interiors
RAILWAY INTERIORS INTERNATIONAL 2017

Xavier Allard
The director of Alstom Design & Styling lifts the lid on new projects and research priorities

Refurbishment
How to revitalize your fleet without costs spiraling

Intercity reborn

Normandy regains control of its intercity lines with the first take on Bombardier's Omneo Premium

SHOW ISSUE
Railway interiors EXPO 2017
NOVEMBER 14-15, 2017
PRAGUE, CZECH REPUBLIC
See the full preview from page 48

Railway Interiors Expo 2017 preview ▮ ÖBB, Austria ▮ Connectivity models

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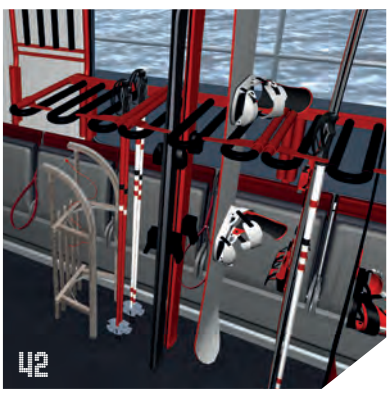

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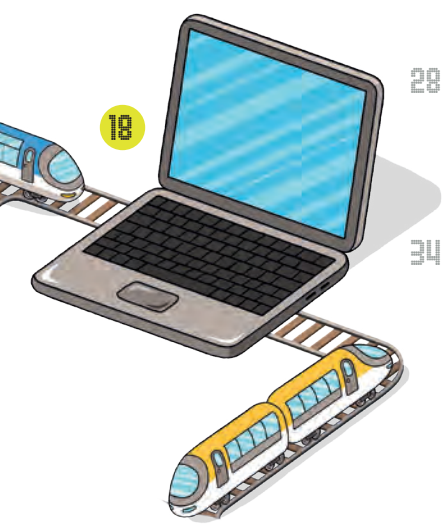

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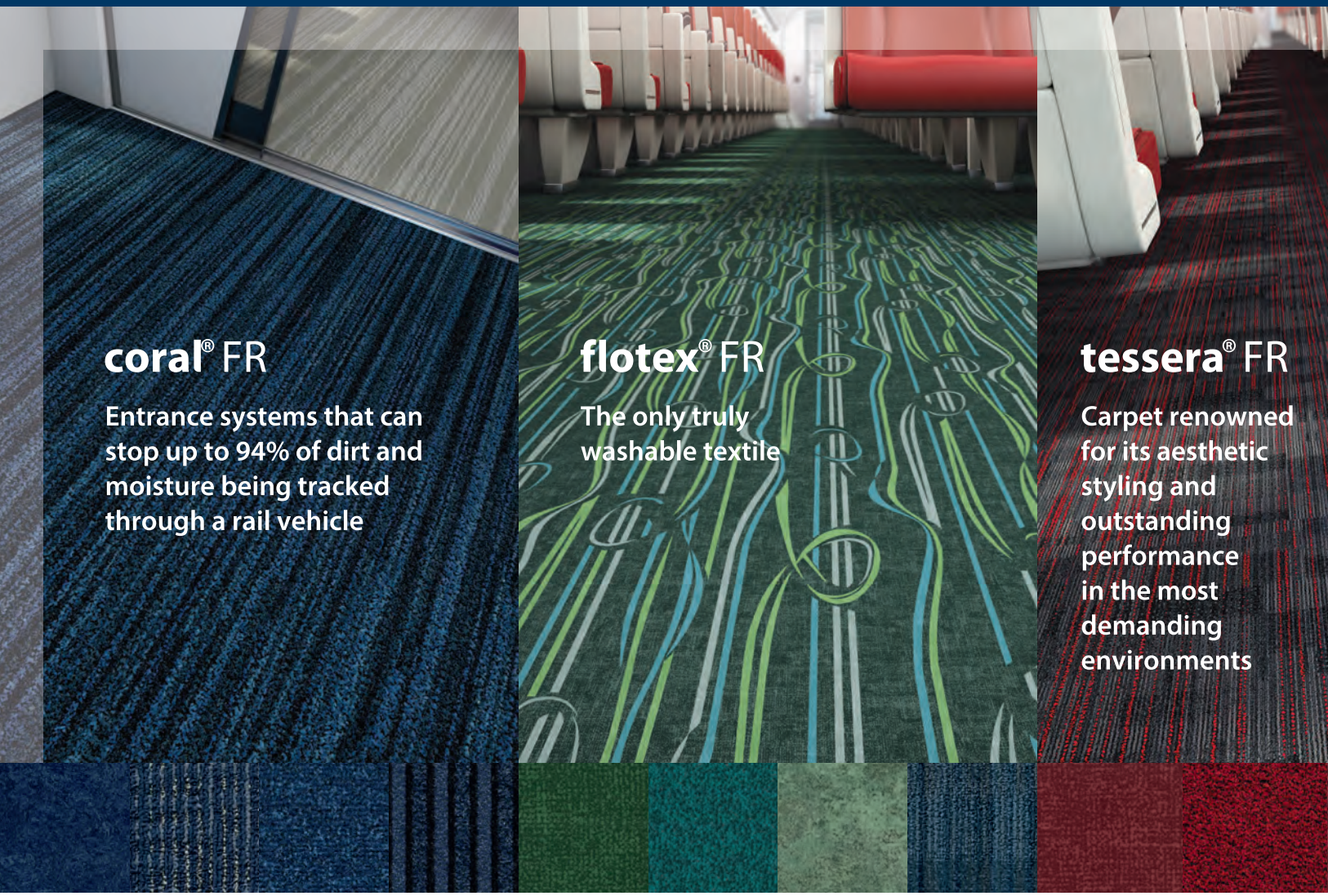

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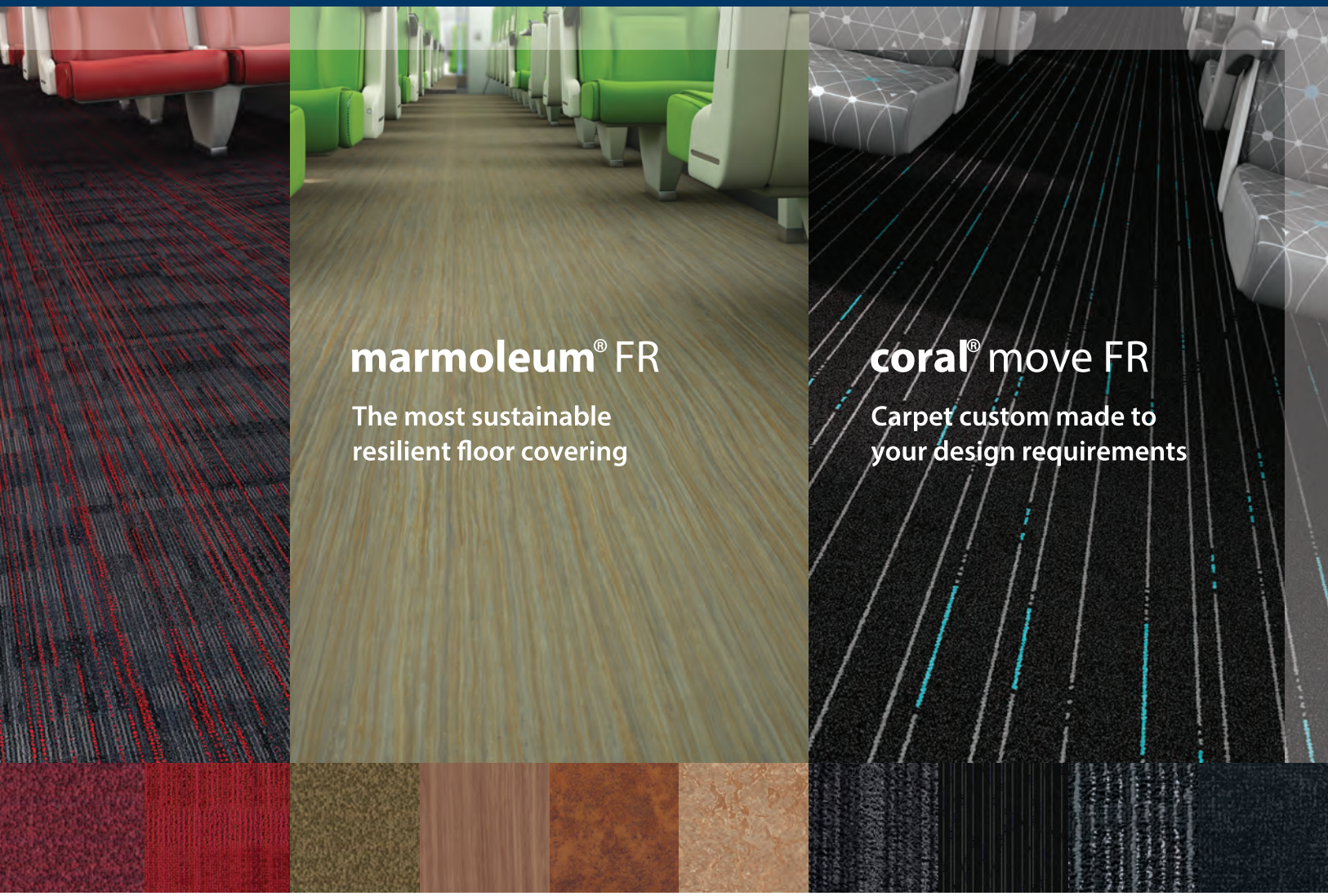

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PRODUCTS AND SERVICES

WELCOME

The 2020 service entry of Normandy's new intercity trains will mark the fulfillment of a politician's promise to dramatically upgrade the passenger experience and take back control of these lines from the state – with the overall project (which also includes track renovations and adapted maintenance equipment) coming in at €720m (US$842.3m). It will also be the first outing for Bombardier Transportation's Omneo Premium intercity platform, designed with Yellow Window. The trains are a mix of double- and single-decked cars, and feature interiors designed in line with the feedback of 7,000 passengers. You can read all about their requests from page 12.

Another big project for the manufacturer is detailed from page 42 – the customization of the Bombardier Talent 3 EMU for commuter/regional use by ÖBB of Austria. These trains are super versatile, with two layouts for winter and summer, and feature a special bike rack design.

One thing that unites both trains is that they feature passenger wi-fi. It seems as though passengers can't live without a connection, and it can also open up interesting possibilities for operators, but what is the best business model for wi-fi deployment? The feature on page 18 explores the merits of each.

Meanwhile, turn to page 34 for a revealing interview with Xavier Allard, director of Alstom's Design & Styling department. The discussion ranges from his big ideas for windows and real-time information to the regional variations in design preferences highlighted by his recent work on Amtrak's new high-speed train.

Clearly there are a lot of big investments going on in the rail industry at the moment – see also Bombardier Transportation's recent £895m (US$1.1bn, €1bn) supply and maintenance contract for the UK's South Western franchise in the UK – so Railway Interiors Expo 2017, to be held in Prague, Czech Republic on November 14-15, 2017, should be a lively event. Certainly there will be lots of product innovations on display, as you can see from the packed preview on page 48. Meanwhile, an exciting line-up of nearly 50 expert speakers are set to share their experiences – turn to page 58 for the program, and keep your eyes peeled on the exhibition website for more announcements. The free-to-attend event regularly attracts more than 2,000 attendees – I look forward to seeing you there!

