has won will benefit 1.4 million daily riders as the new metro will connect the city clusters of Agra and Kanpur and iconic destinations including the Taj Mahal. 536 IGW gearboxes will be used in 201 metro cars.
The third project is for a train design for India's first semi-high-speed Regional Rapid Transit System (RRTS). The 82km system will connect the regions Delhi-Ghaziabad-Meerut. It's going to be one of the fastest lines in India with a design speed of 180km/h, reducing travel time between several regions. Around 800,000 passengers daily are expected.

IGW will deliver 560 gearboxes for the whole project. End of delivery is foreseen in 2023. IGW was able to secure these specific projects because of its customer-oriented approach. Out of all the bidders, it was able to fully comply with all the demands, one of them being that the gearboxes should be made entirely in India.

Ready for the Challenge

IGW is convinced that having a full gearbox production capacity at IGW Involute will make the company an even better and stronger service and parts provider to its Indian customers. By investing in infrastructure, personnel and formations, IGW has positioned itself as the ideal partner for rolling stock producers and operators. IGW's worldwide reputation as a strong and reliable partner will only grow with these new orders.

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Andreas Scheuer

Minister for Transport and Digital Infrastructure, Germany

"The rail industry will be even stronger after this current crisis than it was before. This decade will be the decade of rail, I'm convinced of that. This will be to the benefit of our climate. Passenger and freight rail will benefit from this and the rail industry will benefit from this too. It is our goal, as stated in our coalition agreement, that we want to double the number of rail passengers by 2030 and shift even more goods from road to rail. We can only do that with your help. Who will build the tracks? Who will manufacture innovative freight wagons? Who will deliver high-speed trains, commuter trains and trams? Who will create a stable structure through train control technology? Through tracks, points and stations? Who will digitalise and electrify? Who will automate the entire rail system? The rail industry is doing all of this. From SMEs to major corporations. We're demanding, supporting and funding – you deliver. We need a lot because we have big plans for rail. In January we signed the largest financing agreement in the history of the rail industry in Germany with 86 million euros. This money will go towards maintaining and modernising the rail network."

On the Digital Railway

In addition to ETCS and digital interlocking there will be further technologies, such as "highly precise real-time positioning, intelligent traffic management, 5G data communication and artificial intelligence for automated driving. [...] Digital railways are more reliable and punctual. They increase the energy efficiency, reduce carbon emissions, and lower operating costs."

"On the Trans-European Corridor Scandinavia-Mediterranean we want to investigate how digitalisation can improve rail freight operations. On the High-Speed Line Cologne-Frankfurt We want to learn what digitalisation can add to high-speed services."

"Over the next two years we are making half a billion euros available for digital interlockings."

On the Berlin Declaration

"On the EU level we're [the BMVI] working closely with Member

States to strengthen the railways on the international level. In mid-September I welcomed my fellow ministers to a virtual rail conference where we signed the Berlin Declaration. In it we express our commitment to a high-performance rail freight sector in Europe. The goal is to grow the rail freight sector, to strengthen and to modernise it. The Declaration contains some concrete measures. We want to push ahead with technical and operational harmonisation. We know that the sector won't achieve this on its own. The European Union must create the right framework conditions and fund and support the sector in the right places with the right instruments. This isn't just about ETCS but also about digital automatic coupling. We want to introduce it as quickly as possible. It is a madness that hundreds of thousands of freight wagons in Europe still have to be connected manually – almost like 100 years ago. In order to support the industry in achieving this transition I'm trying to convince my colleagues of a support programme. We also want to increase the capacity of our infrastructure and terminals, expand interoperability and intermodality and improve the useability of 740m trains.
In passenger rail we want to harmonise the national timetables into a pan-European one and establish international trains under the brand name Trans-Europe Express 2.0 – TEE 2.0 for short. I can't wait for all of this to happen and I hope the rail industry is preparing well for this. But I'm not worried about that. We will embark on the decade of rail with this strong programme and we'll make sure that the products of the German rail industry will remain sales hits, both nationally and internationally."

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ROBEL

New: Robel Mini Tamping Machine ROMITAMP 2.0

Following the success of the MINIMA and GWS tamping machines, Robel is introducing an advanced version of the lightweight agile mini tamper, which bridges the gap between manual track geometry repairs and strategic tamping with larger machines.

The machine comes in three models:

- Single plain line fixed tamper head
- Dual plain line fixed tamper head
- Single adjustable tamping head for switch & crossing

With its compact construction the ROMITAMP 2.0 complements the larger tamping fleet by delivering a flexible, low-cost and fast repair solution for shorter maintenance and renewal sites.

Proven Plasser & Theurer Tamping Technology

All models feature the proven technology with the Plasser & Theurer asynchronous 35 Hz head for high-performance tamping. With its compact design, the machine complements the larger tampers by delivering a fast, flexible and low-cost repair solution for maintenance repairs and shorter relays while still delivering the big machine performance to give confidence for line speed hand back.

Fast, Safe and Easy On/Off Tracking

The machine can be easily transported by road to an access point and then mounted on to the track safely and quickly. There are

two options for on and off tracking:

1. Either by using special additional road wheels mounted on the vehicle axles together with an underframe turntable (only possible on the fixed tamper head model). Machine turning on canted track can also be accommodated with the additional option of four lifting jacks which level the machine before turning.
2. Or with robust all-terrain wheels mounted on the front and rear of the tamper. The all-terrain wheels feature an internal brake system which allows offloading from the transport vehicle using a ramp and also allows turning within its own length.

Directional Travel and Working Mode

When on rails, the tamper can be driven both forwards and backwards at 25km/h to and from the worksite. The operator chair rotates 180 degrees to allow easy sighting in both directions. Alternatively, the fixed frame model can be turned using the turntable.

Fast Track Repair with Lift and Lining Capability

The tamper can operate at an impressive 360 sleepers per hour and has the option for bi-directional working to allow tamping of both the run on and off at fix structure without the need to turn the machine.

With the option of an integrated lifting and lining device, together with a super elevation measuring unit, the machine offers a complete solution with just one operator. This means considerable savings when compared to a road-rail vehicle with a tamping head which requires several employees to manually jack and slew the track.
As part of future improvements of the ROMITAMP, Robel will also be looking to develop a track recording system which will monitor track parameters and allow feedback to engineers on the track geometry achieved.

Comfortable and Ergonomic Cab Design

The ROMITAMP comes with the option of a fully enclosed cab with heater and air-conditioning. The enclosed cab also offers protection for the operator from ballast dust generated during the tamping process.

In working mode, the operator has an excellent elevated sighting position for clear visibility of the tamping process. A laser beam target is also available to assist the operator in positioning the tamping tines over the sleeper. The operator seat has all controls integrated in the arm rests and is fully adjusted to allow easy control of foot pedals. Monitors supply the operator with

feedback on lift, line and cross level adjustments applied to the track.

In the cab there is also a 'buddy seat' to allow transport of one extra person. This seated person can also act as the pilot to aid sighting when the tamper is operated in the reverse direction.

A Machine for All Track Configurations

To allow greater operational flexibility, the machine's wheelset and lift & lining device can be configured to accommodate a range of track gauges from 900 to 1676mm. Adjustments can also be made to allow the tamping of a range of sleeper and bearer spacings.

The fixed tamping head machines are designed for plain line tamping only. The adjustable tamping head machine features the tines which can be individually rotated to the horizontal allowing tamping around obstacles throughout switch and crossings layouts.

Flexible Towing Machine

Brackets can also be mounted to carry additional equipment including small Robel vertical tampers. A Rockinger coupler allows the attachment of a lightweight trolley or trailer for the transport of additional labour, plant and materials.

ROMITAMP 2.0 meets the challenge in repairing short maintenance and renewal sites more efficiently, faster and more safely than manual means or road-rail. Fast and agile for easy access and equipped with the high-performance consolidating Plasser & Theurer tamping head, the tamper delivers higher quality and longer lasting repairs. With just one operator, ROMITAMP increases productivity with significant cost-savings compared to the slow, hazardous labour-intensive manual lift and compaction methods.

www.robel.com

CONCRETE EXPRESS

by Costantino Radis

Blend Plants: Ideal for the rail works sector – delivering multi-functionality, compactness and guaranteed results.

It would not be surprising, when travelling on the Orient Express, to come across a station or maintenance depot with a convoy of special wagons manufactured by Blend Plants. The Italian company has built an excellent reputation in the sector, delivering its machinery 'Made in Brescia' to major rail infrastructure projects. And Blend Plants isn't just involved during the construction phase, it is there for the subsequent maintenance works, which can be extremely varied in nature. Blend Plants has been involved in the Ceneri Base Tunnel and with the London Underground, performing routine maintenance to delivering high-speed networks around the world.

Blend Plants bridges the gap for all rail infrastructure projects designed for different network speeds and featuring a plethora of construction technologies.

Flexibility and Efficiency

Flexibility and efficiency are two fundamental characteristics that are essential to the success of Blend's machinery. The definition of 'plants' is actually quite restrictive. The operating conditions found on rail construction sites vary greatly and range from laying aggregate for profiling and creating the layout of embankments to mixing concrete using specific RCK, to intermediate situations requiring cement admixtures, special mortar and cold bituminous conglomerates. The machinery produced by Blend Plants can go from one job to the next with great flexibility and, importantly, with the efficiency needed for such specific uses. When discussing maintenance we should bear in mind the times available given the rail timetable.

When discussing new construction, meanwhile, we must take into account the specific operating needs. The intrinsic flexibility of Blend Plants machinery addresses both situations, thanks to our ability to design specific adaptations that can deal with highly particular

situations. Furthermore, the basic setup of these plants allows very different works to be completed. This is a guarantee that is greatly appreciated on building sites. Blend Plants machinery can perform very different tasks just a few minutes apart.

Beyond the Plant

Installing Blend Plants machinery on rail infrastructure is very simple. The self-supporting structural concept has resulted from the need for the plant to be completely autonomous with installations on chassis, and removable or detachable fittings to ensure functionality is guaranteed regardless of the transport vehicle. This has determined a basic setup where the motor, any accessories, such as pressure washers, water tanks, plants for additives or generator sets, are installed based on individual user requests.

The Blend Plants layout has been designed to deliver this consolidated application flexibility. The shape of the hoppers and the position of the unloading belts allow the positions of the functional components to be perfectly positioned, while also keeping them protected. The water tanks, in thermoformed plastic material, do not take up space at the sides and thus optimise load balancing. The silos are shaped to optimise space and the homogeneous distribution of the mixer. The external geometric shape is compact and regular. This is the case for all our plant models, allowing them to be installed on a vast array of different transport vehicles in terms of their characteristics and dimensions. This feature is of vital importance for the rail sector where shape limitations are essential to the operational efficiency of the open line and tunnels.

Ad Hoc Solutions

The way production is organised at Blend Plants enables us to combine construction quality at an industrial level with the perfect adaptability to operating needs in a wide range of applications. For rail works it is vital to have many options in terms of unloading aggregates and conglomerates. Material is unloaded from the continuous mixer on the rear belt.

This is where a real and proper world of opportunities opens up: from simple conveying on both sides, inverting the direction the hydraulic motor rotates, to directional telescopic belts bringing the mix to the desired position. The possibility of varying a machine's configurations over its operating life is a further benefit that rail sector companies are well aware of. The various types of mixers can be installed on all models, altering productivity regardless of the machine's dimensions. Optional equipment on board, such as generator sets or other useful devices for the production cycle, transform Blend Plants into fully-fledged power control units that become the fulcrum of operations on construction sites. We can therefore pass from a simple plant to a multi-functional machine capable of speeding up and making different works more efficient that normally cannot be carried out with similar machinery whose basic setup is, however, completely different, both with regards to layout and mixing technique.

From the Building Site, for Building Sites

Blend Plants was developed on building sites for building sites. One of its partners, Fabrizio Tetoldini, spent years working in the concrete production business and only afterwards decided to dedicate himself fully to this business, alongside the Biglieri family. This allowed the Brescia-based manufacturer to clearly understand the needs of those dealing with real building site issues on a daily basis.

This is how the operational multi-functionality of these machines was born; their development has led to huge benefits in rail applications as well.

Not just plants for conglomerate mixing, but also horizontal silos and mixers to build full cement mixing trains whose tasks range from mixing aggregates to laying concrete on site. Prompt, functional responses have ensured Blend Plants were chosen by Amtrak, the National Railroad Passenger Corporation owned by the Federal Government of the USA. Amtrak manages the long-distance transport rail system with a network of 33,800km connecting 46 American states servicing a total 500 inter-connected destinations. This client is an important one, taking machinery "Made in Brescia" by Blend Plants on the railroads of a great country.

Jure Mikolcic

VDB Vice-President Rolling Stock, CEO of Stadler Pankow GmbH, Member of the Executive Committee of Stadler Rail AG

Safe and Clean: Mobility Made in Germany

"We're living in unusual times. We're currently all affected by the major issue of the pandemic, but we're also dealing with major challenges in the global economy, which affect us equally. What is clear now within the challenges we see today is that transport – transporting people and goods – will significantly influence the resources, the opportunities that individuals have, economically and politically, but of course influence our climate too.

What is also clear to us today is that the railways are the most environmentally friendly motorised means of transport there is. [...] You'll hear about the technological opportunities we have in the form of alternative traction in order to contribute to the environment and a reduction in carbon emissions. I would like to reference a very recent study that Deutsche Bahn published this week, because it shows us that the young generation too is banking on rail. 64% of 16–29-year-olds viewed local/regional public transport as crucial to supporting and stabilising the transport and therefore climate transition. Another interesting finding of this study was that the usage rates of this public transport will return to pre-coronavirus levels. 38% of respondents said that they were planning on using public transport at least once a week."

"If we look at our customers, it is unfortunate that we are dealing with this pandemic. [...] Safety has become a big issue in the passenger sector, and this is being addressed in different ways. There are a number of different studies – though they can't be compared one to one.

One study by the Berliner Charite is interesting. Samples were taken over a period of time in Deutsche Bahn trains and the medical conclusion was that we aren't at an increased risk on public transport. Nevertheless it is very clear to us that the pandemic has a big impact on the personal sense of safety felt by our customers. The German Travel Association says 54% of people feel a lot more insecure about using this mode of transport. In my view this isn't necessary. As the German, European and international industry, we can provide an answer: we can offer immediate solutions such as the contactless opening of doors, more medium-term we can give passengers the ability to use their devices to view the occupancy of a vehicle in advance, allowing them to seek out a carriage where they can be distanced from others. What is clear is that we're called upon to offer the technological solutions. Government has recognised this and the support is available. It's the only way we'll be capable of giving our customers their sense of safety back and stabilising passenger numbers."

Image 1: Train detection unit of the MFW- System

Wearing Personal Warning Devices Improves Safety during Vegetation Works

The deployment of personal warning devices allows for the highest safety and fastest work progress possible while adhering to all safety requirements of the Deutsche Bahn.

By Ute Alldieck

Climate change and the resulting vast increase in the environmental awareness of railway infrastructure managers has led to a rise in vegetation management in order to keep tracks from becoming overgrown.

Severe storms cause unexpected track closures (due to fallen trees) and at the same time, a reduction in the amount of herbicide used to curb vegetation growth as a result of environmental restrictions means nature is able to reclaim spaces rather quickly. Track infrastructure managers thus have to allocate considerably more time and effort to vegetation management and therefore need the works to progress quickly without too many interruptions.

Routine vegetation management along railway lines requires workers to use strimmers,

Image 2: Lookout using a ZFS manually

chainsaws and mowers. Despite the use of battery-powered machinery, the noise emitted by this work equipment necessitates the use of ear protection.