Izzy Kington, editor

Email your comments: railwayinteriors@ukimediaevents.com

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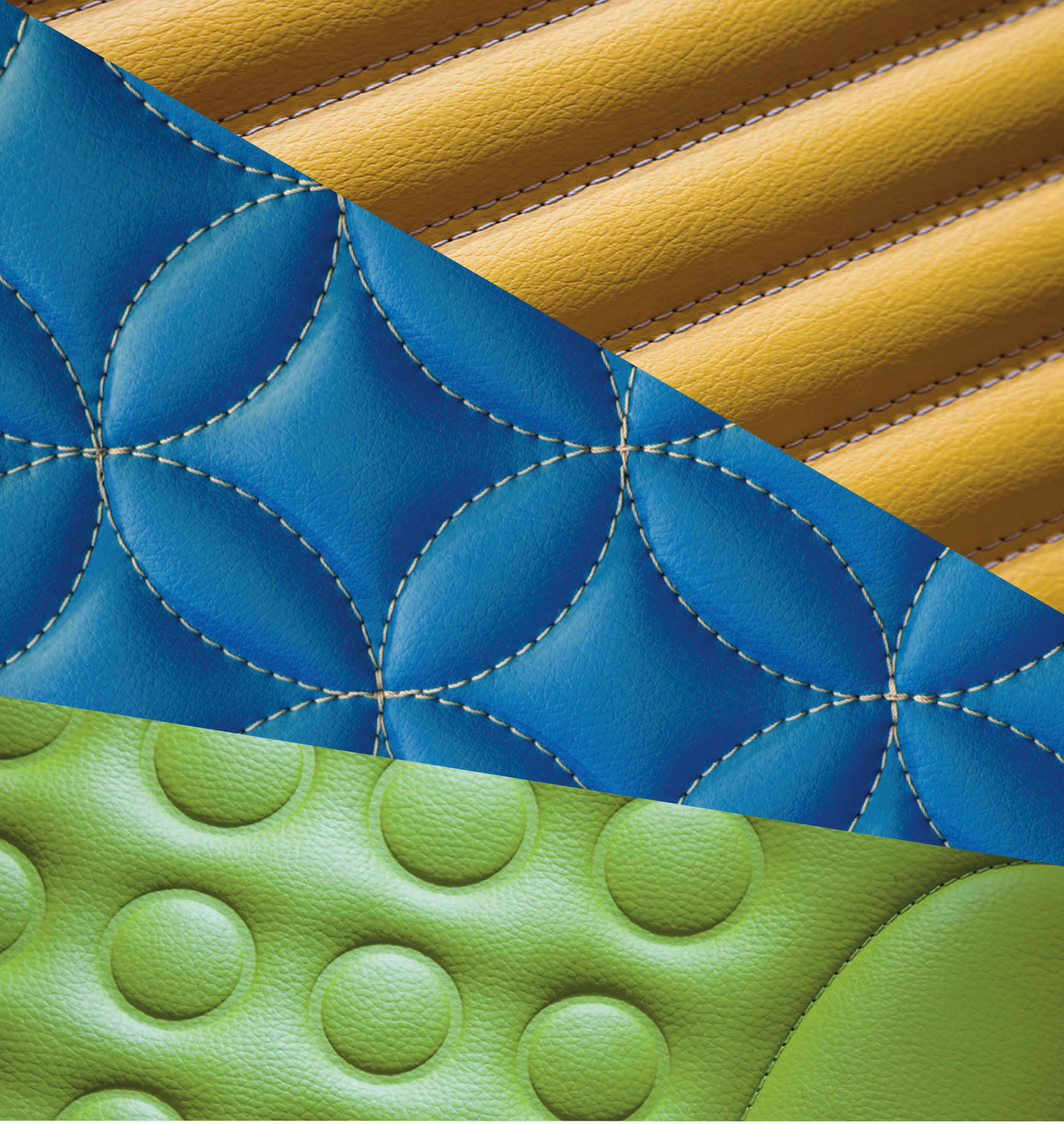

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Normandy

Izzy Kington

One promise made by Hervé Morin during his successful campaign to be elected president of the Normandy region of France was to modernize the area's railways and replace its aging fleet. He is making good on his word. "In April 2016, the region obtained €720m (US$842.3m) from the French government to finance 40 new trains, track renovations and the adaptation of maintenance equipment," says Morin.

In return, the region will take charge of its main intercity routes from January 1, 2020 – the first such agreement in the country. "The challenges are numerous," comments Morin. "The region will become the organizing authority for intercity lines, taking responsibility for schedules, timing and management of equipment."

Normandy's 40 new trains will be the first based on Bombardier Transportation's Omneo Premium platform. The manufacturer developed the Omneo double-decked EMU for the SNCF in 2010, and launched the Premium intercity version, in collaboration with Yellow Window, in 2013. It is envisaged for journeys of two to six hours, and designed to rival France's high-speed TGV in terms of comfort.

Liberty belle

Normandy will be the first French region to take back control of its intercity lines from the state, and is using the opportunity to usher in a fresh new fleet designed to stand the test of time

Capacity will be increased by more than **20%** on the Paris-Rouen-le Havre and Paris-Caen-Cherbourg lines

Bombardier Transportation and Yellow Window have worked with representatives from Normandy and the SNCF to customize the interior, not only to reflect the region's identity, but also to incorporate requested equipment. "7,000 passengers responded to a consultation on this topic," says Morin. "Their wishes included comfortable seats, power outlets, USB ports, and coffee and tea corners. The trains will also be accessible for people with reduced mobility."

Julien D'Hoker, design manager and partner at Yellow Window, says the mission was to transform the experience from simple transportation to an enjoyable journey. "We had to create comfort, and quality through high-end finishes and details," he says. "Our inspiration was not the transportation world, but hotels. Surprisingly, passengers were also asking for very simple things – like a clean train that is not too expensive. That's a reality we had to account for."

The 135m (443ft) articulated train is made up of five double-decked seating cars and five single-decked service cars.

Passengers' wishes included comfortable seats, power outlets, USB ports and coffee and tea corners

Hervé Morin, president, Normandy region

ABOVE: The seats feature integrated LED reading lights

RIGHT: A blue palette is used on the exterior and interior

THE PREMIUM DIFFERENCE

There are many differences between the regional and intercity (Premium) versions of the Omneo platform. Firstly, Bombardier Transportation developed a new traction system that enables a 200km/h (124mph) speed while also accelerating and braking faster than a high-speed train would, necessary because an intercity train stops more often.

Vincent Pouyet of Bombardier Transportation also says that to reduce dwell time at stations, the doors are wider than regular trains. In fact, most doors on the Omneo Premium train are 1.3m (4.3ft) wide, with full low-floor access, and two of the doors are 1.6m (5.2ft) wide.

"Then on the comfort side we added some structural aspects to the double-decked cars to improve the suspension to reach the level of comfort you have with a regular high-floor car," says Pouyet.

The HVAC now has a smart regulation system that adjusts the amount of air inputted in line with how many people are on board. Another new feature is that the lighting system is fully LED, and it's possible to modify the light intensity. The train also has more partitions and interior doors.

The overhead luggage rack design makes use of glass for a modern, airy look

IN NUMBERS

- 40 trains
- €585m cost (US$684.3m)
- 10 cars
- 135m (443ft) long
- 505 seats, including tip-up seats
- 2 classes
- 2 PRM positions
- 200km/h top speed (124mph)
- 2 to 6 hour journeys

The trains will be made at Bombardier's site in **Crespin**, France

The train body is expected to last **40 years**

PRM ACCESSIBILITY

There are two PRM positions on the train, in an area that has a fully flat floor. There are also separate seats nearby for those who wish to transfer from their wheelchair, along with a specially designed table and a dedicated toilet.

Vincent Pouyet of Bombardier Transportation emphasizes that wheelchair users should have the same level of experience as everyone else on board. "These areas are equipped with wi-fi, passenger information screens and CCTV, so you have the same experience," he says.

People with visual impairments can use a new remote control sound system to navigate to their seat. Seat numbers are also marked in braille, and there are spaces for guide dogs to be kept on a leash.

ABOVE: The PRM area

LEFT: The bike racks integrate tip-up seats, helpful for those using the refreshment area opposite

"It's not a simple tube, but has a more architectural feel," says D'Hoker. "We tried to give each part a specific atmosphere. In general, we tried to create a lot of privacy in the train, and also to reduce noise and the visual tube effect."

Work of art

This was done by adding doors and partitions. For example, there are 'office' compartments within first class, where four people can work around a large table. While not completely closed, wooden partitions give some privacy. "This was a special request from the region, to cater for business people traveling from Normandy to Paris," says Vincent Pouyet, Bombardier Transportation's director of sales in France.

The seats on board will be wider than those on the trains they replace, with recline and integrated lighting, tables, trash compartments, USB ports and power outlets. The first class seat is wider, reclines more and has greater seat pitch. In first class, the configuration is 2-1, while in second class it is 2-2. Even second class seats have a double armrest in the middle, so every passenger has two armrests.

Pouyet reveals the region had very particular requests regarding the design and comfort of the seat, particularly the armrests and headrests. He

LEFT: Lounge-style seating areas

BELOW: The hot beverage vending machine area

TIMELINE

2010

The SNCF signed a framework agreement for up to 860 Bombardier Transportation Omneo double-deck trains on behalf of the regions

2013

Bombardier launches an intercity version of Omneo

April 2016

The French state commits €720m (US$842.3m) to fund rail improvements in Normandy

November 2016

Normandy orders 40 Omneo Premium trains from Bombardier Transportation

May 2018

First train to be built for the testing phase

January 2020

First train scheduled to enter service; and Normandy region to take charge of its intercity railway lines

Omneo offers wi-fi access for all passengers, which allows the train to be connected at all times within the GSM network

Vincent Pouyet, director of sales, France, Bombardier Transportation

describes the outcome as offering "the best comfort you can expect from a long-distance seat".

There is also lounge-style seating. "You don't have a simple table in front of you; instead there is a side table," explains D'Hoker. "It's a new way of traveling; more like being in an aircraft."

Service providers

Passengers will enter and exit the train through the single-decked service cars. These cars also house the toilets, bike racks and refreshment areas. The latter consists of a hot beverage machine and a small counter where passengers can rest their drinks. Passengers can also use tip-up seats integrated with the bike racks.

Security equipment including CCTV, emergency buttons, a PA system and a system to talk to the driver are included in the baseline version of the train. "What has been added to the Normandy version is a full set of connected services," says Pouyet. "Omneo offers wi-fi access for all passengers, which allows the train to be connected at all times within the GSM network. The second is passenger information, delivered via LCD screens that run through the train. It will display the next station and connections."

There will also be infotainment screens, which Pouyet expects will be used to display regional information for tourists.

All electrical systems on board the train are remotely monitored to enable the operator to respond to faults quickly. "For example, with the wi-fi system, the operator receives regular reports on the bandwidth usage," says Pouyet.

NATURAL SELECTION

A stratified board with a real wood top layer is used on board for partitions. "Passengers wanted a clean and timeless train, we chose a natural material, although the application is quite new in the rail industry," says Julien D'Hoker of Yellow Window.

Vincent Pouyet of Bombardier Transportation recalls that wood has been used on board before, for example on trams in Marseilles, France. "The fire and smoke regulations are not an issue," he says. "With some plastic materials, you have more fumes and so on when they burn, whereas with wood, with some treatments you can really limit the fumes."

He adds that the main challenge with providing wi-fi is the wayside connection. "There are some good suppliers for the onboard system, and we can get a good connection to the internet as long as the wayside GSM connection is good enough," says Pouyet.

Maintenance matters

Other measures intended to ensure easy maintenance included designing elements with rounded edges, and choosing materials and colors that would be easy to clean, to ensure they would stay looking great.

This chimes with the overarching goal for the aesthetic – a stylish look that wouldn't date. "For the past 15 years, the trains here have been very colorful," says Pouyet. "It's great for the first five years, but then orange is not fashionable anymore. Hervé Morin wanted a classy, timeless train and I think that together, we have achieved that."

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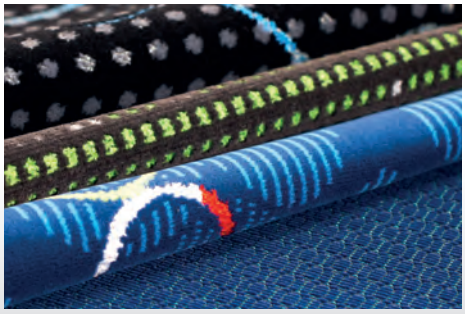

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Get conne

From freemium to advert-subsidized models, there are many ways to offer wi-fi on board

The daily commute used to be dead time: a time to read a book or newspaper, doze serenely, or gather one's thoughts. These days, however, rush hour is becoming an entertainment and shopping peak – all thanks to smartphones and tablets.

Train operators have long recognized the growing trend for people wanting to work, surf and shop on trains, but until recently, most relied on patchy contact with public mobile operator networks and commuters suffered as a result from the many dead spots along the way.

This trend is shifting. There are now some huge incentives for train companies to roll out wi-fi, not least to service their customers. But how to do it? The first question facing anyone looking to roll out a public access network via wi-fi is whether to let users use it for free or whether to charge. However, there is more to it than that. There are many alternatives to just charging or not charging, driven by ways of generating value for train operating companies (TOC) in less direct ways than through coinage.

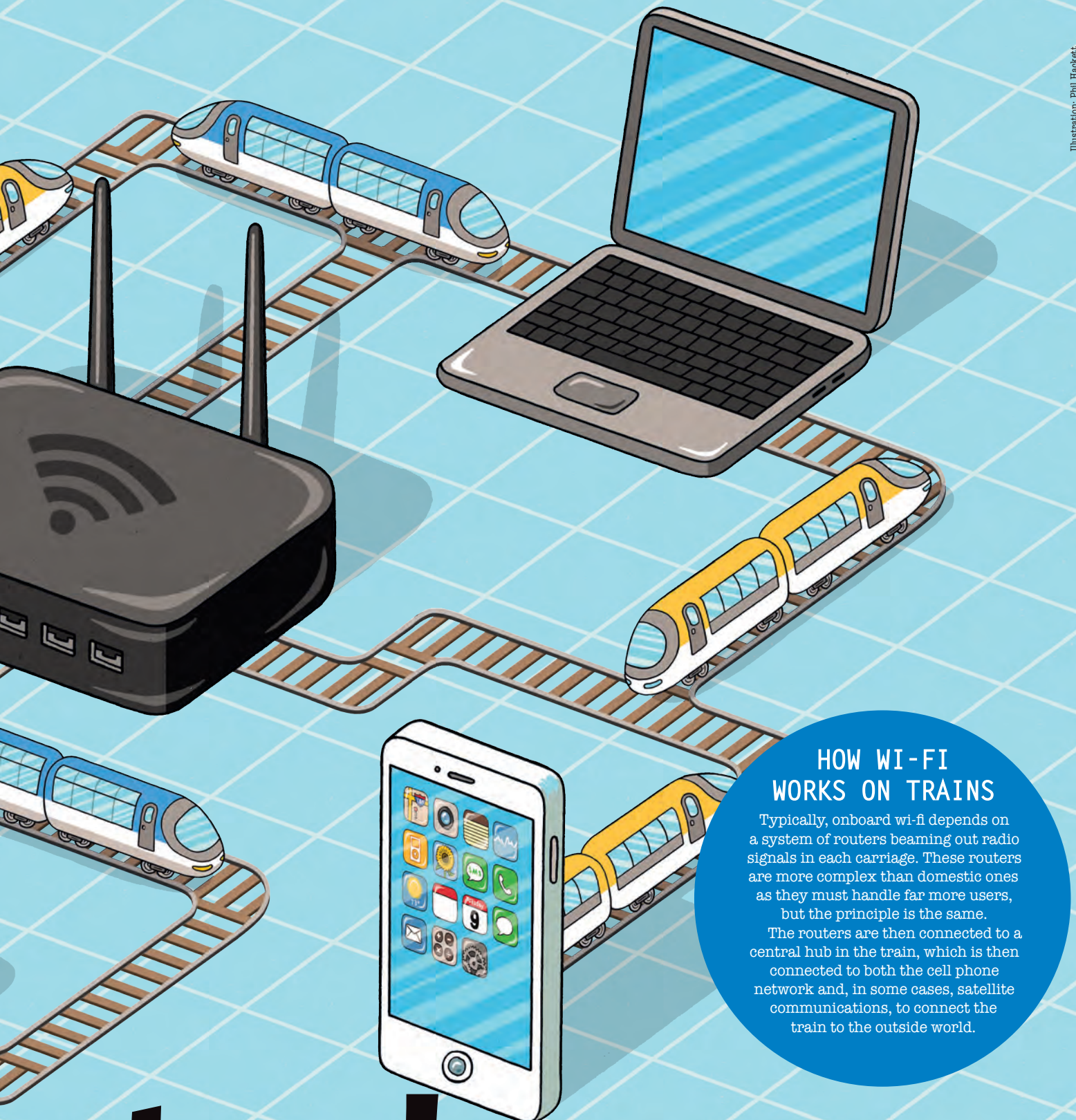

Illustration: Phil Hackett

HOW WI-FI WORKS ON TRAINS

Typically, onboard wi-fi depends on a system of routers beaming out radio signals in each carriage. These routers are more complex than domestic ones as they must handle far more users, but the principle is the same.

The routers are then connected to a central hub in the train, which is then connected to both the cell phone network and, in some cases, satellite communications, to connect the train to the outside world.

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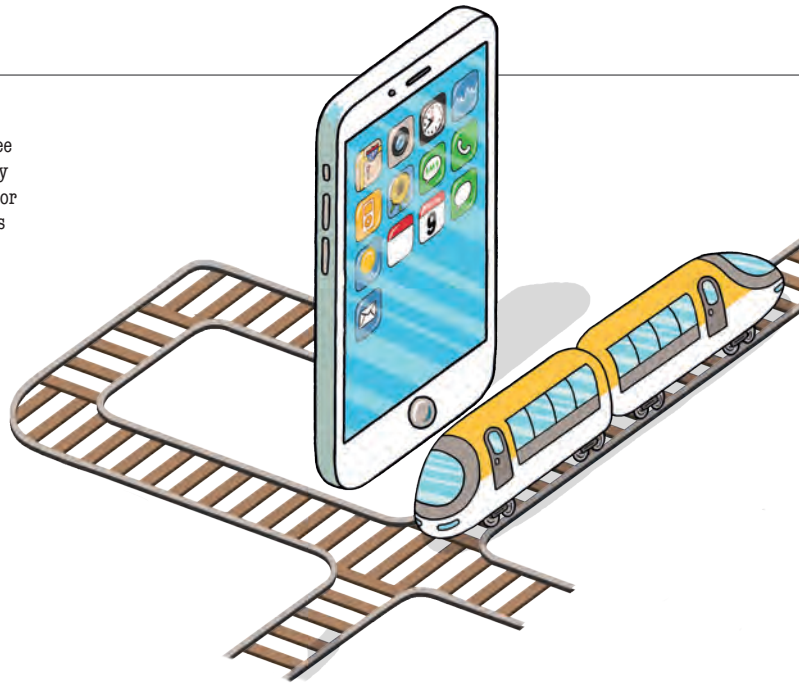

LEFT AND BELOW: Free wi-fi is a key differentiator for the UK's Heathrow Express

One way to look at rolling out wi-fi is to look at a freemium model, where there is a paid-for fast version and a lower-speed free alternative, or where the network is free for a specified period, then changes to a paid-for service.

Free enterprise

The free model is certainly very popular. The UK's Heathrow Express, which serves the UK's busiest airport, is a case in point. The operator faces very real competition from other means of transport to and from the airport and sees free passenger wi-fi as a key differentiator.

"It's about providing passengers with the best onboard experience possible – we are a premium service so don't charge for wi-fi – we never have and have no plans to do so," says Fraser Brown, managing director, Heathrow Express. "Many customers travel for business and therefore value simple and free connection just after landing or just before take-off. If they know they can get this for free with us, they're more likely to choose to travel with us. In this digital age, the same applies to leisure travelers: 15 minutes pre- or post-flight is a perfect time to catch up on social media or news, or plan your onward journey – many of these apps require wi-fi not roaming."

15 minutes pre- or post-flight is a perfect time to catch up on social media or news or plan your onward journey – many of these apps require wi-fi not roaming

Fraser Brown, managing director, Heathrow Express

Over a fifth of UK online sales take place on a commuter journey, with spend totaling **£9.3bn** (€10.3bn/US$12.1bn) annually, according to mobile payment company Zapp

Bundle of fun

London Midland has also opted to roll out free wi-fi on its trains, but it has chosen to sell it as part of an entertainment package, with a view to making train travel fun. What is most interesting is that the Motion entertainment package that this has been sold around actually runs separately to the free wi-fi that is being rolled out on the train – in theory, making sure there is ample bandwidth for users of both the free wi-fi and the entertainment services.

"Twelve months ago, we pledged to install wi-fi on all our long-distance trains, but we have been able to do much more," comments Patrick Verwer, managing director at London Midland. "Our innovative approach to technology means we have been able to include the industry-leading entertainment package and cover key local routes too. Our aim is to create simply better journeys for all our customers. Free entertainment and wi-fi will

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not only improve the customer experience – they will change the way people think about traveling on our trains. We have made the package as user-friendly as possible and this is the first time that Hollywood studios have given the green light for onboard movies and TV shows to be streamed directly to a browser, rather than through a third-party app."

This is the first time that Hollywood studios have given the green light for onboard movies and TV shows to be streamed directly to a browser

Patrick Verwer, managing director, London Midland

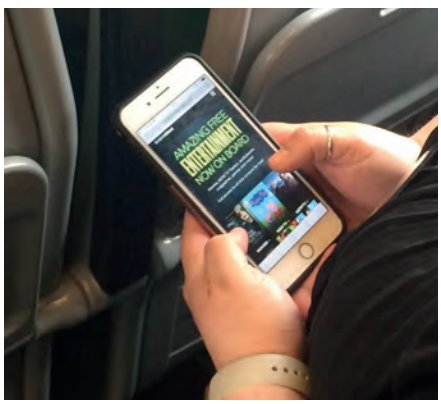
The power of data

A free wi-fi network can also hold value for operators in terms of generating data about what people do when online and on trains. Data is the new oil in many senses, holding value if it can be refined. The data can help TOCs develop more personalized services, driving engagement. It can also be used to make advertising interactive and, therefore, much more valuable.