Even though vegetation management usually occurs outside of the hazardous zone, the rules of work safety near and on tracks [1] still apply. This is also due to the fact that the works are carried out immediately adjacent to active tracks. It is thus always possible, and even probable, that someone accidentally enters the hazardous zone.

DB Netz AG has published a safety plan especially for vegetation management works [2] that addresses the measures discussed below.

Safety Measure: Full Track Closure

The highest-possible safety measure according to the safety plan is a full track closure, a blocking of the track near which the crew is working. If the track closure has to be lifted in order to retain the train schedule, the safety supervisor is informed by the train dispatcher and then has to make sure that the entire crew stops their work and moves to a safe space.

This method is not practical when train traffic is heavy and the times in which the crew is unable to work are too long, thus leaving too little time to do the work. During long wait times, people often become

distracted or lose concentration making them more likely start disregarding safety measures. In addition, the crew will be eager to finish their work which is made impossible by the long wait periods in between track closures and that, too, makes them more likely to work in an unsafe matter.

The equipment used to perform vegetation management requires a distance of at least 15 m between workers (and also to the safety supervisor) in order to prevent injuries caused by twigs or rocks. The safety supervisor being unable to communicate safely with his/her crew without getting too close to them is yet another reason why the full track closure might not be an adequate safety measure.

Safety Measure: ATWS (Automatic Track Warning System)

If a full track closure is not an adequate safety measure due to the aforementioned reasons, vegetation management works can be performed safely using an automatic track warning system.

Using automatic train detectors, which are trigged by an approaching train and in turn trigger a warning signal that warns all workers, is the safest way to secure the works (image 1).

The information is then passed via the ZFS (a transmitter unit) to a warning device ZPW located at the worksite. Because of the work equipment's high noise emission, loud horns (126 dB(A)) are attached to the ZPW to help the signal reach the workers. If vegetation management works move rather quickly however, the train detectors have to be moved frequently, which means frequent interruptions to the work progress.

An alternative solution is to use lookouts who carry the ZFS in a carrying harness and trigger the warming manually (image 2). The lookouts are in contact with the safety supervisor and move along the track in order to keep the correct distance to the worksite even as it is moving forward to accommodate the work progress. The warning devices at the worksite remain as described above.

Nevertheless, collective warning devices as the ones described cannot be deployed if the warning signal of the collective warning device does not exceed the noise of the work equipment, making it clearly audible (with + 3 dB(A)) to every member of the crew.

ZVW – ZÖLLNER Vegetation Warning System offers a safe solution even during the use of loud work equipment at fast-moving worksites

In order to solve the problem of securing vegetation worksites along the track, a new system

Image 3: Vegetation maintenance worker equipped with ZVW

was developed: the vegetation warning system ZVW is an individual warning system that was developed to be integrated directly into each worker's protective gear. The warning signal is generated directly inside the ear protection and LEDs in the visor of the helmet inform its wearer about work pauses or warnings. Image 3 shows a worker equipped with the warning system ZVW.

The ZVW is a member of the ZÖLLNER-MFW-family and is thus radio-based. The vegetation management worker wears the radio receiver in a carrying harness especially developed for this purpose or, alternatively, attaches the pocket holding the receiver to the carrying harness required by his/her piece of equipment.

The warning is triggered via the well-known strike-in components, either via train detectors or manually activated via ZFS.

The safety supervisor remains in charge and carries a control unit (ZRC-V) that is connected to all train detection components as well as all individual warning devices.

The ZRC-V informs the safety supervisor about an approaching train using an acoustic information signal as well as flashing lights while the workers receive the warning signal individually, not collectively. In order for the signal to safely reach each worker, it is necessary for ear protection to be worn correctly at all times. The individual warning devices are therefore outfitted with a sensor that informs the worker but also the safety supervisor should a device not be worn correctly or taken off without permission. In order to ask for permission to take off the device, a worker can ask for a “work break”, in order to refill the tank of his/her equipment for example, by pressing a button. The safety supervisor is then informed about the requested break and can either grant it or deny it, if there is an approaching train for example. The worker receives clear text information directly into the headphones.

The use of the ZVW as safety measure for vegetation maintenance sites has proven very efficient. Times in which the crew is unable to work, for example due to the necessity to move collective warning devices to match the work progress, are eliminated completely. The work can thus progress much quicker and the amount of safety personnel can be reduced.

Conclusion

Due to the circumstances of vegetation work with heavy noise emission and fast work-progress in defined groups of roughly five people working close to the track but not directly on them, individual warning systems are tolerated even by insurance companies for the first time. Only with the use of ZVW it is guaranteed that the warning signal reaches the worker directly and immediately. Therefore the ZVW system is a big step forwards towards delivering the highest safety standards for vegetation workers.

www.zoellner.de

ZÖLLNER
signal system technologies

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DAMM frequency sharing functionality

The official launch of the frequency sharing functionality in the DAMM Outdoor Base Station BS422 is here! With this functionality it becomes possible to…

Improve spectrum efficiency

Frequency sharing allows adjacent BS422s to use the same frequencies. This is a significant benefit in low density networks and gives the possibility to cover for example a railway line with just two frequency pairs.

Simplify repeater systems

With frequency sharing an indoor repeater system can be built without optical fibres. The same hardware can be used as base station and repeater unit, increasing redundancy and simplifying the network architecture by having one unified network management system and reduced spare part stock.

Obtain base station geo-redundancy

With the BS422, network availability can be brought to a new level. Two BS422s located at two sites can act as one fully redundant base station, sharing the same frequencies. This will add redundancy not only to the base station, but also to the whole antenna system.

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Critical communication made easy

Solving the Challenges of Railway Communications

As urban populations are rapidly growing and road congestion continues to get worse, rail and metro are increasingly becoming the first choice for comfortable and smooth local and long-distance journeys for all levels of society.

But the more people use transportation systems, the greater the need for robust and reliable communications becomes. Not just to keep personnel and passengers safe and fully informed at all times, but also to improve journey speed, punctuality and infrastructure utilisation.

Moving passengers quickly, efficiently and safely while reducing complexity and costs is thus a daily challenge for rail operators. Achieving this requires the right communications platform that enables private and secure voice and data communications across all activities in rail and metro operations.

We have asked Regional Sales and Global Transportation Business Pablo Rocha from DAMM Cellular Systems how their communication solutions conform to these requirements.

Pablo Rocha, Regional Sales and Global Transportation Business, DAMM

Why should transportation companies consider a DAMM radio communication solution?

Fail-safe voice and data communications

DAMM fully understands the critical importance of fail-safe voice and data communications in order to ensure safety among passengers and staff. Reliable and fail-safe communications between trains, staff and the operational control centre is key in order to respond quickly to accidents and emergency incidents. DAMM's solution secures uninterrupted and complete site coverage and delivers crucial communications integration across all railway operations.

One unified critical communications solution

Efficient collaboration with system and project management increases the likelihood that projects will be completed on time. We partner with system integrators and experts to provide you with the solution and the support needed to make your rail communication system better and ensure easy integration into complex projects.

The unified voice and data communications solution provided by DAMM unites all communications into one integrated system, thereby eliminating coordination problems in critical situations and optimising TCO. The open API enables easy integration to telcos and DAMM infrastructure can seamlessly be combined with either railway operators' own products or products from DAMM's wide range of partners.

Through collaboration with our wide network of application partners, we are able to supply railway operators with a complete solution consisting of a mix of DAMM TetraFlex products and specialised rail applications from our application partners.

Flexibility, scalability and interoperability – key characteristics

The fully IP-based DAMM communications system enables full scalability of both capacity and coverage while the system is fully operational. This means that the system can support any capacity, from use at single-site stations with few users to large railway and metro infrastructures with several thousand users.

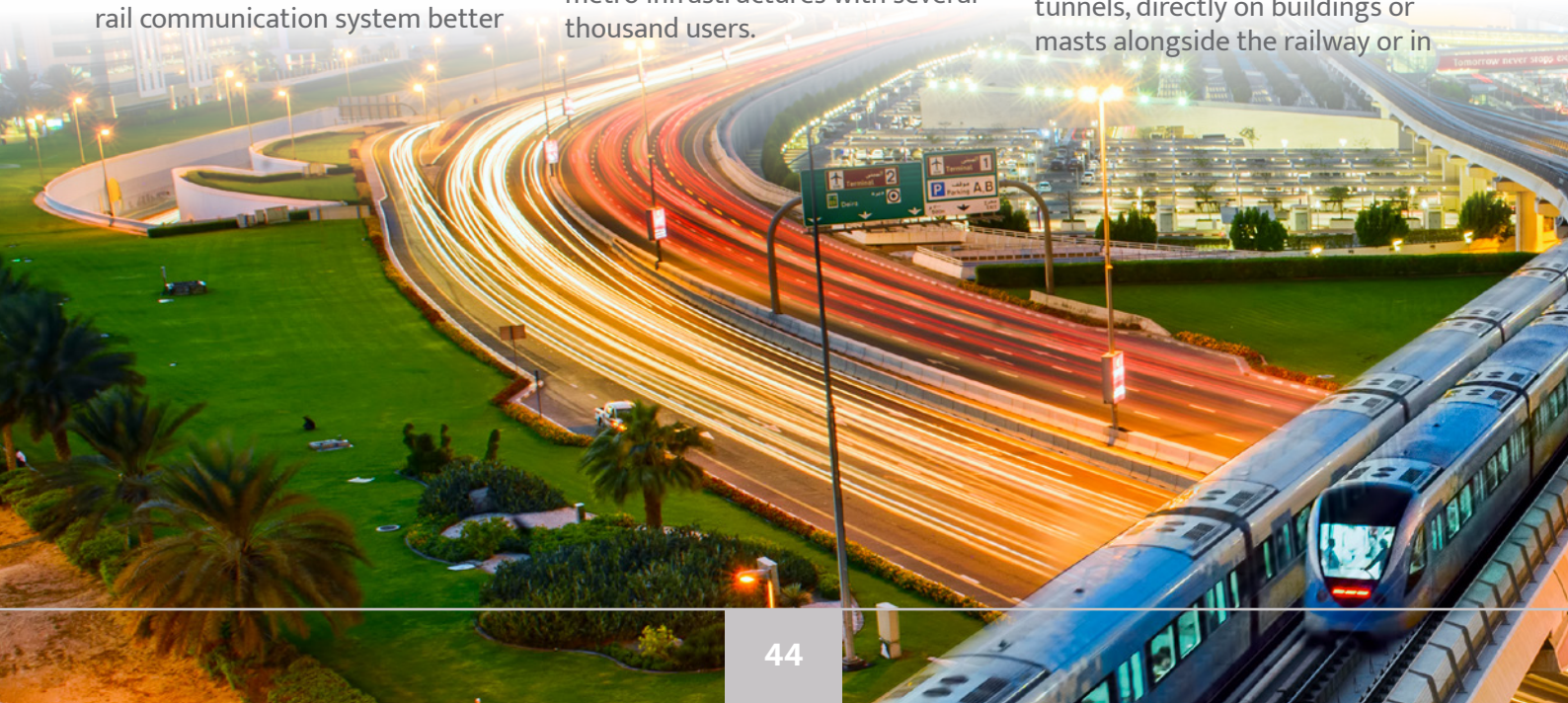
It is even possible to extend an existing TETRA network from a different supplier with a DAMM TetraFlex network through our DAMM TetraFlex Network Bridge, enabling group and individual call and SDS functionalities across networks.

How are DAMM's products specifically useful for the railway sector?

Compact, rugged design

DAMM's rugged EN 50121-4-certified base stations have been optimised for installation within rail and metro operations. Due to the rugged design of the IP65-protected outdoor base station, it can endure the metal dust and high humidity that often characterise the environment in metro tunnels. Even for operations in extreme temperatures, DAMM base stations keep working, giving them a long lifespan. The ribbed design ensures passive cooling, eliminating the need for external air-conditioned housing or a fan with moving parts, both of which risk breaking.

Its compact design makes it ideal for installation in narrow tunnels, directly on buildings or masts alongside the railway or in



stations, reducing feeder loss and installation costs considerably. Due to redundancy, maintenance can be done without shutting down operations, ensuring an efficient railway operation and avoiding costly downtime. DAMM products are developed with flexibility and user-friendliness at the core, saving substantially on training and project costs.

In addition, the plug-and-play design makes deployment hassle-free and quick.

What are the benefits of a DAMM system in terms of CAPEX and OPEX?

Breakthrough TCO and proven success

Not only are our products built for severe environments and for improving operational efficiency and safety. We are committed to offering solutions that ensure low CAPEX and OPEX. One of the key features of our outdoor base stations is their cost efficiency.

Low power consumption

DAMM outdoor base stations offer extremely low power consumption, in large part due to the mast mounting. This setup requires less output power from the base station as the close proximity to the antenna eliminates the need for long cables and subsequent loss of power. Power consumption is so low, the base stations can even run completely on a solar-powered solution saving electricity costs on a daily basis.

Our system is not only cost-efficient when it comes to purchasing and operating it. Due to the high reliability, you are also guaranteed a minimum of costly downtime with operations coming to a standstill

Frequency sharing

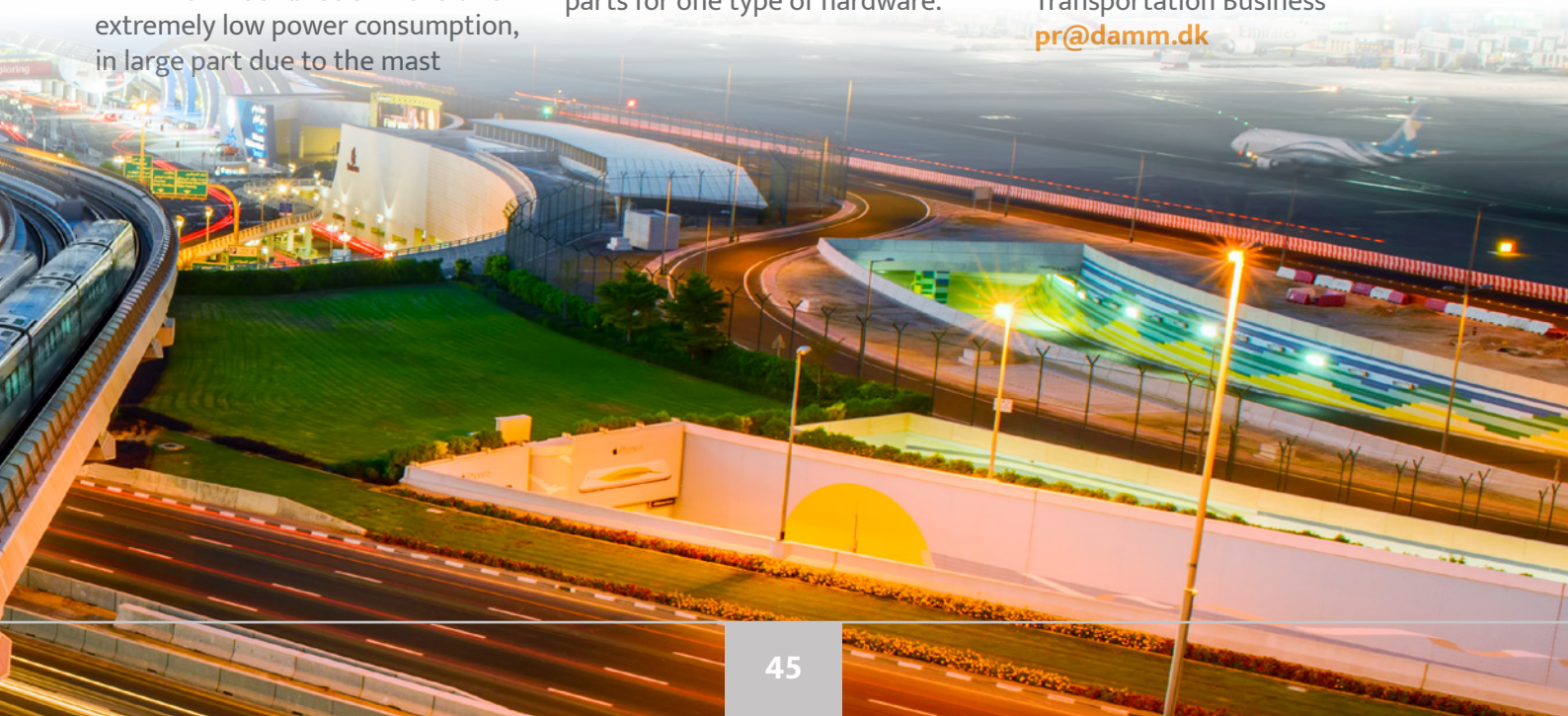
With the frequency sharing functionality in our multi-technology base station, you can even reuse frequency pairs along a railway track or in a tunnel. You normally need five frequency pairs to cover a railway track. With our frequency sharing functionality, you only need two, making huge savings on frequency licences. In tunnels, using a series of BS422 base stations instead of repeaters will also eliminate the need for expensive optical fibres. At the same time, you will get a redundant and fully IP-connected unified network. This means you only need one management system and spare parts for one type of hardware.