"The train carriage is a rare uninterrupted pause point environment – and online retailers could have the full attention of a consumer for 40 minutes per average journey through the use of on-train out-of-home (OOH) formats," says Ian Reynolds, managing director of KBH On-Train Media. "When this is combined with the 36% of train users who have used their cell phone for shopping while on the train, it makes for a unique opportunity to engage with a captive audience and drive consumers to online retail sites."

Commuters want their on-train browsing and shopping experience to be efficient. "On-train media can play a role because ubiquitous technology and connectivity is exploited to make the most efficient use of dead time," explains Reynolds. "This advert format can act as a prompt to encourage train users to lean in to advertising messages when it suits them and actively seek out retail experiences from the comfort of their seat. This provides benefits for both brand and consumer. The consumer may ultimately be more valuable and ready to purchase than otherwise, and the brand benefits by being perceived as less overt and intrusive, instead inviting the consumer to travel at their own speed along the purchase pathway."

ABOVE AND BELOW:
London Midland offers wi-fi as part of an entertainment package



Market value

Free wi-fi ups the value to advertisers of advertising on the train. "On-train ads reach 7.1 million affluent, connected and influential rail users in the UK every four weeks," says Reynolds. "They are the only commercial message accompanying consumers throughout their train journey and are unencumbered by reception or network issues. Effectively reaching the commuting consumer, and powering purchase through classic

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TECHNICAL CHALLENGES

There are two main challenges with connecting trains to the internet. The first is that an in-train wi-fi system may need to handle potentially hundreds of people all trying to stream movies at the same time. The second involves keeping the train connected as it travels through tunnels, rural areas and other dead spots.

To combat the first issue, operators could consider using Wi-max – a souped-up wi-fi service that uses smaller, much more powerful hotspots to service multiple customers.

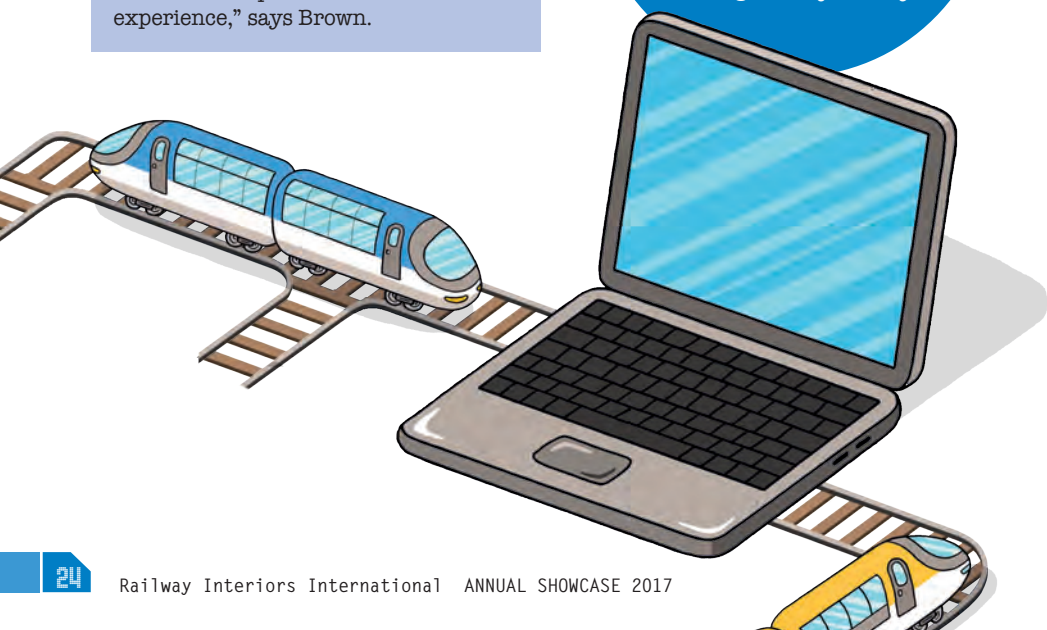
In terms of the second, there are moves in the UK to extend the mobile network grid into trackside areas – funded by £53m (€58.5m/US$69m) from the state. But for now, in tunnels and out in the country, rail operators are using 4G. "Connectivity in tunnels used to be a challenge that sometimes caused an interruption to service," says Fraser Brown, managing director, Heathrow Express. "We have worked with our parent company, Heathrow, to enable us to offer 4G mobile connectivity in the tunnels and at our underground platforms to power the onboard wi-fi and offer a mobile data alternative for customers."

According to Brown, Heathrow Express assesses its network performance continuously and works with its suppliers to seek improvements based on utilization and feedback from its customers.

This is not just an imperative for customer service; in the case of Heathrow Express it is crucial to the running of the service itself. "Our onboard sales terminals need a reliable connection to provide a seamless sales experience," says Brown.

ABOVE: Virgin Trains launched a free entertainment portal in June 2016, using onboard wi-fi to stream content to passengers' devices on East Coast services

Recent research by KBH On-Train Media found that **nearly a third of train users have browsed general retailer websites** on the train, with **20% making a purchase** during their journey



advertising opportunities, presents a very real opportunity for online retailers. By reaching this new shopper group, online retailers can own the journey and drive sales in a unique, powerful way."

Take charge

Not everyone agrees with the free model, and many operators charge for wi-fi access. There are certainly financial investments and technical challenges involved in equipping and running such a service. There is also the argument that by charging, the operator naturally limits network use, and so can avoid latency issues.

In an online forum on why wi-fi charges are implemented on some trains, Andy Cooper, managing director of CrossCountry trains, said, "The investment in our wi-fi service has been made, but we have to service that investment and produce a return. It wasn't a free good! There is a data volume charge, so charges increase with the popularity of the service."

Virgin Trains, which offers free wi-fi in first class and a paid-for service in standard class on its West Coast route in the UK, is working on its aim to offer uninterrupted, free, high-speed wi-fi.

"We're working on ways to provide free wi-fi for everybody," says John Sullivan, chief information officer at Virgin Trains on the West Coast. "In the meantime, we're investing in services that provide customers with the digital experience they want. That's why we introduced a free onboard entertainment service, Beam, in 2016."

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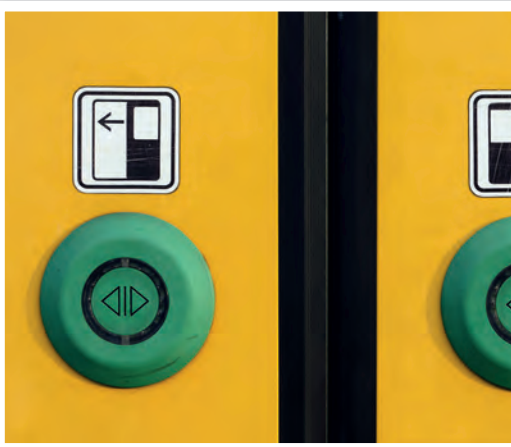

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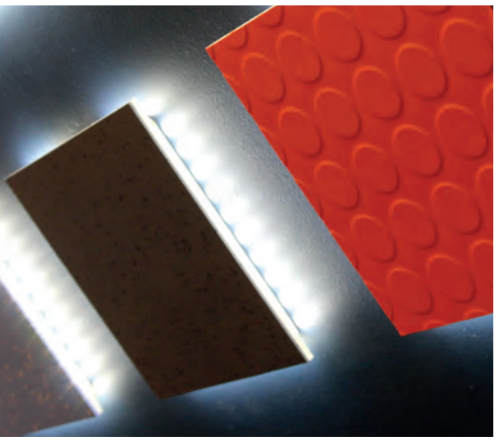

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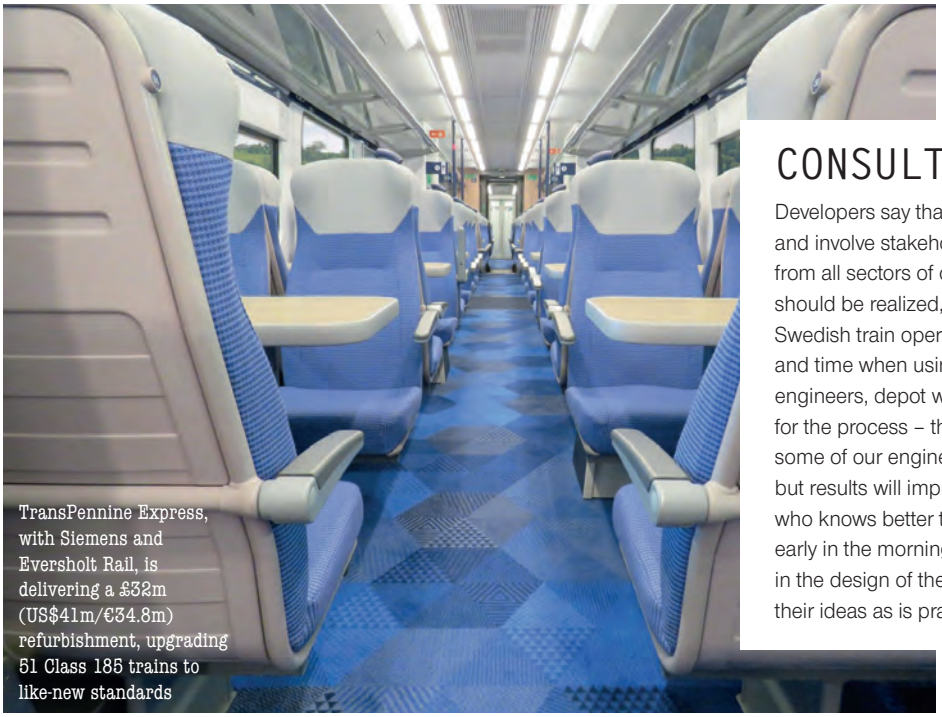
Max Mueller

A how-to guide for that most difficult of tasks - refurbishing rolling stock to satisfy passengers, service personnel and the company's chief financial officer

One careful owner

Alstom recently delivered the first of the 26 regional Coradia Lint 41 trains refurbished for LNVG after 15 years of service, with features including bicycle fastening areas



TransPennine Express, with Siemens and Eversholt Rail, is delivering a £32m (US$41m/€34.8m) refurbishment, upgrading 51 Class 185 trains to like-new standards

CONSULT ALL STAKEHOLDERS

Developers say that consultation must go beyond customer demand and involve stakeholders including service personnel. "We seek input from all sectors of our workforce to find out how design concepts should be realized," says Lars Lindberg, head of fleet management at Swedish train operator SJ. "This makes the most of the limited space and time when using mock-ups. Stewards, service staff, maintenance engineers, depot workers and cleaning personnel are all very important for the process – there are many different points of view. Of course, some of our engineers say, 'We can guess what the personnel think', but results will improve if you talk to the stewards and the cleaners – who knows better than them what it's like working on the trains, say early in the morning or late at night? Everybody is invited to participate in the design of their area of work and we take on board as many of their ideas as is practical."

Results will improve if you talk to the stewards and the cleaners – who knows better than them what it's like working on the trains?

Lars Lindberg, head of fleet management, SJ

LEFT: Alstom's refurbishment for LNVG includes the addition of CCTV

UNDERSTAND PASSENGERS' PRIORITIES

Fleet replacement costs can run into hundreds of millions of dollars and the refurbishment of trains is often the only viable alternative. With passenger expectations at an all-time high, how can OEMs, rail operators and supply specialists achieve the right balance between functionality, comfort and cost?