We have many years of experience in providing cost-effective solutions to major players within the transportation industry and have delivered systems for Western Railway and Nagpur Metro in India, Moscow Metro in Russia and Aurizon and FMG Railway in Australia to name but a few. In other words, we have the know-how and the expertise needed to support large-scale rail and metro projects around the world.

About DAMM

With its nearly 40 years in the industry, DAMM is a well-established name within TETRA radio communication and has built up extensive experience in delivering product that that can endure the harsh environments that characterise the railway industry. DAMM's TetraFlex® solution is 100% IP-based and comes with complete outdoor and/or indoor base stations and comprehensive features as well as integrated software such as network management and voice and data recording applications. To learn more about our products and solutions and how we can help you, please contact:

Pablo Rocha
Regional Sales and Global Transportation Business
pr@damm.dk



By **Kyle Connor**

Transportation Refresh: Finding the Way Forward

We take a look at how the pandemic has interrupted the status quo for transportation around the world, while we assess the implications for the future of mobility.

A few weeks ago, scrolling through LinkedIn, I saw a cartoon graphic asking: "What digitized your organization?" The options for response were A) CIO; B) CTO; C) COVID-19. Since then, I have been asking transportation agencies the same question.

What I have found and continue to find is that many agencies are rapidly adapting to the uncertainty that continues to unfold. Additionally, secure access and connectivity continue to be the foundation that allows for this flexibility.

Smarter Transportation

Adaptation can be viewed in many ways.

Some organisations are accelerating programmes like contactless payment and ridership awareness for social distancing via smart phone apps. Others have been forced to alter routes and slow plans for improved digital services at bus stops and stations due to having less revenue and lower ridership demands.
Roadway authorities are considering the need for cloud-based solutions, virtualised services, and remote management. Railway

companies are in the process of looking at new business models to offset revenue losses and rethinking passenger experience.

Regardless, transportation is a necessity for all. There is a critical need for access to transportation, especially during the pandemic. This is why we continue to see encouraging examples across the world, where transportation agencies are adapting transit services – or launching new ones altogether – to address the rapidly changing needs of their communities and countries.

Restoring Public Transportation

As the backbone of public transport in Luxembourg, Société Nationale des Chemins de Fer Luxembourgeois (CFL) is embracing intent-based networking and automation to modernise operations and make cutting-edge passenger-focused improvements.

Despite guidelines from many different sources to follow strict social distancing, transit operators

"Freedom of movement is something we all tend to take for granted."

Christian Kettmann, CIO, Société Nationale des Chemins de Fer Luxembourgeois (CFL)

join healthcare personnel and frontline workers to provide key services, risking their own personal safety.

In a recent webinar on wireless communications for transportation, I had the pleasure of hosting a panel with some great participants. The Chief of Transit Operations for the Central Ohio Transit Authority, Matt Allison, was on the panel and he discussed how his agency is leveraging the lower traveller demands to provide mobile wifi hotspots in underserved areas of the community.

Public transportation provides key lifelines for people, particularly for underserved communities and to fill key transportation gaps during the pandemic.

Another panellist, Clint Hunter, Systems Architect for Metropolitan Atlanta Rapid Transit Authority (MARTA), shared how their agency uses technology to better understand ridership levels, vehicle occupancy, and where demand is most prevalent.

As the economic ramifications continue to evolve and with a looming climate crisis that has taken a backseat of late, there is no doubt that public transport will be critical to meeting the needs of people and make communities more resilient.

The Bridge to Possible

While the "next normal" is still being defined, transportation agencies continue working the front lines. In parallel, they are trying to evolve more rapidly than government or the slow-moving industry (pun intended) typically allows.

It is apparent that our current reality and the fallout from ongoing events may very well be the true lever for digitisation. Now, there is a bright light shining on the need for secure connectivity to keep the world moving.

We believe that it's critical to help provide secure access and safe mobility so people can get where they need to go, especially in times of change. That's why at Cisco, we focus on you. We're in this together, and Cisco is committed to securely connecting what's now and what's next to power an inclusive future for all.

By **Kyle Connor**

Co-authored with **Andy Manuel**

Dr Jörg Nikutta

CEO of Alstom Germany and Austria

Autonomous, Digital and Emission-Free: A Vision for the Train of the Future

"A year ago all of us – not least thanks to the #FridaysForFuture movement – we were all talking about carbon emissions and how to reduce them. All of this has fallen out of view a little bit because of the pandemic but the subject hasn't gone away. It's still there. And that means we all need environmentally friendly mobility and the railways can and will make a major contribution to this. To achieve that we need a high-performing railway – rail 4.0 – and the VDB President Andre Rodenbeck already mentioned a very important step and that's transitioning train control in Germany to ETCS. The German government has made a unique quantity of money available for this, and made it available quickly so that we can have a digital rail network in Germany. A thriving railway will allow us to increase capacity and it will create many pre-conditions too, such as for automatic train operations – ATO. What has been established in the metro sector for 30 years is not yet something that is established for mainline operations. And please don't make the first thing you think of in connection to driverless trains saving personnel costs. The goal is a completely different one. The goal is the flexible deployment of trains when customers need them. Within the framework of the European Shift2Rail initiative, we at Alstom, together with the operator enno, are working over the next three years on converting two trains in Lower Saxony so that they will be capable of driverless operation. This is one contribution that digitalisation can deliver for more comfortable rail travel and more comfort, more mobility means reduced emissions.

Under 70% of railway lines in Germany are electrified. Is that a lot or not? Opinions differ, but what's clear is that we need concepts for environmentally friendly mobility on non-electrified routes too. Don't get me wrong – even a diesel train on those tracks is better than 100 people driving their private cars. But there are currently two technologies that are positioning themselves as options for these lines: battery trains, which are being developed and sold in Germany. At Alstom we're building battery trains at our site in Salzgitter too.

Hydrogen

But we also have hydrogen. The subject of hydrogen is new, but two years ago our pre-series Coradia iLint started operating in Bremervörde in regular passenger service. Anyone was able to buy a ticket, get on board, and travel on them.
For two weeks now one of these two trains is running in Austria, south of Vienna, to demonstrate that hydrogen technology is also capable of dealing with more mountainous terrain. It demonstrates that this isn't a technology that will only be deployed in a few years' time. The technology is here now. Environmentally friendly mobility on our railway is already available and will be expanded so that nobody will be dependent on private cars anymore, however they are powered."

Technical Experts for Advanced Reliable Electrical Connections

Low-carbon journeys on public transportation, high-voltage power supplies, data collection to increase safe operations and radio systems to improve train performance guide the technology innovations in railway. As a specialist for long-lasting and high-quality electrical connectors, Stäubli Electrical Connectors is an experienced partner for railway engineers.

Whether it's for the high-power transmission in train applications, for electrification of railway lines in some parts of the world or for data and signal transmission in communications, Stäubli's reliable and powerful connection solutions are a recommendable option. Not only because of their proven longevity, but also because of Stäubli's expert know-how and skills to design dependable and top-performing pluggable railway connection solutions.

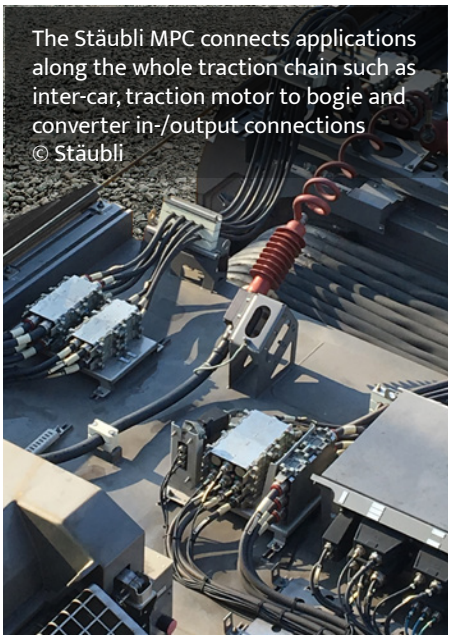
Flexible Connection for Telecommunications

Well-known suppliers of infrastructure and onboard equipment rely on the Stäubli connectors. When it comes to providing reliable service for voice and data communications from the driver cockpits in metros, trams and trains to the control centres, advanced telecommunication equipment is implemented. These systems receive and transmit various data such as signals, alarms or messages, often feature a modular and flexible design, and require the hook-up of all media and power in one compact, but freely configurable connection according to the customer's design specifications.

Stäubli's modular and fully customisable connector system CombiTac makes it possible to integrate any contact device with various performance features, as for example Coaxial 50 Ohm, CAT5, 10 GBits, signal and power. Like all Stäubli connectors, the CombiTac is tested above and beyond the requirements of the industry standards and is specifically certified according to EN 45545-2, EN50467, EN61373 to be fire, shock and vibration resistant.

Safe Power Connection

For rackable battery applications on trains, international rolling stock manufacturers use Stäubli's solutions for quick connection and disconnection to ease the installation, improve the efficiency during maintenance and ensure low downtimes. Such connections need to provide the highest reliability and guiding for misalignment. Safety is a key priority in the railway industry and compliance with IP2X for touch-



The Stäubli MPC connects applications along the whole traction chain such as inter-car, traction motor to bogie and converter in-/output connections
© Stäubli

proof design and EN 45545-2 with HL2/HL3 R23 are basic prerequisites for such components. Again, the Stäubli CombiTac conforms to all of these requirements and industry standards and is also capable of withstanding harsh environments.

Robust and Compact Inter-Car Connector

Other essential electrical connections on trains are applications along the whole traction chain, such as inter-car, traction motor to bogie and converter in-/output connections. The universal, compact and modular Stäubli MPC is a facilitator to increase process efficiency during installation as well as during maintenance. A quick section separation when replacing motors helps to minimise downtime. The very compact, space-saving design of the MPC is an advantage for construction as well as installation and maintenance. Numerous trains made by different manufacturers around the globe run with Stäubli MPCs. In terms of functionality the MPC delivers durability and low-loss energy transmission for high currents, maximum shock, impact and vibration resistance and the highest robustness – even in extreme climatic conditions.

With the Dynamic Cable Option (DCO) Stäubli's specialists developed a strain relief to complement the company's portfolio in railway connection solutions, which is suitable for various high-current and high-voltage applications. The system eliminates mechanical stress on the cable glands and contributes to the durability of the connectors. To round off the service, customised cable assembly is also available and Stäubli also carries out customer-specific test procedures in its own test laboratories.

High-power connections are also needed in the converter cabinet. The Stäubli bipolar fork connector connects the IGBT module (insulated gate bipolar transistor) to the bus bars. The higher the travelling speed of the trains, the greater the physical forces; therefore vibration resistance and stability are essential.

Advanced Contact Technology

At the core of all these high-performance railway connection solutions is the unique MULTILAM contact technology. With the lowest contact resistance and far above-average service life, it allows for highly efficient energy transmission. The specially shaped and resilient contact elements provide high electrical, mechanical and thermal performance. Thanks to their constant contact force, MULTILAM louvers ensure continuous contact with contact surfaces.

Stäubli CombiTac – the modular hybrid connection system for combining various connection needs, e.g. Coaxial 50 Ohm, CAT5, 10 GBits, signal and power
© Stäubli

This results in consistently low contact resistance and excellent contact quality with a long service life.

We Do Quality

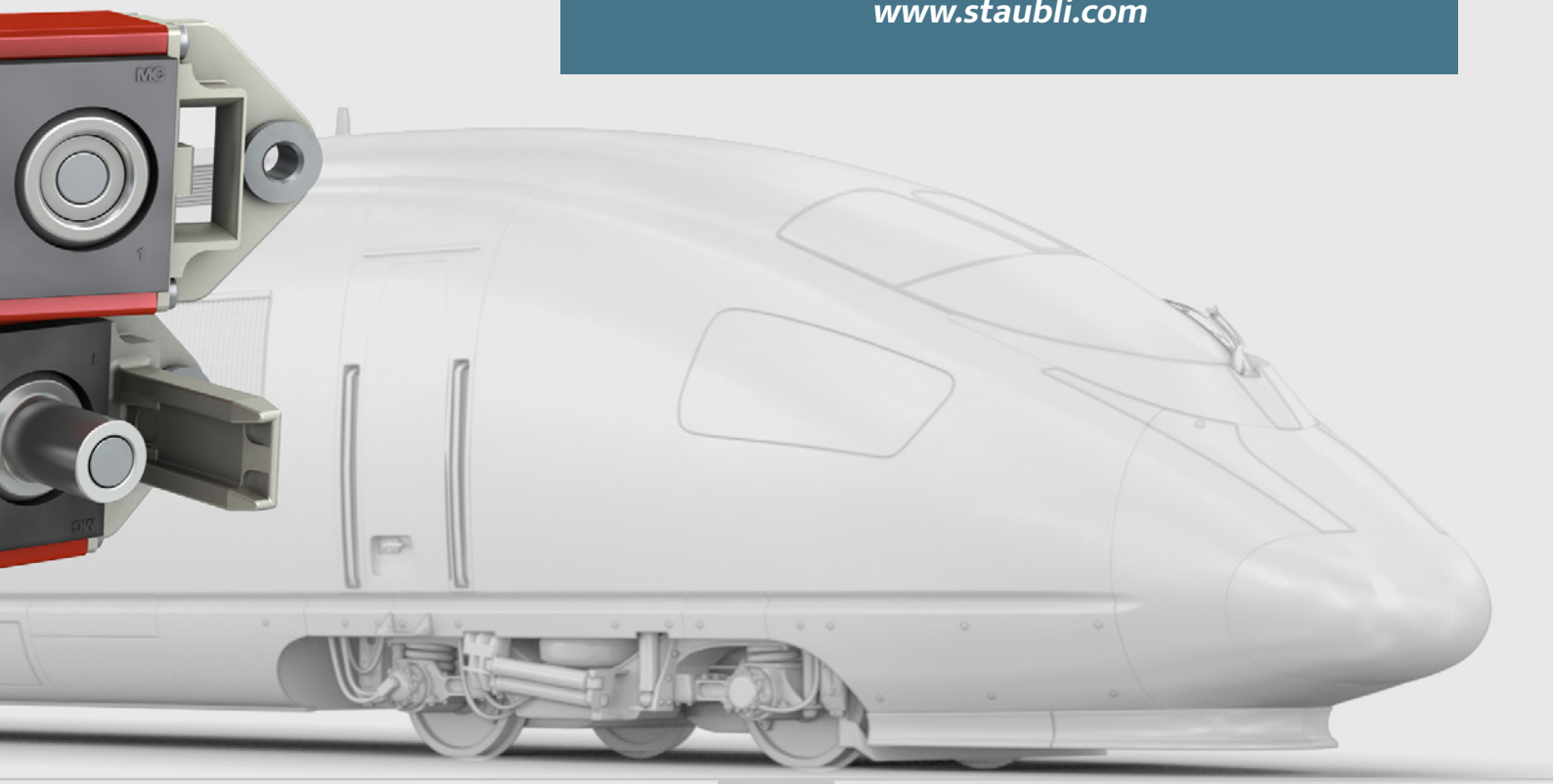
Stäubli owns the entire process from the first conceptual idea to the end product. As a certified manufacturer, Stäubli meets all the requirements of the global markets and complies with international standards and local regulations. The ISO/TS 22163 certification, formerly IRIS – International Railway Industry Standard, confirms the suitability of the company's quality management system and know-how for the requirements of the railway sector. Beyond official certifications, Stäubli even places a higher value on field data, testing by customer specifications and performing long-term in-house testing to guarantee quality and durability. The company's own test laboratories worldwide are regularly reviewed by the national and international standard organisations. At the same time, Stäubli experts participate actively in the relevant standards committees and can therefore quickly adapt to changes. During the evaluation processes and quality tests, Stäubli engineers push the products and components to the limit, while simultaneously determining the absolute safety limit set by the application requirements. The comprehensive tests simulate extreme ambient conditions as well as the mechanical and electrical strain the solutions will have to withstand when in railway operations. Thus, functionality and safety can be guaranteed with a maximum load.