Martin Baier, manager of service for urban transport at Siemens, says that refurbishment projects commonly prioritize extending lifetime and improving comfort in line with passenger expectations. "The value of refurbishment measures depends pretty much on the subjective preferences of customers," he says. "Of course, there are some measures that also lead to a direct return on investment, for example by offering energy savings – LED lighting being the most popular example. Security is also of the highest importance and has a high value for our customers. CCTV systems are commonly requested, but the benefits are not easy to measure financially."

Siemens has also seen growing interest in its Expert Sitrail system, which enables the driver to monitor the platform on a screen inside the cab, even at a distance to the station – the aim is to avoid accidents.

"Our latest passenger information systems are also of high value for our customers as they improve comfort: they are deeply integrated in the vehicle control system, provide real-time transport updates and guide passengers perfectly for their last mile, using the relative position of the train and the passenger within it," says Baier. "Recently, demand for retrofit connectivity and data services has been growing, reducing maintenance costs, raising availability and supporting operations."

MANAGE EXPECTATIONS AND COSTS

When the design process is led by passenger expectation, costs can spiral. Customer surveys and focus groups are apt to result in extravagant demands that are difficult to meet within allocated budgets. "You can't start a focus group with a clean slate," says Lars Lindberg of SJ. The company is refurbishing 36 train sets of X2000 tilting stock at a cost of Skr3.6bn (US$416m) and is keen to make its investment count. "Our method is to have certain proposals to frame the discussion and keep the project economically viable. Without that, some customer suggestions could be pretty fantastical."

This approach is seen through to later stages in the design process, when SJ uses virtual reality to supplement its careful use of mock-ups. "VR is used mainly for discussions with focus groups," says Lindberg. "The goggles are easy to use and give participants the chance of a virtual walkthrough, with a clear picture of what's being proposed. However, we also have mock-ups for certain zones in the train from very early in the project, which we then refine all the way to the final design. We restrict those to the most important areas, as in the worst-case scenario the whole mock-up will have to be re-engineered at great cost."

BELOW: Bigger tables and leather first class seats feature on TransPennine Express's recent refurbishment

ABOVE: LED lighting is another big upgrade on the LNVG project, along with new ceiling paneling

ABOVE RIGHT: Passenger-pleasing upgrades could include onboard entertainment

LEFT: Virgin Trains' East Coast fleet refurbishment, started in 2015, includes leather upholstery and mood lighting in first class

LEARN FROM OTHER INDUSTRIES

One recent trend has been to use technologies and skills from other transportation industries to improve rail interiors. "As disruptive innovation becomes the norm in the aviation and automotive sectors; it's only a matter of time until the same happens in the design and refurbishment of train interiors," says Hugo Jamson, creative director at New Territory, a design company that has worked with Airbus and the Virgin Group. "Passengers are being offered ever more advanced systems of travel on the road and in the air – think ride sharing, car clubs and growing levels of automation – and these developments make themselves felt in the rail industry."

Jamson says there are big opportunities to increase passenger comfort/control and capacity when seats are replaced. "This has similarities with the best airline cabin refurbishments, where previous in-service issues are corrected and future-proofed: implementing materials that wear better, improving seat functionality and comfort, and creating better interior lighting," he adds. "We should also champion new construction methods and more advanced material treatments, as well as new embedded technologies that deliver information to passengers seamlessly."

This broader approach is already implemented by some train operators. "When recruiting, we also try to find people with experience from other industries," comments Lars Lindberg of Swedish operator SJ. "We have employed people from the energy sector as well as from the automotive and aerospace industries, to maximize our knowledge internally, with very good results."

LOOK AT THE BIG PICTURE

A coherent overall concept is critical in the quest to achieve value for money with a refurbishment. At Siemens, developers are aware of the complex interactions between different elements. “The goal of operators is to bring their trains up-to-date in matters of design, comfort and technology,” says Martin Baier of Siemens. “Technically, pretty much anything is possible, and it can easily happen that requirements lead to a price that makes the whole project uneconomical: the weight added by air-conditioning systems may require the car body to be refurbished, or requests for interoperability may call for a new train control system. To avoid this, requirements should be developed with a supplier. Siemens is ready to consult with operators from the first idea through to the creation of an adequate concept to material supply and implementation.”

It can easily happen that requirements lead to a price that makes the whole project uneconomical

Martin Baier, manager of service for urban transport, Siemens

ABOVE: The Virgin Trains project includes new red cloth upholstery in standard class, and new carpets and fittings

ABOVE: The upgraded LNVG trains now have a wheelchair space with intercom

LEFT AND ABOVE INSET: They also now have power sockets and USB connections

PAY ATTENTION TO DETAILS

With refurbishment usually focusing on seating, information systems and wi-fi, it’s easy to neglect other aspects that nonetheless affect passenger opinion, including handrails, protective surfaces and graphics.

TBM Rail, a UK-based rail refurbishment specialist, is in the process of revamping the passenger grab poles, rails and handles on almost 700 Bombardier Class 377 Electrostar multiple-unit cars used on Govia Thameslink Railway’s Southern services. “We were asked to source and provide a solution to the aging polyester coatings that in today’s climate are no longer fit for purpose,” says Neil Smith, director at TBM Rail. “Passengers quite rightly demand higher standards. Chipped and damaged poles and handles are not acceptable.”

Apart from replacing the carriages’ rubber, silicone and neoprene gaskets, the three-year project involves sandblasting the handrails’ existing polyester surfaces, before applying a Nylon R-AG coating supplied by Omnikote.

Information graphics and protective surfaces are also important, if often overlooked, elements. Aura Graphics has supplied UK train operator Greater Anglia with labels and logos for many years. One recent project involved refreshing Class 317 and 321 interiors. Part of the work involved preparing the internal surfaces for a full respray, following the strip-out of 136 carriages. Following interior painting, contractor teams installed new flooring and carpet runners and all other fixtures and fittings. Dado panels were covered using protective AuraFlex laminates, along with all required safety and information labels. The graphic laminate is used for tabletops, vestibule walls and other interior panels.

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Future focused

Xavier Allard, director of Alstom's Design & Styling department, discusses projects including a new high-speed train for Amtrak, and the key areas he feels are ripe for innovation

LEFT: SNCF's Régiolis train was Design & Styling's first clean-sheet train design

BELOW: Xavier Allard

Before Xavier Allard joined Alstom in 2005, the manufacturer had always used external agencies for its interior designs . "Some very good projects came from these agencies, but there was no link between them," says Allard. "Philippe Mellier, who was president of Alstom at the time, and came from the automotive industry, decided to invest in a design organization to improve the visual links between our projects."

Allard was headhunted from Renault, where he had spent 21 years designing everything from heavy and light trucks to agricultural vehicles and bicycles. "It was really, really great experience," he enthuses. "So much changed during those years – there was no link between the Renault I joined in the 1980s and the company of 2005."

In-house design

Alstom's new in-house design organization was named Design & Styling, and its remit was to design the complete Alstom range, from metros to high-speed trains, regional trains, trams and locomotives, covering all stages, from the first sketches to the delivery.

The department's first opportunity to work on a completely new train came in 2007 with the beginnings of SNCF's regional Régiolis project. Allard recalls the excitement of being tasked with producing something very innovative, from scratch.

Today the difference between first and second class is based only on seat dimensions, but operators are thinking about something new

Alstom will provide up to 217 eight-car **metro trains** for the RATP's Line 14, an order **worth more than €2bn** (US$2.3bn). The design includes boomerang-shaped seats, dedicated PRM spaces, LED lighting, warm and cool air-conditioning, CCTV and a dynamic information system

ABOVE AND LEFT: The MP14 metro for Île-de-France is due to enter service in 2019

More recently, Design & Styling has been very busy working on designs including a metro for Hanoi in Vietnam, a light rail vehicle for Sydney in Australia, and metros for Paris in France.

"We are just reaching the final design for the new Metro Paris MP 14, and we are in the tendering phase for the Grand Paris," says Allard. "We are also working on the new TGV2020 program, which is very exciting. We're working closely with SNCF and pushing for innovation. The passenger experience is getting to be more and more important. This is the main issue we want to push in designing the new vehicle."

Amtrak's high-speed train

The team has also been occupied with a very special project – designing a high-speed train for Amtrak in the USA. "We are now in the design freeze process," says Allard.

The 28 new trains will add 33% capacity on the Northeast Corridor (NEC) between Boston and Washington DC, replacing Acela trains. This 730km (454 mile) stretch of railroad has seen a massive increase in ridership – from 2.4m people in FY 2002 to 3.5m in FY 2014.

The trains comprise a power car and nine passenger cars, although three more cars could be added if required. They are based on the Avelia Liberty platform, which features articulated architecture and anticipative tilting technology, and will be made in Hornell, New York. Together with a technical support and spare parts agreement, the contract is worth €1.8bn (US$2.1bn).

Allard says that, typically, Europe and Japan lead the world in terms of train design, but Amtrak's new train will up the USA's

Alstom will supply **10 Metropolis trainsets** for the metro in Hanoi, Vietnam, due to enter service by the end of 2021

ROAD VERSUS RAIL

Xavier Allard points to two fundamental differences between the two industries he has worked in – automotive and rail.

The main departure for Allard when he joined Alstom was the tendering process, which doesn't happen in an automotive organization.

"Secondly, there are some technologies – for example, plastic injection – that are used all the time in the automotive industry, but can't be used in the railway industry because of the constraints of volume," says Allard. "I have had to adapt my way of designing to use thermoplastics, which don't have quite the same possibilities in terms of shaping. The possibilities are very different, and we must be more imaginative."

Trend on Track

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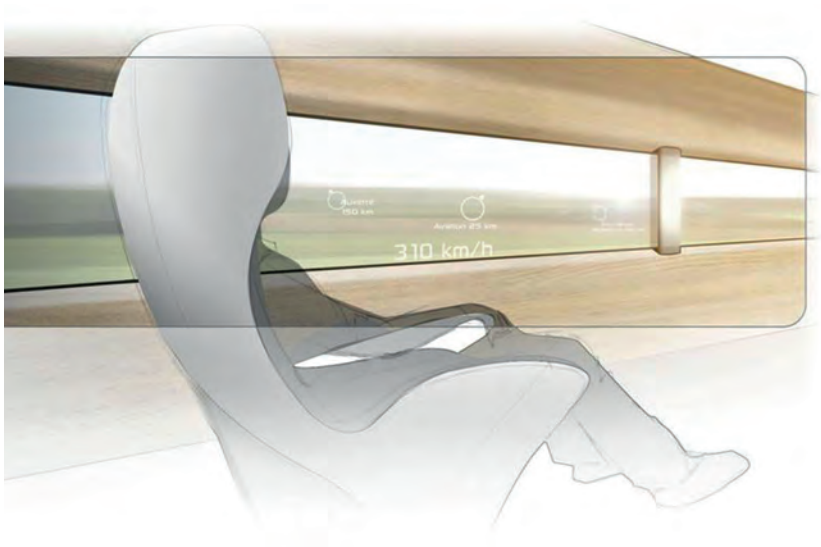

We are very proud that this Amtrak design is on par with the best European trains

Xavier Allard, head of Design & Styling, Alstom

standing. "Train design has not been at the same level in the USA as in Europe," he adds. "We are very proud that this Amtrak design is on par with the best European trains."