STÄUBLI

Stäubli offers innovative mechatronic solutions in three core areas including Connectors, Robotics and Textile. Founded in 1892, today Stäubli is an international group headquartered in Pfäffikon, Switzerland with more than 5,500 employees worldwide. Stäubli has a presence in 29 countries with production companies, sales and service subsidiaries and is supplemented by agents in 50 countries.

As a world market leader in the field of connectors, Stäubli manufactures quick connector systems for all types of fluids, gases and electrical energy. The Electrical Connectors product portfolio (formerly Multi-Contact) ranges from miniature connectors to high-performance connectors for power transmission, industrial automation, transportation, test and measurement. In Photovoltaics, Stäubli is the global market leader with its MC4 connector components. The core of all Stäubli electrical connectors is the unique MULTILAM technology.

www.staubli.com

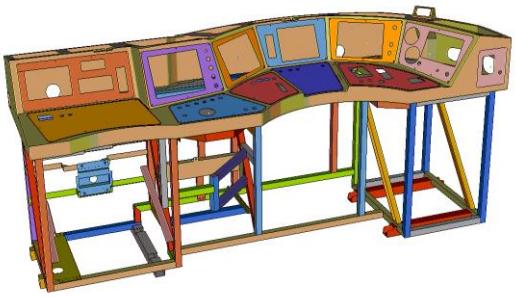


SIMULATION SOLUTIONS FOR THE RAILWAY INDUSTRY

PRODUCT DEVELOPMENT WITH VIRTUAL PROTOTYPES

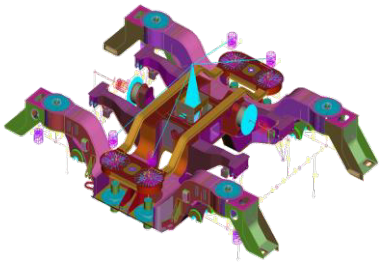
- LOWER DEVELOPMENT, TESTING, CERTIFICATION, WARRANTY & CALL-BACK COSTS
- FASTER GO-TO-MARKET TIME
- LIFE-TIME ESTIMATION
- MULTI-BODY SIMULATIONS
- ADVANCED MATERIAL SOLUTIONS
- NVH, THERMAL COMFORT ANALYSIS
- HVAC SYSTEMS
- DESIGN OPTIMIZATION
- IMPROVED SAFETY & SECURITY
- ELECTRIFICATION & AUTONOMOUS SYSTEMS

FROM OUR PROJECTS



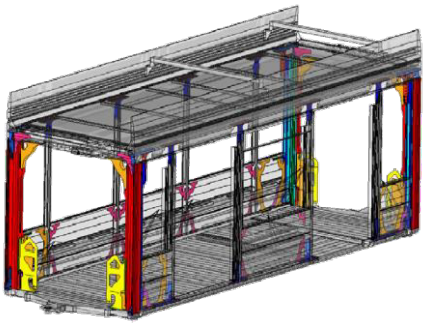
INSTRUMENT PANEL

- Quasi-static loadcases
- Layer optimization of polymer composite
- Evaluation of composite failure criteria



MOTOR BOGIE

- Standard load-case combinations
- Strength assessment
- Fatigue evaluation of welds



TRAM CALCULATION

- Stiffness & strength analysis
- Life-time estimation
- Mass-optimization

CUTTING-EDGE ENGINEERING SERVICES – **WHY eCON?**

18 years expertise	Tailor-made solutions	ISO 27001 & 9001
Professional support team	Mastery of composite materials	JEC WORLD INNOVATION AWARD 2019
Wide simulation portfolio	Numerous international projects	

CONTACT US: econengineering.com | sales@econengineering.com

PaxLife Innovations brings Passenger Onboard Experience to the next level with increased bandwidth, uninterrupted connectivity and personalized travel experience on passengers' own devices.

High-quality media experience for passengers

PaxLife's **paxCDN** can host any applications from a third party media provider on the vehicle; in this way it guarantees passengers fast and continuous access to the media they like, while preserving 4G bandwidth for other uses.

Uninterrupted live radio streaming services and high resolution video stream at every seat!

PaxLife's **paxSTREAM** coupled with **paxDAB+** is the first digital platform providing interruption-free live radio (and soon live TV streams) in trains or other public transport. The train receives a single live stream and passengers can access it individually on their personal devices, in high quality and without interruption.

The first collaboration with **Deutschlandradio** has already started. These services can also be easily integrated into any existing Passenger Information Systems or complement ISPs offerings used in public Wifi.

check what we do **www.paxlife.aero**

» visit us at IT Trans on Dec 1-3 dm arena stand T9

Große Weinmeisterstraße 2 · 14469 Potsdam
info@paxlife.aero · +49 331 243424-0

paxlife INNOVATIONS

Interview

Ralf Cabos, Founder and CEO of Potsdam-based PaxLife Innovations startup, explains how to answer, with today's technology, passengers' evolving demands for increased bandwidth, uninterrupted connectivity and personalised travel experience.

High-Quality Media Experience Onboard with Optimized 4G Use

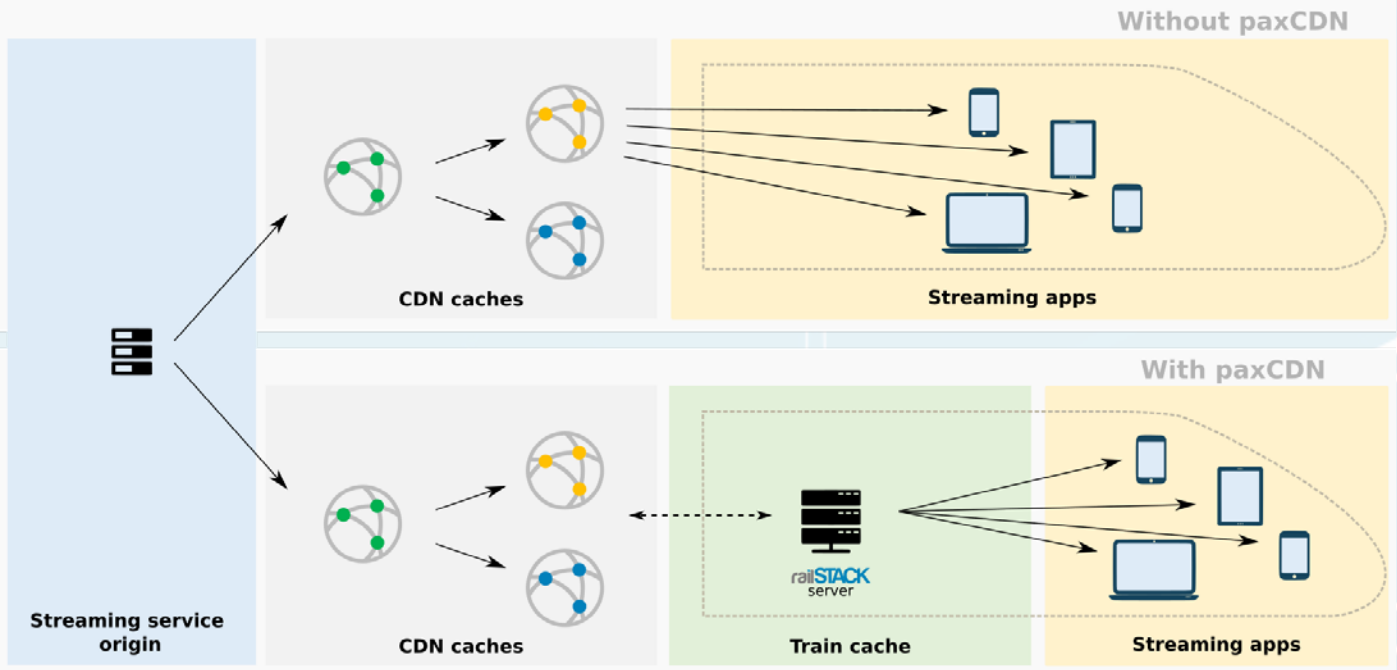
Q: PaxLife originally started to connect aircraft passengers to the digital world; how do you see the onboard entertainment in the railway industry today?

A: Just as in the aviation industry a few years ago, the passenger experience is now a top priority for manufacturers and transport operators alike. From leisure journeys to regular commutes, onboard entertainment and continuous information has become crucial to ensure that passengers get the most out of their travel time.

Data consumption has been increasing every year, especially for video content. When used by a larger number of passengers it can quickly push even the most modern system to its performance limits. The challenge is that the bandwidth available in vehicles still remains limited and has to be shared, and ensuring a reliable connection throughout the entire journey is difficult. Also, with the technological evolution of personal devices, passengers are expecting a more personalised experience than ever before.

Q: So, what is PaxLife Innovations' approach at this point? Which solutions have you developed?

A: First of all, we strongly believe that an attractive and modern onboard infotainment offer has to adapt to the passenger's own consumption behaviour; **we have to meet the passengers where they are: on their devices, on their smartphone, through the apps** they have already downloaded on their phone. We should not anymore have to set up a local platform filled with media content no one is really keen about while



it still needs management from the transport operator or service provider.

Second of all, in order to optimise bandwidth use, it makes total sense today **to store the high-volume content part of the media apps locally on an embedded server**. It is with this concept in mind that we have designed our offers.

PaxLife's paxCDN solution: supported media apps can be used onboard with the same quality as at home

PaxLife has developed a content delivery network approach. Thanks to its railSTACK-powered onboard server, PaxLife's paxCDN solution can host any applications from a third-party media provider (such as ARD mediathek, DLF audiothek etc...) on the vehicle; because it is embedded locally, **it guarantees passengers fast and continuous access on their devices to the media they like, in high quality, while preserving the 4G bandwidth for other uses** than media transmission. Passengers do not need to install an additional application on their phones.

They can enjoy on-demand content (video or news) in the same way they experience it outside a train, without any strain on their mobile data budget. Furthermore, new media content can be added to the onboard server at any time.

PaxLife's paxSTREAM / paxDAB+ services: uninterrupted live radio streaming

In partnership with a railway operator, PaxLife has also developed an interruption-free offering of live streams available onboard. paxSTREAM coupled with paxDAB+ is the first digital platform providing **interruption-free live radio (and soon live TV streams) on trains or other public transport**.
Integrated into a train's wifi system, paxSTREAM is based on the train relaying one single live stream that passengers can access individually on their personal devices, in the highest audio quality. paxDAB+ then guarantees a stream without any interruption by combining streams via DAB+ and 4G and switch when needed from 4G to the DAB+ network to achieve uninterrupted transmission.

Each passenger can choose from up to 40 radio channels on their phone.

The first collaboration with **Deutschlandradio** has already started.

paxCDN, **paxSTREAM** and **paxDAB+** complement the services offered by the usual wifi internet service provider. The technology can be easily integrated into any existing passenger information system.

PaxLife in a Nutshell

PaxLife Innovations GmbH originally started to connect aircraft passengers to the digital world. Based in Potsdam, Germany, PaxLife Innovations now brings its cutting-edge technology to rail and public transport. Check what we do www.paxlife.aero

Get in touch info@paxlife.aero / +49 331 243424-0

3M Science. Applied to Life.™

More than just strong.

When you're designing and building rail cars, strong is important... but also just the starting point. Finding ways to attach lightweight composite materials and how the whole rail car will perform under the stresses of everyday use are also critical.

3M can help. We'll help you explore and understand the science of rail bonding and assembly, including fast bonding options that require less labor or are quicker to reach handling strength and full cure. Beyond the assembly line we can also provide FEA modeling data for many of our adhesives so you can plan for the stresses you need to meet.

Understanding the Science

Rail Bonding and Assembly

Using the latest composite materials helps you stay on the leading edge of the rail car manufacturing industry, bringing high-performance aerodynamic designs to life to help with fuel efficiency while still providing the strength to withstand the stresses of daily use year after year. New materials also provide new challenges in attaching those materials. Fortunately, science doesn't just create new substrates—it also finds ways to bond them and to analyze how they'll perform in your rail cars.

New Materials = New Fastening Techniques

Many new lightweight materials are made by placing fiberglass, carbon fiber or other tough fibrous materials in a mold and flowing resin to fill the mold. This creates a piece that's strong and lightweight and—for attachment purposes, at least—often essentially a piece of plastic. It can't be welded, and drilling holes for rivets or other mechanical fasteners can weaken the part. Other composites are created by putting different materials together in layers, but they often present similar issues.

The solution is to use an adhesive, either in a liquid form or one that can be applied as a tape.

Adhesives and tapes spread joint stress across the entire area of the bond rather than creating a series of stress points at the edge of each hole. They can also help save on labor costs since they are relatively easy to apply correctly and don't require a large amount of drilling or tightening.

Wet Out and LSE Bonding

Of course, it isn't as simple as just picking an adhesive and starting production. Composite materials have their own surface properties which make many of them Low Surface Energy (LSE) materials. Surface energy is a measurement of how well a liquid or the adhesive on a tape "wets out", a surface. (Think of water beading up on a freshly waxed car: the wax creates low surface energy rather than spreading out.)

When you're bonding two pieces together it's important that your adhesive can wet out and form a good bond on both.

Where metals and glass have high surface energies and are generally easy to bond with adhesives, LSE materials such as polypropylene, polyethylene, polystyrene and many composites are resistant to wetting out and are more difficult to bond. Molded parts may also have a mold-release agent from the casting process which can also create a lower surface energy for bonding.

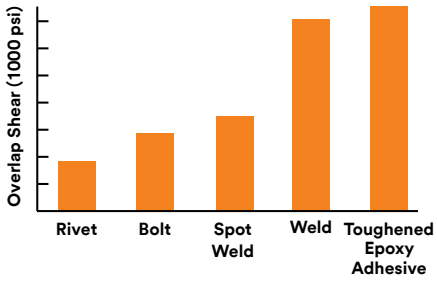
That's where science comes in. We've applied our decades of experience creating 3M adhesives and tapes to come up with several solutions that can help you bond LSE materials, including lightweight composites.