Transatlantic divide

For Allard, the main difference between Europe and the USA in terms of design relates to how comfort is conveyed. He says Amtrak was really demanding in this area, especially in terms of the seat design. "In Europe, especially Northern/Scandinavian countries, they have a very specific expression of comfort, with very thin seats that have a very modern look and feature very modern materials and fabrics," says Allard. "In the USA, you must express comfort with very thick shapes. It's not possible to use the shapes we use for the European market. The shapes must look more solid. This is something we see from listening to Amtrak representatives, looking at the passengers using the train, and taking other US projects into account."

One of the key considerations on all Alstom's design projects is how, given the long life of a train, the interior can offer the flexibility to accommodate future needs. "We must be creative, but at the same time enable the designers of the future to express their creativity," says Allard. "Our trains are now more flexible in terms of interior layout and amenities, so in the future they will be easier to maintain and renovate."

Allard predicts that operators' demands will change a lot. "Passengers will find different ways to use the train," he explains. "Today the difference between first and second class is based only on seat dimensions, but operators are thinking about something new. For example, they are thinking about business areas, family areas or communal areas where you can eat, rest and meet people. Operators are now expecting flexibility from us."

TOP: A high-speed concept by Alstom, designed for the widest view possible, contrasting with urban concepts based on verticality

BELOW: The high-speed Avelia Liberty platform is being customized for Amtrak's Northeast Corridor

Euroduplex double-decked trains were designed for a new high-speed line connecting Paris and Bordeaux, which launched in July 2017. The trains have 556 seats and four PRM places, with equipment including first-class seats that can rotate 180°, real-time information screens, a buffet car and provisions for in-seat catering

The interface between the train's exterior and interior is also on Allard's mind, encouraging him to push for window innovations. "In metros and trams, we want to open the cabin in a more vertical way, so passengers have a great experience coming into the city and seeing tall buildings," he explains. "Meanwhile, on a high-speed train, we want to provide the widest view possible. So, the discussion with our engineer colleagues is about how to enlarge the windows and minimize the pillars in-between."

Through the looking glass

Allard's dream is to have windows running all along the coach without any pillars, and to integrate new functions, for example information displays. "We want to push this technology, working with window suppliers," he says. "Let's imagine you could read information on the windows while maintaining their transparency. I don't want to see the frame of the display in the window; the point is to display information in a very free way."

Allard believes that this technology will be available in the next decade. "The issue is cost," he adds. "We have also to work on reliability, maintenance and the sizes possible. This technology works as a small square, but we want to make it work on a larger scale."

I say to my designers, when you get on the train, take your pencil in one hand and keep a sponge in your other

Xavier Allard, head of Design & Styling, Alstom

COLLECTIVE SPACES

One of the benefits of a career that has included long tenures in the automotive and rail industries is having had the chance to work on both individual and collective modes of transportation, says Xavier Allard.

"I maintain strong relationships with ex-colleagues and other people from different automotive companies," he says. "It's very interesting to see the automotive industry become interested in moving to a more collective experience, with car sharing, because the opposite is happening in the rail industry, where one of the main challenges is how to provide individual comfort in a sometimes crowded area. We are at a turning point between shared and individual systems. I also have some relationships with aircraft designers and they are thinking about the same things."

Alstom has begun the delivery of 60 **Citadis X05 LRVs** for Sydney, Australia. Each 67m couple set accommodates 450 people. Highlights include double doors, balcony-style windows, multipurpose areas, LED lighting, sensor-based air-conditioning, real-time travel information, CCTV and emergency intercoms

ABOVE: The bar area of Alstom's new Euroduplex high-speed train, designed in collaboration with Saguez & Partners

Keeping passengers informed is clearly a focus for Allard. "One of the ideas we want to pursue, especially on underground trains, is providing passengers with more information regarding what is happening on the surface – for example, the weather, traffic conditions and what is open – so passengers can adapt their plans," he says. "It's a very big challenge when you think the metro is 11m under the surface."

Lighting could also be used to convey information. "Lighting is a key issue for designers; the best way to provide a new atmosphere is through a very sensitive lighting system," says Allard. "It can also impart information to the passenger through changes in color or intensity, perhaps to subtly prepare them that the train is arriving at a station. These are the kind of things we are working on."

Pure intentions

The team is also working on new materials to optimize ease of cleaning and maintenance. "I say to my designers, when you get on the train, take your pencil in one hand and keep a sponge in your other, as it is so important to design something that can be cleaned easily," says Allard.

Finally, safety is a fundamental concern. At the beginning of 2017, the team participated in a program looking at how to design a tray table to be more secure during a crash, so it doesn't unfold, and if that's not possible, how to shape it to reduce the risk of injury.

"It's becoming more important for the operators to ensure that all interior equipment – from seats to luggage racks, grab bars, and so on – is designed to maximize passenger safety in a crash ," says Allard. "Coming from the automotive industry, where you follow very strict regulations, I'm a bit surprised that the railway industry has no specific regulation on this point yet."

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The flexibility to adapt to seasonal requirements was a key factor in the customization of Bombardier's Talent 3 platform for ÖBB's commuter and regional operations in Vorarlberg, Austria

Open season

IN NUMBERS

21 trainsets

6 cars per train

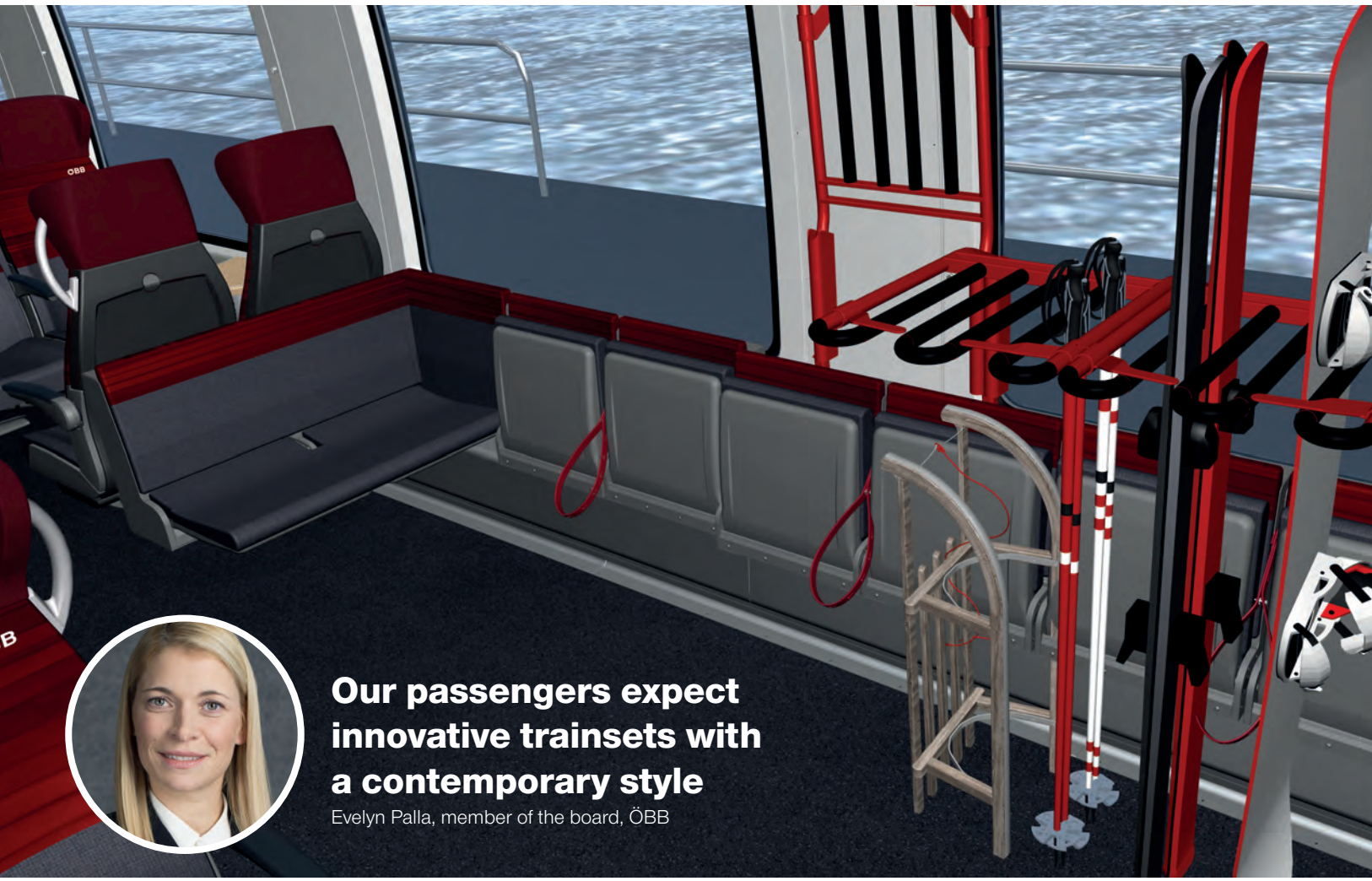
105m (344.5ft) length

2 layouts

304 seats,
428 standing places,
2 PRM places and space for
24 bicycles and
7 ski holders in the
winter version

276 seats,
478 standing places,
2 PRM places and space for
40 bicycles in the
summer version

2 toilets, including
1 PRM toilet



Our passengers expect innovative trainsets with a contemporary style

Evelyn Palla, member of the board, ÖBB

The mountainous Austrian state of Vorarlberg is full of skiers in the winter and cyclists in the summer, as well as having its fair share of commuters. This has led to interesting solutions on ÖBB's new trains for the region, due to enter service from 2019. The operator chose the Bombardier Talent 3 EMU – versions of which have already been customized for future use in Germany, Austria, Switzerland and Italy – as the basis for its design. Christian Diewald, managing director of Bombardier Transportation in Austria, says the contract was won partly because of the train's wide body, which "offers ample space for passengers and allows for the flexible positioning of design features".

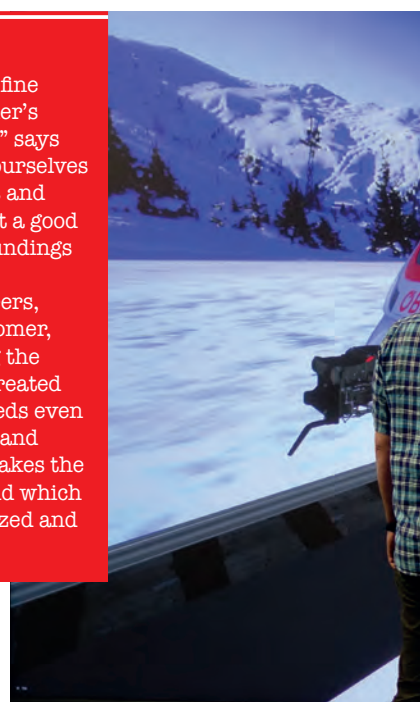
Split personality

The trains can be switched between two layouts, for summer or winter, both with six cars. "Depending on the season, there are adequate capacities for bicycles or ski equipment," says Diewald. "This is a strong advantage in a tourism-driven country such as Austria." In the winter, the trains will have 304 seats, 428 standing places, two places for people with reduced mobility (PRMs) and space for 24 bicycles and seven sets of skis. In the summer, they will have 276 seats, 478 standing places, two PRM places and space for 40 bikes. Both configurations will have two toilets – one of which is suitable for use by PRMs.