Several products in the 3M™ Scotch-Weld™ Structural Acrylic Adhesives family are specifically formulated for bonding LSE plastics and composites. We also have tapes for bonding these materials, particularly our 3M™ VHB™ LSE series tapes which add LSE bonding properties, excellent durability and wide temperature resistance to the viscoelasticity and versatility you expect from 3M™ VHB™ Tapes.

Using FEA to Analyze Your Designs

Science can also help you analyze designs before you start building with solid pieces. Finite Element Analysis (FEA) uses computer modeling and the known properties of objects to predict how they will react to real-world stresses when your rail cars are put into service. To help you, we can provide FEA modeling data about many of our adhesives and tapes and the ways they react under various stresses. Added to your models, this data can help you choose materials based on the characteristics you feel are most important.

2-3X overlap shear strength*
of spot welds and other mechanical fasteners



3M Can Help

One of the most important things to know about bonding composites is that you don't have to find all the answers by yourself. With application engineers available across the globe to serve as a dependable resource, 3M is a global leader in the science of rail bonding and assembly and provides a strong support system in addition to our high-quality and long-lasting products. These experts are on hand to provide answers whenever questions arise, working with you to solve unique challenges and demonstrate that along with great products comes great support.

To learn more, visit 3M.com/rail.

* Data was collected by 3M, https://multimedia.3m.com/mws/media/646994O/3ms-tough-stuff-white-paper.pdf, https://multimedia.3m.com/mws/media/1054052O/acrylic-adhesives-recent-advancements-white-paper.pdf

Dr Anne-Marie Grossmann

Managing Director, Windhoff Bahn- und Anlagentechnik GmbH

Together We Start the Mobility Revolution

"I'm itching to get going. We just heard we need a mobility revolution. But our society is still talking far too much about individual mobility and is supporting buyer's premiums for the automobile industry. We need this revolution now. That requires people to start thinking differently. People in industry and in government. Dear government, dear viewers – please help. We are in this crisis now. The drop in turnover in rail freight in Q2 of 2020 is almost 20%.

Passenger figures in April collapsed by 90%. We – a member organisation of VDB – are expecting a significant drop in exports in 2020/21. At the same time we want to achieve the climate transition and we're aware of the goals of the Paris Agreement. If we stay on our current path, we'll miss them by a very great deal. Our industry knows the answer to both problems. From an ecological perspective, rail is unbeatable while having competitive costs and acceptable delivery periods. It is the alternative for people and goods. We – German SMEs – are both willing and able to make a contribution to overcoming the crisis, if you will let us.

We deliver innovations that contribute substantially to protecting our climate. In the global railway technology sector, many German SMEs are, hidden champions – market leaders. Windhoff is an example. Since 1889 we have been solving our customers' challenges in vehicle and shunting technology. You only achieve such a position with the best-trained employees who incorporate their knowledge in innovative solutions, which we implement flexibly and without bureaucracy. Windhoff's multi-purpose vehicles help build and maintain our railways. The innovative multi-purpose

vehicle Ventus is the necessary breath of fresh air on the rail network. The modular concept delivers the right cost-effective, future-oriented solution, for example through emission-free traction modules. Protecting our climate starts with building and maintaining the rail network.

SMEs deliver quality throughout the entire life-cycle. We offer engineering skill throughout the value-creation chain, from primary materials such as recycled steel from electric steel plants to the factory equipment for fleet maintenance. No matter the area, we see ourselves as problem-solvers alongside our customers. Thanks to quality made in Germany, our products are durable. Our service is such that function is guaranteed throughout the life-cycle. That makes investments sustainable. With its innovative factory equipment, Windhoff makes sure that trains return to the rails more quickly. The use of our universal work stands the average downtime of the Austrian Railways trains could be cut by more than half. This increased availability makes rail travel more attractive to passengers and therefore helps rail passenger numbers grow.

We are already providing solutions for the revolution. But they must be implemented. To do that we – industry and government – have to work together. We need customers who support our innovations. Procurement policies should look for innovative, emission-free concepts and make investment available to match. Our customers need the courage to bring about change quickly. That means the funding mechanisms must be manageable for small businesses too. But we also need government support so that rail travel can become more attractive. Incentives should focus on climate-friendly mobility so it's crazy that I have to pay more for a train ticket from Berlin to Munich than for the same flight.

Abolishing differences between countries and supporting interoperability strengthens growth, for example via the Fourth Railway Package. If we work together, we can achieve our shared goals and get out of this crisis on the railway, full speed ahead. Long live the revolution!"

In Conversation with Camira: Transport Textile Experts for over 200 Years

With public transport undergoing such seismic changes over the last six months, we wanted to speak with Camira – one of the oldest manufacturers of transport textiles in the world – to get their perspective on the post-pandemic rail landscape.

Discussing their long heritage in creating fabrics for rail interiors, what they think future carriages will look like following the coronavirus outbreak, and the changes we can expect to see on the fabrics within them, we took a trip through the centuries in this Q&A.

Firstly, could you tell us a little about your heritage in transport textiles?

Of course. We were founded as Holdsworth in the UK textile heartland of Halifax, Yorkshire, England back in 1822 – so it's fair to say that our roots in the transport industry are certainly well established. Throughout the 1800s we created speciality wool moquettes for railcar interiors and began our relationship with Transport for London, which has continued ever since! Specialising in transport textiles for the last two hundred years, we are committed to investing in state-of-the-art equipment, developing pioneering new products, and are constantly striving to remain at the forefront of this industry which plays such an integral part in our company identity.

You're based in the UK, but are your fabrics available in other countries?

Absolutely! Whilst our head office and our core manufacturing facility are located in Yorkshire, our reach is truly global – we have warehouse and distribution facilities in the USA and Australia, as well as the UK, a manufacturing plant in Lithuania, and we work with distributors in North America, MEI, Europe and Asia Pacific. On average, we sell our products to around 80 countries worldwide, so our textiles make an appearance in rail interiors across the globe; everywhere from Israel to France, New Zealand to Los Angeles, has a Camira fabric on its rail line.

With over two centuries' experience in creating transport textiles, you've seen an incredible number of changes in the industry throughout that time! How do you adapt to new customer requirements?

The key thing to remember is that, as in most industries, transport fabrics constantly need to adapt, innovate and – literally – move forward – everything from durability requirements, flammability standards and aesthetic preferences are continuously changing, and, as a result, our textiles have to meet these new demands.

At Camira, we really do pride ourselves on our adaptability – with in-house design and technical innovation teams, extensive manufacturing capabilities, and our own testing laboratory, we never stand still; we work to ensure we remain ahead of the curve so that we can pre-empt our customers' needs. We are continuously researching trends, developing our technical capabilities and investing in new equipment to make sure that our fabrics are not just perfect for today's market, but also for whatever comes next.

The outbreak of coronavirus has obviously had a major impact on public transport, with operators and manufacturers working to adapt to the new requirements in terms of sanitisation and social distancing. How do you see rail interiors changing as a result of the pandemic?

Many people envisage that following the pandemic, operators will move towards 'wipe clean' seating covers, with hard plastic, vinyl and polyurethanes becoming the preferred choice, but we believe that there is a very bright future for natural materials to work alongside a variety of other complementary surfaces. Whilst research is still not certain, it is thought that viruses do not survive as well on fabrics as they do on frequently touched hard surfaces, such as plastics, laminates, metal and glass. On textiles, viruses can get trapped and therefore have a reduced likelihood of spreading.

Alongside this, there's a large amount of research which indicates that the use of natural materials within interiors is incredibly beneficial for our wellbeing – particularly in light of the recent focus on indoor air quality and the emission of VOCs (Volatile Organic Compounds) which can be harmful to human health – and this is something that rail operators are really considering when designing their carriage spaces. With wool being nature's ultra-intelligent fibre type, it is a naturally low emitter of VOCs, and actually improves indoor air quality. These in-built health properties, combined with its sustainable nature and the textural and visual appeal of a wool fabric, make it a truly timeless choice for rail interiors – as popular today as it was when we started back in 1822!

With hygiene – and staying safe – now of the utmost importance for travellers, manufacturers and operators alike, how has Camira adapted to this increased need for sanitisation?

As the industry works to reassure passengers that it is safe to use public transport once again, we've made it our duty to educate our customers on how they can clean and disinfect our fabrics effectively, to ensure they know exactly which products to use on which type of upholstery.

Our comprehensive guide to cleaning and disinfecting can be downloaded at www.camirafabrics.com/stayingsafe and our team are always happy to advise further! They can be contacted at transport@camirafabrics.com.


Made
by Camira.
A leader in sustainability, we look to the future, creating timeless plush wool moquette and contemporary flat-woven fabrics – styles and materials which continue to have their place in a post-pandemic world.
Find the ideal fabric solution for your rail interior at www.camirafabrics.com/rail.
camira

Propex® GEOSOLUTIONS

Reinland photos of side slopes, vegitation and gabion mats

Resilient Infrastructure Slope Protection to Prevent Earthwork Failures

Railway systems commonly face a range of technical challenges when it comes to managing earthworks assets. Some of the challenges include exposure to prolonged wet weather and extreme weather events, increased embankment traffic loading, effects of vegetation on soil and rock slopes and impacts of climate change.

ARMORMAX® is an innovative solution for infrastructure slope stabilisation that provides vegetated reinforcement, improves the factor of safety, and significantly reduces the probability of failure. The system is composed of engineered earth anchors that are designed and tested for compatibility and performance with Propex's High Performance Turf Reinforcement Mat (HPTRM) to increase slope stability for up to 75 years.

The Reinland Channel case study illustrates how ARMORMAX provides weather-resilient slope protection to prevent earthwork failures for long-term results. The Reinland Drain is a municipal drainage channel in Manitoba, Canada that receives flows from the entire Pembina Valley. The channel's sandy, silty clay soil could not handle the flow from a 100-year storm event. Years of erosion, combined with damage from significant flooding, caused major failures to three kilometres of the channel. The town needed to stabilise the eroded channel banks to prevent further flooding and shoreline loss.

Due to wet weather, the construction schedule was delayed until the winter months. This delay drastically shortened the allotted construction schedule because the project had to be completed before the start of the spring run-off in March.


Reinland Problem

Originally, the project design called for a combination of reno mattresses on the bottom of the channel with rock riprap on the side slopes. Rock riprap had previously been used in the channel but had failed during rain events. Another challenge of using rock was transporting it to the project site. The closest quarry was 90 minutes away and shipping the amount of rock needed would add considerable time and cost. Propex worked with the project engineer to value engineer ARMORMAX in place of the rock riprap.

One truckload of 20,000 square yards of HPTRMs is equivalent to 667 truckloads (6,667 cubic yards) of rock riprap. The ability to expedite materials to the job site,

and ARMORMAX's easy installation, enabled the team to complete the project within the narrow timeline. In rail applications, this means minimal disruptions to train services when repairing a failed slope and offers a proactive approach to prevent future track closures for up to 75 years.

Use of an ARMORMAX over rock riprap reduced Reinland's overall project cost by nearly 30 percent and lowered carbon emissions by 90 percent. ARMORMAX's carbon footprint has been independently verified and is up to 30 times lower than rock riprap and concrete-based solutions.

Once installation is complete, ARMORMAX promotes vegetated reinforcement. The system is engineered with a trilobal design that locks seeds and soil in place to promote rapid root development for long-term vegetation. This helps to decrease sedimentation and pollutants and encourages infiltration of water back into the ground water table. These are two reasons why the Environmental Protection Agency (EPA) has identified systems that utilise HPTRMs like ARMORMAX as a Best Management Practice (BMP) for improving water quality. Conversely, rock does not promote vegetation and offers poor filtering and pollutant-removal capabilities.

Within six months, the channel was vegetated. Currently the system has been in place for two years and has experienced major weather and flood events, without any failure. An additional benefit of a vegetated design is that it is more graffiti-resistant than a concrete or rock-based solution.

ARMORMAX has been tested and approved by the U.S. Corps of Army Engineers, and more than 20 million square metres have been installed across the globe. For more than a decade, this technology has been used to reinforce embankments and slopes to protect transportation infrastructure.

For more information about ARMORMAX or to inquire about our next webinar, please contact Randy Thompson at Randy.Thompson@PropexGlobal.com

Reinland Installation

Panel Discussion 1

With:

- **Jure Mikolcic, CEO of Stadler Pankow GmbH**
- **Dr Jörg Nikutta, CEO Alstom Germany and Austria**
- **Dr Anne-Marie Grossmann, Managing Director at Windhoff Bahn- und Anlagentechnik GmbH**

Digital Maintenance

AMG: "It's very important that we become more digital. As an SME we can be on the frontlines of this. We need fast reaction times when it comes to fleet maintenance. Our facilities are highly specialised and can be operated by experts. Of course employees are trained appropriately, but should something happen, there must be rapid support. That's excellently possible with the digital transformation of the data and joining this up with our facilities in agreement with our customers, meaning that diagnostics can be digital, as can solving the problems, not

just in facilities, but also on rail vehicles."

Skills Shortage

AMG: "The rail industry isn't free from the impact of the baby boomer generation. That means we have an ageing structure that's slowly growing out. But the good thing is that we're an industry with a future, which makes us attractive to apprentices as well as skilled workers coming from universities. As an SME we're pleased that we have an apprenticeship level of 8%. We take on apprentices who want further training. We also support dual education streams so people can become more qualified. We're extremely proud of our team of experts in Germany and globally."

"How will the population respond to driverless mainline and high-speed rail?"

JN: "There will have to be a joint growing together, a joint getting used to a new system together. That will happen. Train drivers won't just disappear. It still makes sense to have technical members of staff on board, who can help in the event of a problem. It will also be a good first step for passengers, who can then see how well it works and how safe it is. We might feel concerned in regular rail traffic, but most of us have been in airport shuttles that go back and forth between terminals without a driver. And that wasn't a concern to us. It is just a process of getting used to a new technology."

"What is the added value of driverless trains?"

JN: "Operational flexibility. Imagine you have a screen that shows you that certain stations have a large number of people arriving. Normally you have a timetable and it's clear that there will be a train every ten minutes and crowds of people will be waiting. Imagine a world where the dispatcher who sees that and says, 'okay, I have more potential passengers than expected, I'm going to get more trains from the depot because I can flexibly call on those trains and direct them to those platforms to transport passengers'. That's not possible today with train drivers who have schedules and where things have to be planned more in advance. More flexible systems allow you to respond to demand much better. That would be a direct advantage for all passengers."

"Battery technology, hydrogen technology, diesel, electrification, digitalisation – which will assert itself? Will they all exist alongside each other? Especially with regards to protecting our climate."

JM: "I think it's very case-specific. There will be networks where fuel cells make more sense than batteries. There will be other cases. You have to build knowledge and know-how and make the optimal decision for each individual case."

JN: "You don't have a one-size-fits-all here. You have to look at each case individually and maybe a hybrid diesel is a good solution. You have to look at the network, determine its conditions and work out the cost-performance ratio. I'm convinced that batteries and hydrogen will establish themselves long-term on the marketplace. Sometimes one, sometimes the other depending on the network."

"Having different traction power isn't a problem in terms of harmonisation?"

JM: "No."