DESIGN PROCESS

Bombardier and ÖBB met regularly to define the design. "First, we studied the customer's technical requirements very intensively," says Nicole Michel of Bombardier. "We made ourselves familiar with their culture and the needs and habits of their passengers. We tried to get a good feeling for the tracks, landscapes, surroundings and stations."

Then in close cooperation with engineers, and with regular feedback from the customer, Bombardier created solutions answering the invitation to tender. "Furthermore, we created optional solutions that might fit their needs even better in terms of comfort, maintenance and aesthetics," says Michel. "This is what makes the whole process interesting and fruitful and which often ends up in producing very customized and even unique solutions."

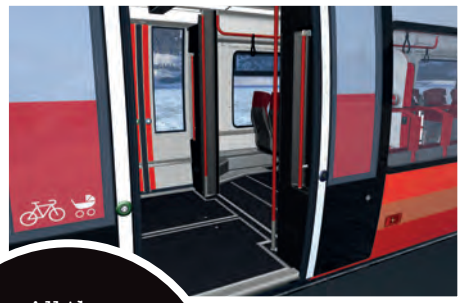


RIGHT: Bombardier Transportation uses a virtual reality room to explore designs

The trains are built to last more than **30 years**, with a midlife interior refurbishment

LEFT: The flexible bike/ski rack is designer Nicole Michel's favorite detail

All the entrance doors have **retracting steps** to enable rapid passenger exchange



LEFT: PRM facilities are concentrated in one area of the train

ABOVE: Eduard Glanzer of ÖBB says the black doors stand out, for speedier boarding

The Talent 3 train can reach **160km/h** (100mph) and has a power output of **4,100hp** (3MW)

TIMELINE

December 2016

Following a call for tenders, Bombardier contracted by ÖBB to deliver up to 300 Talent 3 trains, given notice to proceed with a definite order for 21 commuter trains for Vorarlberg

February 2017

Concept design phase completed

May 2017

Preliminary design phase completed

August 2017

Detail design phase completed

April 2019

Expected delivery of the Vorarlberg trains

A multifunctional area on each train will feature a rack for 14 bikes, which can be repurposed in the winter for sports equipment and a seating area. ÖBB's criteria were that passengers should be able to fix and dispense bikes easily (without them leaning on one another); there should be provision for at least 14 bikes; there should be one holder for each bike; the bike should not be hung; and the front wheel should not be the main holder, to avoid damaging the spokes. "Bombardier patented a bike holder about two years ago that meets the first two requirements," says Nicole Michel, Bombardier Transportation's lead designer on this project. "We just needed to be creative and adapt the existing design."

Bombardier organized a one-day workshop at its site in Hennigsdorf, Germany, to work on the design with ÖBB. "We explored the technical conditions using a 1:1 layout taped on the floor," says Michel. "A 1:1 prototype was available, as well as bikes of different sizes, and we tested entering and fixing the bikes. Proposals and solutions were then verified in our Visual Room lab. Since then, the statics have been approved by our engineering specialist. The supplier is building three prototypes, which we will test in the train."

Mixed message

The multifunctional areas will also feature luggage racks and folding seats. One of these areas has two PRM places, two seats for their companions and a PRM toilet. Michel says it is vital to think about the needs of the various people here, so there is a clear definition, and pictograms to show who is to be seated where. "We have worked very constructively with Austrian associations

The Talent 3 platform can be homologated for the whole of Europe, and will be approved for ÖBB in **Austria, Germany and Switzerland**

Depending on the season, there are adequate capacities for bicycles or ski equipment

Christian Diewald, managing director, Bombardier Transportation Austria

for people with disabilities for many years on projects like this," says Eduard Glanzer, a designer at ÖBB. "Their input has a direct influence on passenger comfort and accessibility."

Another big part of the design involved customizing a standard commuter seat from Kiel. "The most important elements were to improve the headrest, improve the separation with the next seat through a middle armrest, and design an ergonomic seating area to allow passengers, especially morning commuters, to relax," says Glanzer. "With its adjustable seat surfaces, foot supports, fixed headrests, overhead lamp and ample foot space, the redesigned seat fulfills all requirements."

Michel adds that adaptations were made to the form and softness of the cushioning, the shape of the grab handle, the proportion of red and gray used, and the material and width of the armrest. Ergonomics were optimized at the Technical University of Munich. "Its ergonomics department uses the RAMSIS digital human model, which integrates a lot of anthropometric data on central European users, including up-to-date body dimension data," says Glanzer. "In the evaluation, we included standards, guidelines, the RAMSIS study and pressure sensor data."

Technological highlights

Other key tasks included implementing 21in monitors for the passenger information system, and optimizing materials in terms of production and maintenance costs. The trains will also be equipped with security cameras covering the interior and exterior, and with air-conditioning. "It has always been challenging to maintain a certain temperature level, but with the Talent 3's new CO_2 air-conditioning system, we found an environmentally friendly and energy-efficient solution with high volumetric cooling and heating capacity," says Diewald.

As well as modifications that Diewald says create "an even more maintenance-friendly design that enables fast daily visual inspections", other customized elements on board include the driver's desk and a non-slip rubber flooring, chosen from a supplier that could provide it in a very broad width, and in line with the color requirements of ÖBB's corporate identity.

The provision of **WLAN wi-fi** is a first for a commuter/regional train in Austria

ABOVE LEFT: The seats are a customized version of a Kiel model

LIGHT WORK

The lighting concept varies through the train. "The quiet zones at the front and back will have a warm ambience with a color temperature of 2,800-3,000K," says Eduard Glanzer of ÖBB. "For the middle part of the train, which hosts the reconfigurable zones and multi-use areas, we will have a color temperature of 4,000-4,500K, ideal for activities such as reading and working. In addition, each seat is individually equipped with a reading lamp."

Brand designs

In fact, the whole design had to align with ÖBB's corporate design manual for urban/commuter trains, defined in 2014. "Designing a new class of trainsets is a great opportunity to position ourselves as a railway operator that takes special care of our customers' needs," says Evelyn Palla, member of the board at ÖBB. "In recent years, we have developed ÖBB's particular design for commuter and regional traffic, both in terms of functionality and aesthetics. Our sub-brand Cityjet will represent this new style in commuter and regional traffic. The exterior and interior will match and be in line with the standards set by our contracting authorities."

As Austria's national carrier, red and white are very important. "The red tone Ral 3020 has been ÖBB's company color for approximately 35 years," says Glanzer. "For the interior design, we value neutral and timeless themes. The walls and ceilings are painted in gray tones, while the floor features an asphalt look to match its urban surroundings. The handrails are red and fulfill the need to contrast with the surrounding space."

Seats are upholstered in red and gray velour, with wood furnishings completing the modern aesthetic. "Besides punctuality, comfort, safety and cleanliness, our passengers expect innovative trainsets with a contemporary style," says Palla.

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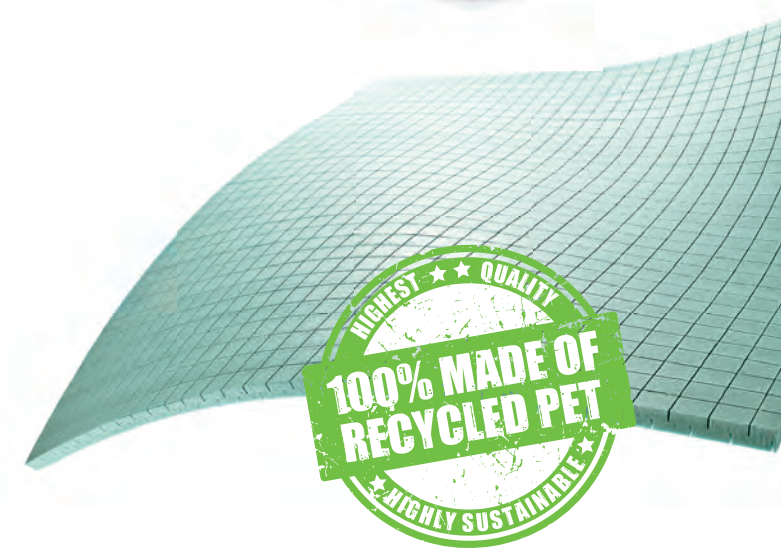

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Railway interiors EXPO 2017

The greatest show yet

Your guide to the must-attend showcase of railcar interior innovations

ALMOST
100
EXHIBITORS EXPECTED!

Railway Interiors Expo heads to Prague, Czech Republic, on **November 14-15**, 2017, to provide a vital showcase of all of the latest and next-generation railcar interior developments. Railcar manufacturers, operators and designers will be able to take a close look at all the very latest railcar interior designs, technologies and components. Visitors will be greeted by everything from seats to flooring, composite materials, sanitary units, lighting, soft furnishings, infotainment systems, and so much more. This year almost 100 exhibitors are expected, from countries including Canada, Japan and the USA – not to mention a very strong European contingent.

The show, which was launched in 2004, regularly attracts more than 2,000 attendees from all over the world. As well as the highly targeted exhibition, another big draw is the carefully curated two-day, two-stream conference, which, like the exhibition, is free to attend. This year almost 50 speakers will share their experiences and ideas – including representatives from Fraunhofer FEP, Idesign Sweden, NewRail, Ostende Vienne Orient Experience, PriestmanGoode, SNCF, Spirit Design and Vienna University of Technology. In addition, tangerine will treat attendees to exclusive design workshops. Networking opportunities continue into the evening of Tuesday, November 14 with a drinks party, which is open to all attendees.

Read on for a taste of the product innovations and conference highlights set to make Railway Interiors Expo 2017 this year's must-attend event.

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SEE MORE RAILCAR INTERIOR TECHNOLOGIES THAN EVER!

ALMOST
50
EXPERT SPEAKERS TO PRESENT AT THE CONFERENCE

FREE TO ATTEND!
DRINKS PARTY
TUESDAY
NOVEMBER 14
5:00PM
ALL ATTENDEES WELCOME!

FREE TO ATTEND!

NON-WOVEN FABRICS

Duflot Industrie will promote its technical non-woven fabrics, which are designed to delay the combustion of materials and mitigate the emission of toxic fumes, in compliance with international standards including EN 45545, BS 6853, NFPA 130 and DIN 5510. Protection against vandalism is a key factor in the development of Duflot Industrie's products; the company designs and produces fender barriers that are resistant to laceration.

Founded in 1980, Duflot Industrie has become a European leader in technical non-wovens for the railway, aeronautics, building, community, personal protection and industrial applications markets.

Stand 1079

NOISE REDUCTION

People like to use their traveling time efficiently without being disturbed by noise, but to travel fast and in silence is a challenge for train manufacturers. **Getzner** will present solutions to make the passenger cabin quieter. Based on EN 45545-2-certified fire-retardant polyurethane material Sylomer FR, structure-borne noise is decoupled with floating floor systems. The new Isotop DZE Railway – an element made from stainless steel combined with Getzner's PU materials – is designed to reduce the structure-borne noise of HVAC systems and weaken strong amplitudes. Getzner has supplied vibration- and noise-reduction solutions for decades. The company says passengers benefit from a lower noise level, while operators gain from lower lifetime costs.