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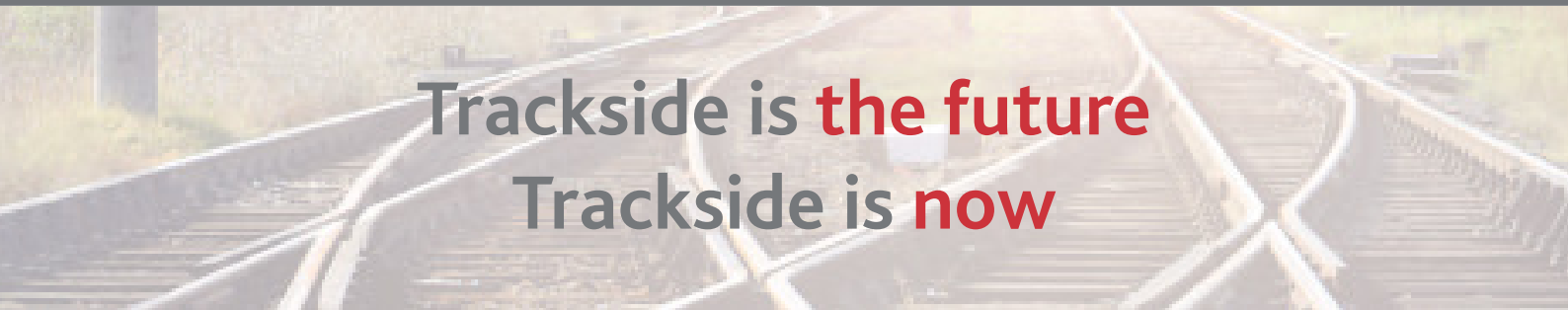

Trackside is the future
Trackside is now

Nomad Digital
smarter trains, connected passengers

The Evolution of WiFi

WiFi has quickly become an integral part of people's daily lives whether it is at home, at work or in public areas. We use WiFi to stay connected and rely on it to do everyday tasks such as checking emails, finding directions and posting on social media.

The history of WiFi started in 1971 when ALOHA net-connected the Hawaiian Islands with a UHF wireless packet network. Another breakthrough occurred in 1991 when NCR Corporation with AT&T Corporation invented the first wireless products, under the name WaveLAN.

In 1997 the first release of WiFi for consumers happened when a committee called 802.11 was created. This sparked a development in prototype equipment (routers) and in 1999, WiFi was introduced for home use. (reference: CableFree: Wireless Excellence).

The Progression

It may seem like only yesterday we were all dialling up for our connection, but wireless internet is almost 30 years old. Let's have a look at some facts and statistics:

- 71% of mobile communications flow over wireless internet.
- WiFi is the most powerful communications tool in the world.
- "WiFi" was a play on the term "Hi-Fi" or "High Fidelity". However, WiFi doesn't actually stand for anything.
- The term Internet of Things (IoT) has actually been around for almost 20 years!
- Some of the strangest WiFi connected devices are walking sticks, umbrellas, shirts, water bottles, and cutlery.
- In 2016 there was approximately 7 billion people living on the planet, and over 23 billion devices connected to the Internet – an average of 3 devices per person.
- By 2020 it is estimated there will be over 50 billion WiFi connected devices worldwide being used by 7.8 billion people – more than doubling the number of devices per person!
- There are currently around 150 million smart homes worldwide

–WiFi-connected homes are becoming the norm.

- Right now, 3.7 billion people are using the Internet – that's over half the world.

It is safe to say that WiFi has become a regular aspect of our daily lives, and this is no different when we are travelling. Passengers expect to be able to work, have up to date information and be entertained whilst they travel.

It is detailed that a high capacity connection is needed for travelling very quickly through many environments – cities, remote rural areas, tunnels, cuttings etc. Therefore, solutions must use multiple connections and adapt very quickly to changing environments so that passengers on the train experience a continuous connection to the internet. It is not that long ago that a domestic internet connection would struggle to deliver a website with a video. Whereas now, we all expect HD video and streaming services on our phones! Solutions continuously evolve to take advantage of the advances in technology including 3G, 4G dedicated trackside networks and will soon include satellite, 5G and beyond.

The Future: Connectivity on Trains

Jeremy Haskey, Chief Architect at Nomad Digital adds "it is clear digital connectivity whilst we travel is becoming expected and rightly criticised when not available. Transport systems, specifically rail, embraced digital connectivity to the train in various ways, accelerated through the introduction of 3G back in early 2004, for both operation and passenger WiFi connectivity. However, even with the introduction of 4G (LTE) both operational and Passenger WiFi systems are not getting the full route coverage or indeed, the quality of service required to fully support these services.

The growth in data-hungry applications and entertainment is particularly highlighting this issue. As data demands increase, the train operator's data costs typically rise in line with the passenger demand; unfortunately, the experience the passengers get of this service is generally poor, due to low data throughputs on the cellular links or lack of consistent coverage.

As we await the new world of 5G, and what that really looks like in terms of improving the passenger experience, I suggest the future has a mix of cellular and private networks providing the best experience to the travelling passengers."

Passenger Experience Is Key

The ever-growing number of transport passengers continue to identify WiFi as a reason for choosing a particular operator. This allows operators to respond to this through class-leading technologies, that provide an outstanding passenger experience.

Technology is constantly developing and products which provide an intelligent journey on trains and other transport services, have dramatically improved.

So, as passengers continue to demand seamless connectivity and the other value-adding services that come with it such as security, media, passenger information systems and many more, transport operators must stay ahead of the game

Click here to understand more about Nomad Digitals world-leading connectivity solutions

Dr Elmar Zeiler

Siemens Mobility

Battery and Hydrogen: Will They Replace Conventional Diesel Engines on Many Routes in the Future?

"I would like to turn this question into an appeal: diesel vehicles will be replaced – and that should be our standard – by battery and hydrogen trains in the future. What is the prerequisite for this? The technology has to be there and we've heard already that the technology is there. There are other prerequisites and I'd like to address them, taking a closer look at the two technologies. Let me start with battery technology: our battery technology has been in passenger operation for 12 months now, in this case in Austria with Austrian Federal Railways [CityJet Eco]. We've completed 70,000km in battery operation. We can travel distances of 80km between recharging. We can learn a lot about battery technology and we're pleased that this technology isn't just meeting but exceeding our expectations. That makes us optimistic about this technology as we look towards the future. If you look at current life-cycle costs, a battery train today is already significantly superior to a diesel train, based on whole life-cycle costs. The up-front cost of purchasing a battery train is somewhat higher.

Now hydrogen: we've been investing a lot into this technology for many years now. The situation there is still somewhat different. The life-cycle costs here are almost equal to those of a diesel train. But here too hydrogen technology is making great leaps forward. We're not the only manufacturer gaining insights in this area. The leaps we can expect for this technology are surely still the biggest to come. The other prerequisite when it comes to hydrogen – and this is part of my appeal to all stakeholders involved – is the associated infrastructure. Major steps are still necessary here. We can't just look at the rail industry here. Other transport modes such as regional bus networks or delivery services are also involved and this will have the outcome of reducing the cost of hydrogen.

At Siemens we offer both technologies. We see advantages for both technologies, depending on the particular circumstances and based on that we're convinced that these technologies will quite rapidly replace diesel."


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Keeping the Rails Safe — Even in a COVID World

More than 26 ENSCO Rail autonomous track geometry measurement systems around the world are maintaining continuity of track inspection operations during COVID-19, helping railways identify defects earlier and improve rail network safety and efficiency.

When it comes to successfully identifying derailment risks, railways face two principal challenges: scheduling critical track activities within limited track time without impacting revenue service and accomplishing that within budget.

Railways are continually tasked with finding creative ways of identifying derailment risks and necessary maintenance without taking track time away from revenue cars.

Fortunately, the integration of advanced technology – such as autonomous inspection, artificial intelligence and big-data analytics – offers unprecedented opportunities for planning efficiency and significant maintenance cost savings.By integrating these technologies across the entire continuum of asset monitoring and maintenance planning – from track inspection and data collection to condition trending and data-driven prescriptive maintenance – railway maintenance engineers are achieving improved safety and fewer revenue service disruptions

Autonomous Systems Offer a Highly Efficient Solution

Today, autonomous inspection systems provide reliable, fully autonomous inspection installed on passenger and freight cars operating in revenue service.

One of the most significant advantages of autonomous inspection technology is that every movement of the host train offers an opportunity to evaluate the track, allowing for more frequent inspections without track time being consumed by dedicated inspection vehicles.

The use of autonomous inspection technologies can result in earlier detection of track defects, allowing for maintenance practices to be preventative rather than reactive. This ultimately reduces the risk of track-related derailments and decreases the cost per inspection.

Earlier Defect Detection

ENSCO Rail, a pioneer in the research, development and delivery of track measurement and inspection technologies, has developed the Autonomous Track Geometry Measurement System (ATGMS). The ATGMS uses the latest fully digital, non-contact measurement technology employed by ENSCO Rail in all of its traditional manned track geometry systems.

Measurements are performed every 250mm, up to the maximum speed of the vehicle, and can be performed in either direction. The ATGMS provides real-time transmission of continuous metre-by-metre measurement data, as well as exception processing in accordance with the automatically determined class of track.

More Reliable Detection Through Artificial Intelligence

One inherent challenge faced by traditional autonomous track measurement systems is that certain conditions or track features can mimic defects, when in fact, track conditions are normal. To remedy this, ENSCO Rail developed advanced artificial intelligence algorithms that recognise and filter out these false exceptions. The algorithms are based on human data editors from thousands of miles of actual survey data, from which the ENSCO Rail algorithms learned to edit out false exceptions for real-time reporting.

Condition Trending and Data-driven Maintenance Planning

Maintenance is a necessary and significant expenditure by railway undertakings. Taking a proactive approach to maintenance and asset planning can yield significant savings by reducing manual condition data analysis and unnecessary maintenance expenditures.

New asset condition technology that relies on artificial intelligence, machine learning and data analysis offers the potential for significant reductions in maintenance costs every year while increasing operational capacity through accurate application of maintenance tasks.

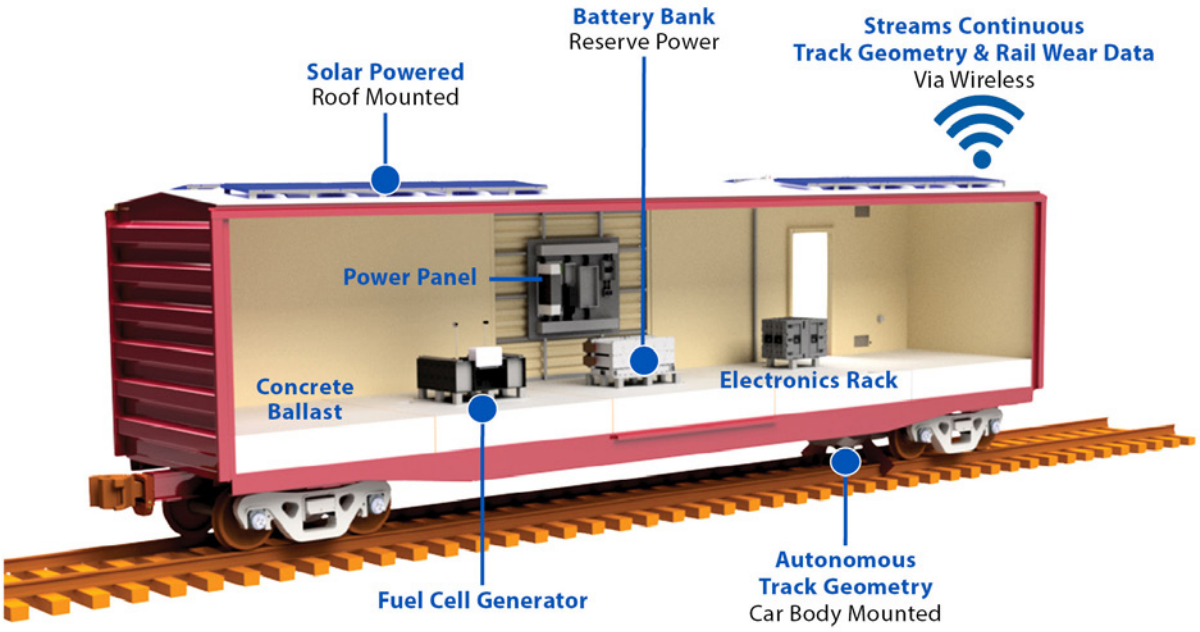
Cost Savings Through Predictive Maintenance

The ENSCO Rail Automated Maintenance Advisor (AMA) automatically identifies areas of poor track performance, determines trends in track condition deterioration and translates that data into prescriptive maintenance tasks, resulting in proactive and data-driven track maintenance planning and sound, efficient maintenance decisions

Fully automated and cloud-based, the AMA is flexible and configurable to railway customer deterioration trending needs. It operates automatically, routinely assessing track condition data and recommending maintenance tasks based on specified maintenance strategy. Asset management plans include rail grinding, rail replacement, ballast renewal, tamping and turnout maintenance requirements.

The railway industry is on the cusp of an exciting new era of innovation in the way technology is applied to safety, operations and efficiency. As next-generation track defect detection and software analysis capabilities evolve, these technologies will optimise railway maintenance and renewal planning, reduce risks through earlier identification of track defects and improve rail network safety.

To learn more about ENSCO Rail autonomous track inspection products, please contact us at +1 703 321 4475 or rail@ensco.com, or visit www.ensco.com/rail.



The ENSCO Rail Autonomous Track Geometry Measurement System increases network safety and has the lowest cost per inspection.

Digital InnoTrans Continued...

Panel Discussion 2

With:

- **Andreas Becker VDB Vice-President SMEs**
- **Stefan Orlinski, Thales Germany**
- **Dr Elmar Zeiler, Head of Commuter, Regional and Passenger Coaches at Siemens Mobility**


Stefan Orlinski

SME Involvement

AB: "50% of components in the Vectron locomotive come from SMEs, in high-speed trains such as the ICE or the Velaro it's 60%, and in regional trains it's even 70%."

Adapting to the Pandemic

AB: "SMEs must be internationally competitive, especially when looking at the major players that are currently entering the marketplace from Asia. But this competition is strengthening too. We have to keep our supply chains intact. We managed that really quite well during the pandemic. Our major customers kept their warehouses open so that we could still deliver. It was only towards the end of the crisis, when the first wave was over, that we felt dates were shifting. It's not great when you can't deliver what you've manufactured. It's not as important when you make small temperature sensors as it is if you make axles, which take up a lot of space. We have to find ways to come to terms with the crisis and deploy a good safety concept. I don't know of anyone in our association who had to accept a full lockdown because of an infection. We have to continue being able to deliver and we can do that with our innovative and very flexible businesses."

SO: "We introduced distancing, but we also brought in shift models so that the same groups always worked together at the same time in the same place, always with a half-hour gap to allow for cleaning. It was quite a big effort, but we were able to keep our productivity at above 95% and now at 100% again."

EZ: "It was a big challenge for us and we really achieved a lot in a short space of time and this is a good time to really say thank you to everyone involved, who did so much behind the scenes too. We sent several hundred thousand people to work from home over night."

Climate Goal: 100% Emission-free Transport by 2050 – Realistic?

EZ: "That's 30 years from now and in my view that's definitely realistic, even in the life-cycles we're familiar with in the rail industry. We have the technology already, other prerequisites must be met, for example with regards to infrastructure if we look at hydrogen, but the 30 years should be our motivation to get emission-free. Maybe it won't even take that long."

EZ: "No one needs to invite tenders for diesel trains anymore."

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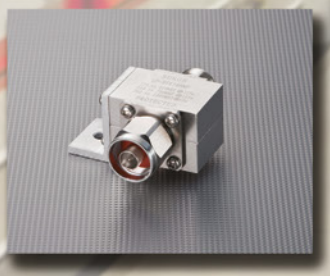

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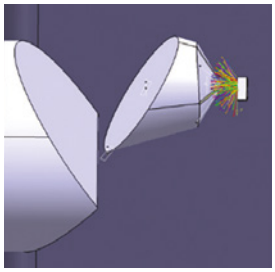

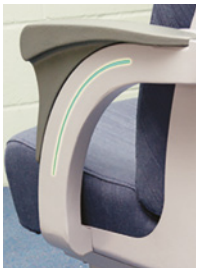

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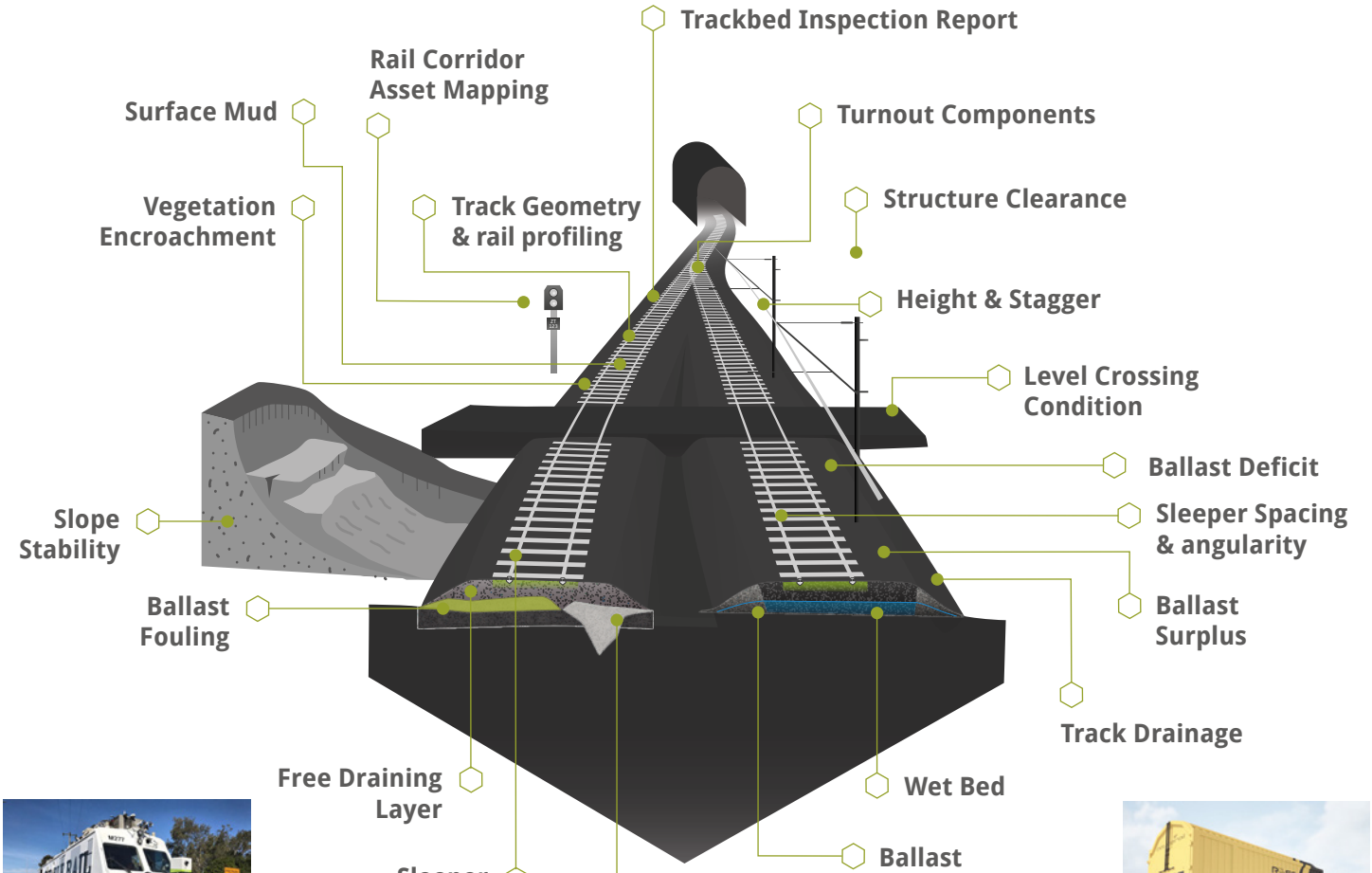
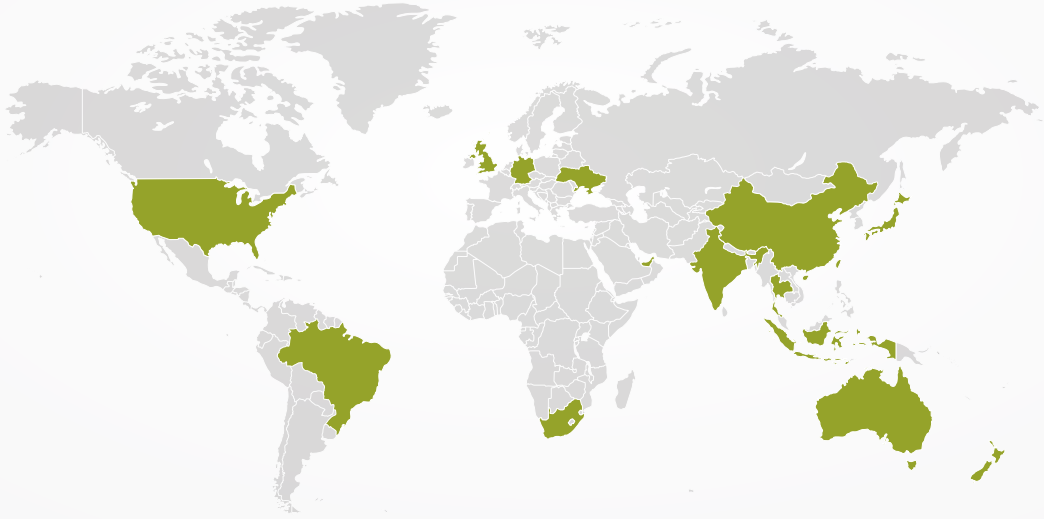
Trackbed inspection for condition-based maintenance planning



Survey systems can be fitted to a customer's rail vehicle or on the RASC® Pod.

Location of customers and partners in 2020
More than 1.2 million GPR kms surveyed in the past decade.



Multiple View Cameras
Panoramic view
IR enhanced for night view
Thermal imaging

Modular Platform
Flexible – any flatbed
Scalable – add 3rd party sensors
Add solar power

3D Laser Surface Imaging
Sleeper condition
Fastenings
Switch wear

2D, 360º Laser Point Cloud
Ballast profile
Slope stability
Track drainage
Track centres
Heights and staggers
Structure clearance
Vegetation encroachment

Linescan Cameras
Surface mudspots
Sleeper spacing
Sleeper angularity

GPR Antennas
Ballast quality
Depth of clean ballast
Failed formation
Wet beds

Track Geometry & Rail Profiling
Standard track geometry parameters
Full rail profile

RASC® Pod MKII

Integration of essential trackbed scanning technologies. Synchronised views and linked data for exception reporting. Scalable sensor package. Automatic data collection. Providing trackbed and trackside information for inspection and maintenance planning.

See the RASC® Pod in augmented reality on your device:

1.

Scan this QR code with your mobile device or visit **zeticarail.com/products/rasc-pod**

2.

Click on the **truck or wagon links**, then **aim your camera at this pattern**

Zetica Rail contact details:

Zetica House
Southfield Road
Eynsham
Oxfordshire, OX29 4JB
United Kingdom

Tel: +44 (0) 1993 886682
Email: rail@zetica.com

zeticarail.com

Rolling Stock Applications

nVent ERIFLEX

CONNECT AND PROTECT

Innovative Low-Voltage Power and Grounding Solutions

APPLICATIONS

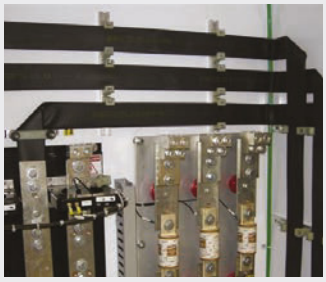
- **Power Conversion and Supply**
- **Control & Device Panels**
- **Batteries**
- **Bonding of Metallic Parts**

nVent ERIFLEX *conductors*, *terminals* and *cables* deliver SUPER PERFORMANCE featuring INNOVATIVE DESIGNS that make it an EFFICIENT and EFFECTIVE solution, especially when the conditions are challenging or have unique requirements.

nVent ERIFLEX electrical connection solutions are durable, high quality, and are expertly designed to provide better form, fit and function to improve the overall system. With extensive engineering experience, nVent ERIFLEX has design and made-to-order capabilities on a global level. nVent ERIFLEX offers the following products to rolling stock customers:

- Power Flexible Conductors
- Distribution and Power Blocks
- Busbar Systems and Supports
- Insulators and Earthing Braids
- Metallic Braids
- Cabling Sleeves

NVENT ERIFLEX FLEXIBAR ADVANCED



nVent ERIFLEX Flexibar Advanced

nVent ERIFLEX Flexibar Advanced flexible busbar has numerous advantages over traditional cable wire that make it well suited for onboard electrical panels, including a lightweight, low-profile design that can be bent or shaped in any direction for endless connection possibilities. The proprietary TPE insulation of Flexibar Advanced is low smoke/halogen free in conformance with EN 45545-2.

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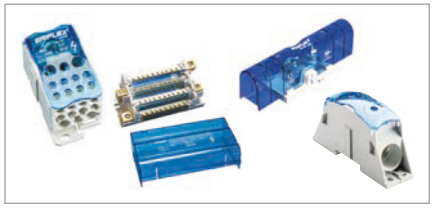
NVENT ERIFLEX FOR RAIL

Why choose nVent ERIFLEX Products over conventional cable wire or other commodity components?

Most nVent ERIFLEX products contain some or all of the following characteristics.

- Greater Ampacity, Superior Connections
- Excellent Resistance to Shock and Vibrations
- Flexible, Low Profile and Lightweight
- Easier to Install
- Creates efficiencies that can reduce or eliminate the need for certain components
- Helps customers optimize and improve the overall electrical panel aesthetic

Power Flexible Conductors

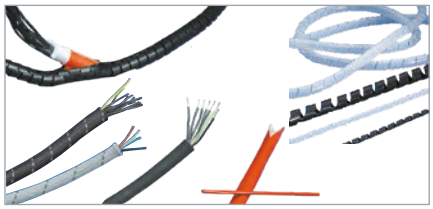


Distribution Blocks and Power Blocks

Busbar Systems and Supports

Insulators and Earthing Busbars

Metallic Braids

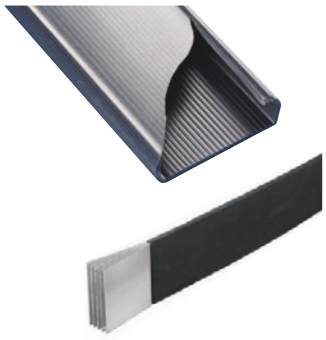


Cabling Sleeves

NVENT ERIFLEX ADVANCED TECHNOLOGY

nVent ERIFLEX Advanced Technology is a range of products featuring material compositions and insulation that are low smoke, halogen free and flame retardant.

- nVent ERIFLEX Advanced Technology insulation is low smoke, halogen free and flame retardant (EN 45545-2) capable of operating at higher temperatures, thus improving system safety and reliability.
- Comprised of an advanced TPE material, Advanced Technology insulation of nVent ERIFLEX power conductors improves performance and service life, and provides the extreme flexibility to bend and shape busbars and braided cables to make any connection.



CERTIFICATIONS

nVent ERIFLEX Advanced Technology is a range of products that featuring material compositions and insulation that are low smoke, halogen free and flame retardant.

- EN-45545-2
- International Certifications

NVENT ERIFLEX ENGINEERING & SUPPORT

nVent ERIFLEX engineering experts can support your system design, provide technical and configuration advice, and help quote your complete low voltage power solution. Trusted nVent solutions include: nVent ERIFLEX Flexibar Advanced, Braids and IBS/IBSB Advanced – all designed to meet your most challenging panel design and production requirements.

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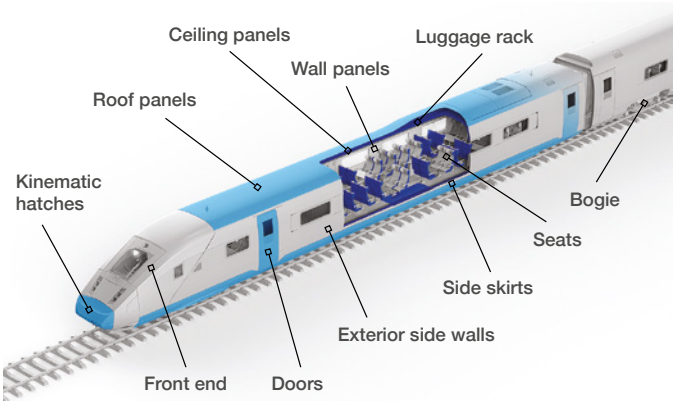
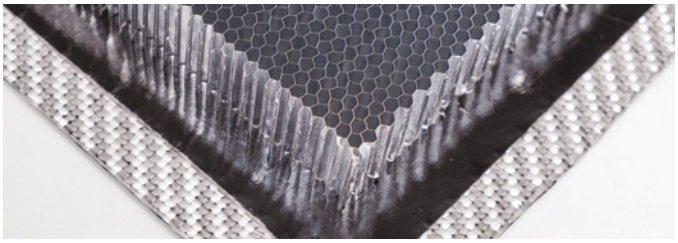
Gurit's Advanced Composite Solutions for Rail

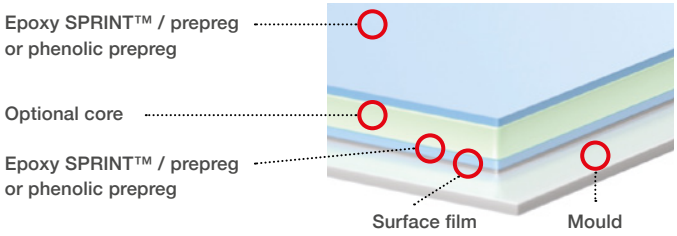
Advanced composites are becoming more widely adopted within the Rail industry for efficient manufacture of rail parts and infrastructure applications. Composites deliver vital performance improvements, enabling faster, lighter, more efficient and lower maintenance structures to be built with low total cost. Gurit offers both epoxy and phenolic chemistries with fire retardant properties, in SPRINT™ or preimpregnated fabric (prepreg) format, as well as a full range of core materials including fire retardant PET Kerdyn™ Green FR. This range of materials enables manufacturers to meet the most stringent safety requirements.



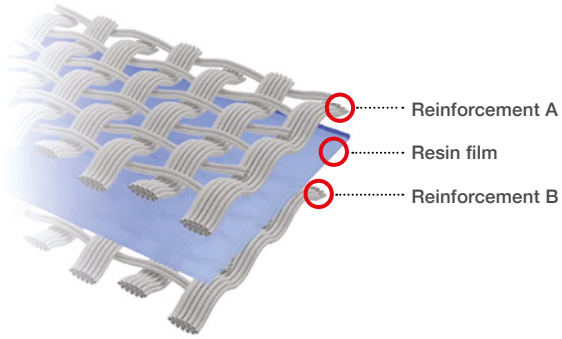
Examples of composite material applications in rail



A composite rail panel



Typical panel construction for rail with epoxy SPRINT™ or phenolic prepreg



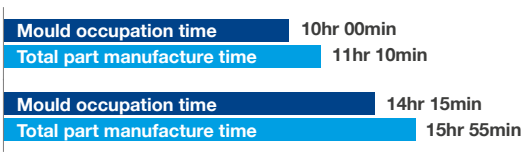
Gurit SPRINT™ consists of two reinforcement layers with a resin film between

Gurit conducted a side-by-side study, manufacturing the same component using two different materials and processing choices to compare results and conclude if either method demonstrated clear advantages over the other:

1. **SPRINT™** - a sandwich structure made with surface film, ST 130FR SPRINT™ and Kerdyn™ Green FR recycled PET core.
2. **Gelcoat/infusion** - a sandwich structure made with gelcoat, infusion resin and Kerdyn™ Green FR recycled PET core.

Key steps and findings of the study are summarised on the next page:

Total part manufacture time



Conclusion

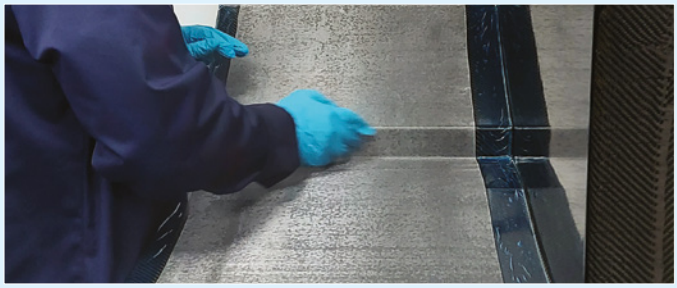
Using ST 130FR SPRINT™ for series part manufacture of rail components provides significant benefits over a gelcoat/infusion method. One of the main advantages is reduced total part manufacture time as shown in the illustration above, but SPRINT™ is also simple to use, lightweight (due to pre-determined, consistent resin content) and provides an excellent final part quality with air content less than 1.5%.

In addition, manufacturing with SPRINT™ provides improved health and safety, being a cleaner process and with minimal PPE required when compared to the gelcoat/infusion method, resulting in a significant reduction in consumable and trim waste.

Manufacturing rail components with SPRINT™ ST 130FR panel solution vs. gelcoat/infusion

Step 1 – Surface layer

SPRINT™: First layer in the mould is the surface film. Applying surface film is simple: cut the material to shape, remove backer and adhere to the mould. The material has enough tack to remain in place, but can easily be re-positioned. The process is clean with minimal requirement for personal protective equipment (PPE).



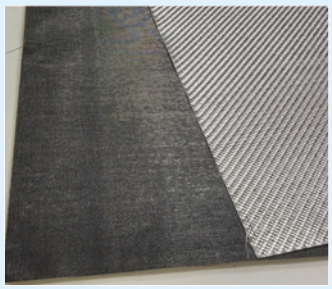
Laying the surface film into the mould

Gelcoat/infusion: First layer in the mould is a sprayed gelcoat. Additional time is required to prepare the mould, mix the resin, move the mould into the spray booth and apply PPE and ventilation apparatus.

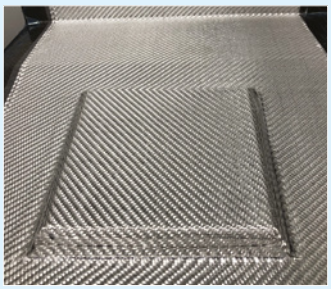
Infusion Solution: Spraying the gelcoat into the mould – additional PPE and preparation time is necessary

Step 2 – Inner skin, core and outer skin application

SPRINT™: Next are the SPRINT™ layers made with glass reinforcement. (These can be cut to shape and laid into the mould immediately after the surface film). Due to its unique construction, where a resin film is applied to dry reinforcement, it is easy to maintain good fibre alignment and a clean edge when cutting SPRINT™ material to shape. The SPRINT™ and Kerdyn™ FR core can be positioned and held in place in the mould without the need for spray adhesive or a hot glue gun.

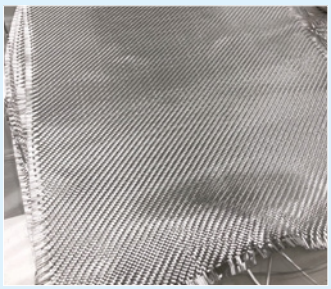


Cut surface film and SPRINT™ with clean edges and good fibre alignment

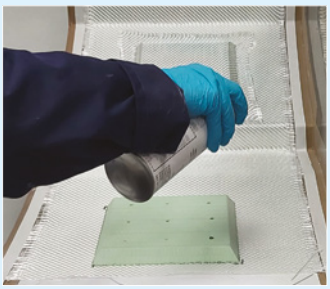


SPRINT™ In the mould, note: the material is very drapeable

Gelcoat/infusion: After spraying the gelcoat, ~1 hour is required for the material to 'tack off' before the dry reinforcement layers can be positioned into the mould. It is more difficult to maintain a clean edge and good fibre alignment with dry reinforcements and there will be loose fibres in the workshop. Spray adhesive or a hot glue gun is needed to hold the glass reinforcement and core in place, adding cost, time and PPE requirements.



Glass reinforcements cut to shape



Spray adhesive required for manufacture of the gelcoat/infused part

Step 3 – Vacuum consumable application

SPRINT™: After SPRINT™ and core, the vacuum consumables are applied. The list of vacuum consumables required to make a SPRINT™ part is quite short at just 5 items. One vacuum drop test is then performed.

Gelcoat/infusion: The list of vacuum consumables is 10 items, requiring more preparation time. Two vacuum drop tests should be performed: one before the infusion inlet hoses are connected and one once all feedlines and buckets are installed.

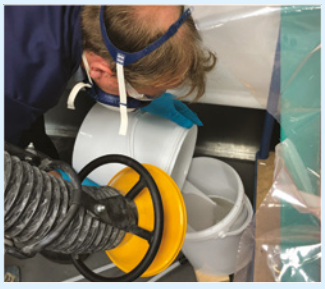
Step 4 – Ready to cure…. mixing, infusion and cure

SPRINT™: The part is ready to be moved to the oven and cured. The part manufacture time has reached 3.5 hours and the part should be cured for ~7 hours at 85°C.

Applying vacuum consumables to SPRINT™ part, after which it's ready to cure

Gelcoat/infusion: The part manufacture time has reached ~6.5 hours. Now starts the process of mixing and infusing the resin, taking around 1 hour. Once infused, the cure and postcure can be completed, taking approx. 8 hours in total.

The gelcoat/infusion part ready for the resin infusion process to commence



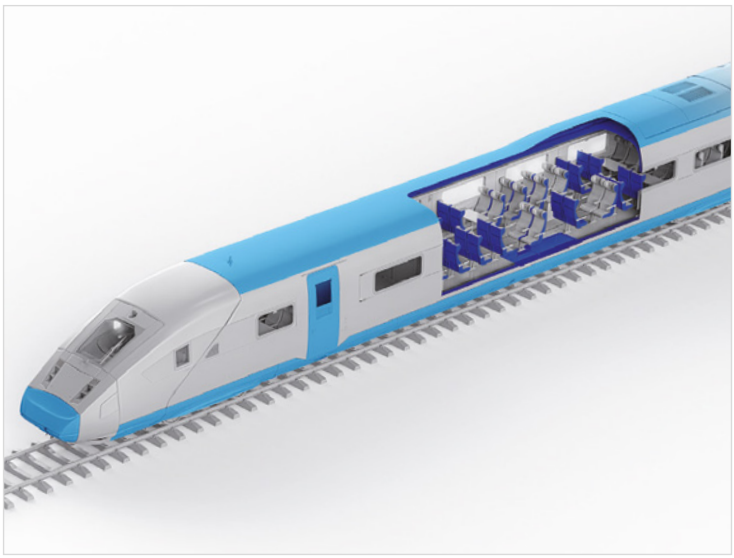
Resin has to be weighed, mixed and the part infused before cure and postcure

Step 5 - Parts fully cured and ready for demould

SPRINT™: After ~10.5 hours, the part is ready to be demoulded, trimmed and painted. The consumable waste weighs in at just 0.51kg and since cutting and nesting can be precise, flange waste is <5mm.

Gelcoat/infusion: After ~15.5 hours the gelcoat/infused part is ready to be demoulded. The consumable waste is significantly more at 2.74kg and flange waste is higher at 10-20mm.

Gurit



Advanced Composite Materials for the Rail Industry

Gurit offers a range of products tested to EN45545-2 meeting HL2 and 3, for lightweight monolithic and sandwich rail component manufacture:

- Epoxy fire retardant structural prepregs & SPRINT™ curable from 85°C
- Structural core materials including fire retardant PET
- Epoxy fire retardant adhesive and surfacing films
- Phenolic prepregs with excellent fire, smoke & toxicity behaviour

www.gurit.com/rail

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Functional Tester

FREEDOM R8100 LMR/PTC
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The efficient and reliable maintenance of electronic circuits over their long working life is critical to the safe operation of mass transit systems. Test all of your critical electronics systems with our comprehensive solutions, consolidating the work of many testers into one.

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TEST SOLUTIONS

ELEVATING performance

ASTRONICS TEST SYSTEMS

Are you covering all of your passenger safety concerns?

A Focus on State of Good Repair for Onboard & Wayside Assets

Safety is top priority in transit systems. It is the responsibility of the government, transit authorities, vehicle and wayside system manufacturers, and major system suppliers to provide reliable, safe transportation on schedule, every trip. As we all work to make traveling safe during the COVID-19 pandemic, we must remember to focus on providing State of Good Repair (SOGR) for all of our systems.

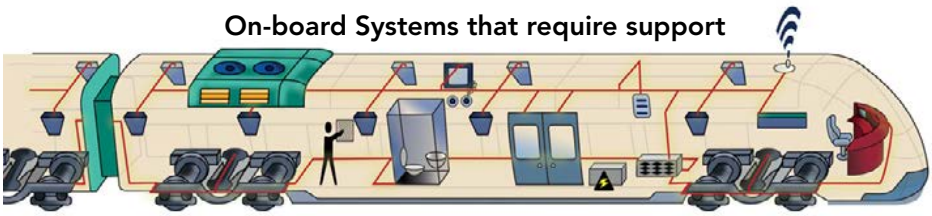
For more than 60 years, Astronics Test Systems has developed test and measurement instruments and automated test solutions that verify system performance, commission systems, and can help test, diagnose, and repair complex electronics over their lifetime. The Astronics approach and primary focus is to support and optimize performance of complex systems, including High Power, Communications and Control, Radio Frequency, and Electrical-Mechanical-Pneumatic systems, during design verification, manufacturing test, product commissioning, and over the lifetime of the product. Astronics Test Systems Senior Director of Engineering, Chuck Kohfeldt, said, "There are many challenges in developing a solution to provide a single family of support equipment for a railcar, bus, or wayside system." "Railcar and bus manufacturers typically rely on ten or more different major system suppliers for each new vehicle. Often times, these suppliers are competitors and will not share intellectual property with each other. This detailed design data is required to verify system performance. In order to control obsolescence and long term logistics costs, transit authorities are now specifying a consolidated support solution in RFPs. As test, measurement, and integration experts, the Astronics team is able to coordinate with vehicle manufacturers, major system suppliers, and transit authorities to provide a single family of consolidated support equipment to meet this requirement." Astronics has developed a commercial off the shelf (COTS) Common Core family of consolidated support equipment for meeting all of your manufacturing test, system verification, commissioning and lifetime test, and diagnostic requirements. Both portable and stationary systems are available; the former to support commissioning, maintenance of way, or on board testing and the latter to provide factory and depot or back shop support. All of the systems share common software, operator tools, and instrumentation. Each system is configured and scaled to provide "just enough" capability.

A consolidated family of test equipment provides all of the tools you need in one platform for system validation and diagnostics. All Astronics equipment adheres to standard test practices, validates consistent performance, and provides long-term support for your systems.

Consolidated Test Equipment from Astronics Test Systems helps major systems manufactures, railcar and vehicle integrators, and transit authorities assure the safety of the traveling public.

Providing this capability is no simple task. Astronics works with vehicle manufacturers and wayside systems providers using an integrated product team (IPT) approach. As stakeholders in every IPT review, Astronics engineering teams can identify and strictly adhere to standardized test requirements for every system, LRU, and LLRU. A combination of deep expertise in test and system integration along with co-located manufacturing and engineering enables Astronics to be agile and flexible throughout the development process. Innovations in design or adjustments in requirements for the variety of products involved can be implemented quickly and cost-effectively.

On-board Systems that require support



1	HVAC Systems	11	Event Recorder
2	Propulsion Systems	12	Monitoring and Diagnostics Systems
3	Master Controller	13	Radio Communications
4	Lighting Systems	14	Auxiliary Inverter & LVPS
5	Water and Sewer Systems	15	Air Compressor and Pneumatics Systems
6	Audio Systems	16	Coupler Systems
7	CCTV Systems	17	Cab and Cab Control Systems
8	Door Systems	18	Tread Brake Unit
9	Batteries	19	Trainline and Car Control
10	Customer Communications	20	Rail Gap Detector

Wayside Systems that require support

1	PTC, CBTC, ATC	8	Power Monitoring
2	Computer Based Interlocking	9	Signal Relays
3	Radio Communications	10	Energy Storage / Recovery
4	Signaling Control	11	Display and Signs
5	Gate Level Crossing Controls	12	CCTV`
6	Switch Point Controls	13	Door Systems
7	Control Room Systems	14	Customer Communications

As advanced technology insertions continue to expand in transit systems, the need to provide appropriate support has become more challenging. Astronics helps alleviate this challenge with tools to help your team ensure optimal performance, verify commission, and maintain SOGR for all of your on board and wayside assets.

Currently, Astronics is working with New York City Transit (NYCT) to provide 8,200 average weekday train trips ensuring safe, on time arrivals for 5.58 million riders on an average weekday. Astronics' Consolidated Bench Test Equipment (CBTE) and Maintenance of Way tools are a key part of NYCT's strategy for maintaining SOGR. Major system suppliers, railcar manufacturers, and transit authorities around the world partner with Astronics to provide this capability, per customer requirements.

As a member of APTA, UITP, and IEEE, Astronics works diligently to ensure standards are set to protect the traveling public. As evidenced in the House of Representatives and Departments of Transportation and Housing and Urban Development and Related Agencies Appropriations Bill 2021, the company's work with local state and federal governments has led to legislation and funding to help maintain safety for the traveling public (see excerpt at top right).

System safety and risk reduction programs *—The Committee recognizes that continued investments in critical rail infrastructure programs will make rail infrastructure, equipment, and the operating environment safer. Therefore, the Committee urges FRA to continue prioritizing investments in the development of technologies designed to verify the functional performance of complex electronic systems such as: PTC, passenger door control, railroad crossing equipment, communication systems, train and locomotive systems, train environmental control, railcar signs, infrastructure maintenance, and monitoring systems. The Committee recognizes the importance of deploying these technologies in new and existing systems and acknowledges investments made in such technologies by cities, transportation agencies, and railroads across the country. The Committee urges FRA to continue working with industry to develop standardized performance specifications, test and verification processes, and maintenance and diagnostics tools for such systems.*

Consolidated support systems from Astronicss help major systems manufactures, railcar and vehicle integrators, and transit authorities assure the safety of the traveling public and meet all of their system verification, test, diagnostic, and support needs.

Contact us now with your most difficult support issues. We have solutions that will help ensure your systems function per specifications and that you have the organic capability to repair out of spec or aging systems.

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Track more with less.

Simplifying innovative railway operations

Pioneer in Wheel Sensors and Axle Counters

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