Stand 4047

SPEAKER SPOTLIGHT

Can design encourage positive passenger behavior? That's the debate **Paul Priestman**, designer and chairman, PriestmanGoode, hopes to ignite

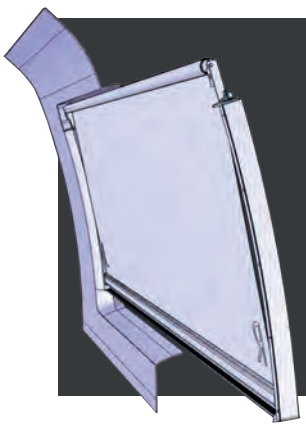
Why did you choose this topic?
There have been countless technological advancements – even just in the past 10 years – that have enabled trains to go faster, directly affecting the design of the vehicles, with the need for better aerodynamics, for instance. Technology, however, has not only affected the design of vehicles or the efficiency of operating systems, it also directly impacts train interiors. For example, most passengers today use smartphones, tablets or laptops, and train operators are increasingly expected to provide internet access and charging points, to counter nomophobia – the fear of being out of cellular phone contact.

I'm also interested in the psychological changes that consumer patterns are having on passenger behavior. People no longer move as crowds. Consider the passenger who delays embarkation or disembarkation because they are looking at their phone or tablet. While for the individual those few seconds might seem insignificant, they have an impact on the system. If this happens at every stop along the way, the whole infrastructure can be delayed.

How can train interior design improve the situation?
I'll kick off the conference program by exploring how we can use design to counter selfish passenger behavior to improve the overall health of our infrastructure. For example, we can create interiors that encourage passenger flow, which results in reduced dwell times at stations.

What do you hope to get out of the event?
I'm looking forward to seeing what new products and materials suppliers have been developing.

Paul Priestman will make his presentation on Day 1 of the conference, Tuesday, November 14, on Conference Stage 1



PRODUCT LAUNCH

SHADE SOLUTIONS

New window shading systems will be displayed by **Texat decor engineering (Tde)**. One of the new systems allows continuous adjustment without jamming, even in the case of large windows and upper-deck windows with curved guiding. This system can also be expanded with a motor to work electrically.

The company says that improvements have also been made to existing systems in terms of operability, mounting time and fire certificates.

Founded in 1990 in Zurich, Switzerland, Tde specializes in customized and individual solutions for rail interiors and related industries. Jürg Scheu, managing director, attaches great importance to the development of new technologies.

The speed and ease of installation/exchange, ease of integration into the production process and ease of maintenance are all continuously tested to optimize customers' costs.

Stand 3048

SPECIALIST LEATHER

SEAT COVERS

The Trainlys range of leather products – on display at **Couro Azul**'s booth – was specially designed for trains. Taking bovine raw material from Europe, the company applies tradition, know-how and the most recent technologies to create a range of leather suitable for applications where durability is key.

Couro Azul's research and development and design departments worked to ensure Trainlys retains the natural look of leather, with the required elasticity and smoothness, anti-soiling treatment and ease of cleaning. The company says the range is produced using an environmentally friendly tanning process and can be supplied in cut and perforated sets ready to be sewn.

Stand 1047

LIGHTING SOLUTIONS

Seat-integrated reading lights will be shown by **CML Innovative Technologies (CML IT)**. These lights utilize touch-sensitive switch technology designed for high reliability, and offering flexibility in terms of location options and the potential to add functions including intensity variation and color adjustment.

Visitors will also be able to see examples of CML's light guide technology, which can be used to create accent and ambient lighting. In conjunction with CML's color-changing light engines, it can also be used to reinforce brand awareness. There will also be the opportunity to see some of CML's large range of LED modules. These can be used to provide additional ambient or emergency exit lighting.

CML IT, part of Grupo Antolin's lighting business, is a vertically integrated designer, manufacturer and seller of miniature lighting systems and components for interior and exterior applications. The unit has more than 1,500 employees and an annual turnover over €300m (US$355m).

Stand 1040

RUBBER FLOORS

FLOORING

Partners **Artigo** and **Mondo** will highlight their expertise in the design, engineering and production of flooring solutions. All ranges can be produced with smooth, embossed or hammered surfaces. Most of Artigo's transport flooring products are produced with a 2m width to reduce the number of joints and make them especially suitable for high-use areas.

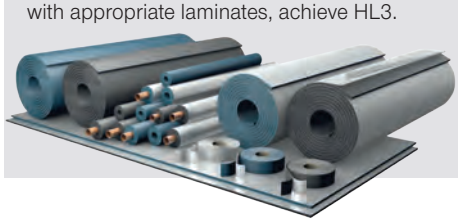
Artigo can supply rubber flooring cut to requested sizes or into kits to speed up the installation process. The company says cutting is done by water jet, without causing any deformation to the flooring and enabling perfect joins between pieces. Artigo floors are created to meet the most demanding international standards for fire and smoke generation behavior.

Stand 3050

STRUCTURAL FOAM CORES

MATERIALS

The ArmaForm PET range of polyethylene terephthalate-based structural foam cores from **Armacell** is designed to combine high strength with low weight, excellent fatigue and durability, superior temperature stability and compatibility with all common resins and manufacturing methods. With regard to EN 45545-2, Armacell says the range offers very low smoke and toxicity levels when subjected to fire; testing has shown that ArmaForm PET cored sandwich structures, in combination with appropriate laminates, achieve HL3.



Armaflex Rail – a range of flexible closed-cell insulation materials with integrated fire protection – will also be showcased. Armaflex Rail achieves HL2 R1 and is classified under NFPA 130, GOST 12.1.044-89 and DIN 5510-2.

Meanwhile, Armaflex Rail SD-C is for use in areas requiring HL3. Its silver covering is UV resistant, protects the material against mechanical impact, and is easy to clean.

Then there is Armaflex Rail ZH, a halogen-free, closed-cell insulation material that achieves the HL2 R1 classification; and Armaflex Rail ZH-C, which achieves HL3 R1 and can be used in operating class 4 in underground track sections and tunnels.

Stand 2040

FREE TO ATTEND!

STAFF UNIFORMS

High-quality uniforms are a vital finishing touch to a rail operator's service, and that is where **Modus** comes in. The Polish company has specialized in the production of uniforms, suits and corporate clothing for more than 70 years. It creates roughly 60,000 pairs of trousers and 50,000 jackets every year, serving 100 Polish institutions and exporting its products to more than 15 countries.

Despite the scale of its production, the company prides itself on taking an individual approach with each client, as well as a commitment to quality that is reflected in its ISO 9001 2008 and AQAP 2110 2009 certificates.

Many organizations require their representatives to wear specific clothing that is not only of high quality, but also constitutes a trademark. It has to be elegant while also meeting functional requirements. For Modus, it is very important that such clothing is not only comfortable, but suitable for all the seasons.

Stand 1080

SPECIAL PROJECT

HEATED FLOOR

The EC 250 from Stadler Rail made its first trip through the Gotthard Base Tunnel in Switzerland at the beginning of July 2017. For the first time, the entire floor of a high-speed train was equipped with an electrically heated floor system including sound insulation from **Metawell**.

The floor is made from Metawell's double panels, which are corrugated to enable the integration and protection of the heating cables. An additional panel is filled with special sand. This results in a heated floor panel and, in certain areas, a sound reduction index of Rw =36dB, despite the total weight of 20kg/m² and 22mm panel thickness.

Stand 2025

SEAT COVERS

GREEN LEATHER

Swedish tannery **Elmo** has focused on the environmental aspects of its processes for decades, making its booth a key destination for rail operators looking for an environmentally friendly leather that exceeds international standards in terms of certifications such as EN 45545.

In 2004, Elmo invested in a €5m (US$5.9m) cleaning facility that enables it to reduce nitrogen by 94%, chromium by 99.6%, BOD by 99.9% and COD by 99.1%. The company says the reduced amount of water used in the tanning process is taken from a nearby river and later returned into it cleaner than before. Downstream, a regional cleaning facility is turning the river water into drinking water, supplying cities on the west coast of Sweden. "We proudly see this as a proof of our minimum impact on the environment and as a great leap in becoming at one with nature," says Jimmy Ahlgren, sales director at Elmo.

Stand 3015

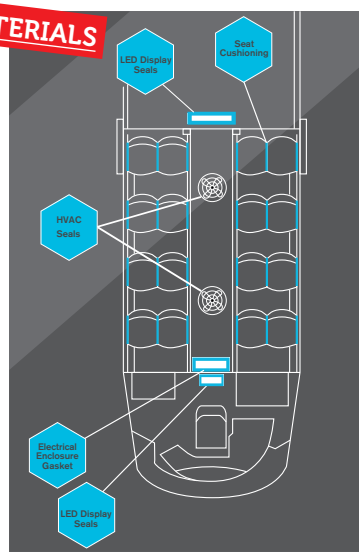
MATERIALS

SILICONE SOLUTION

In all rail interior applications, health and safety is critical, and materials must also offer excellent durability and a long lifespan – which is why silicone is used extensively, says **Silicone Engineering**. kSil V-0 is a closed-cell silicone sponge formulated to improve fire and smoke safety where high-performance sealing and insulation is needed. It is flame-retardant to UL94v-0 and compliant with EN 45545-2.

The low-density silicone sponge can be used in seat/cushioning applications; the material is designed to offer great comfort and excellent recovery from extensive use. It is also formulated to withstand temperatures from -60°C to 230°C while sealing to IP67. Silicone Engineering says the material's flexibility allows simple installation on even the most complex-shaped HVAC fittings. kSil V-0 has a compact, closed-cell structure designed to absorb vibration.

Stand 1081



MODULAR SEAT RANGE

A seat described as "the first antibacterial seat in the world" by supplier **STA 2000** will be highlighted. The modular Romeo range was designed in Italy to offer the advantages of low weight, high strength, great ergonomics, modularity and protection from vandalism.

The 'plastic-free' seats are available in aluminum or wood. Aluminum versions can be supplied with wooden, soft or fabric pads. School bus models come with seatbelts. Flip and tip-up seats are also available.

Stand 2080

TURNKEY INTERIORS

Colway Ferroviaria recently moved to new facilities in Barcelona, Spain, which offer more assembly, logistics and office space. The company is a turnkey partner for the design, engineering, manufacture, supply, installation and commissioning of rail interior projects. It has developed interiors for a wide variety of railcars and trams, in addition to toilet modules.

In the past five years, Colway Ferroviaria has refurbished 196 passenger coaches, delivered complete interiors for 212 coaches, supplied more than 400 toilet modules, modernized seats for long-distance trains and delivered components for sleeping coaches. Recent projects include a cooperation with EMEF for the refurbishment of CP Pendolino trains; minor refurbishment projects with Metro Barcelona and Catalonian Railways; and the development of a Universal Toilet Module for the British market, meeting TSI Method B.

Stand 2017

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SPEAKER SPOTLIGHT

Two presentations will be made by **Dr Bernhard Rüger**, researcher at Vienna University of Technology. In one he will warn of the potential drawbacks of concepts designed to make maximum use of space, and in the other he will present an idea for integrating the air baggage drop-off process on the train

How might designs aiming to maximize efficiency have the opposite effect?
Today's focus is on maximizing the number of seats to gain the highest possible return. This partial view leads to a lack of baggage storage. As well as disregarding passengers' basic needs, this always leads to items blocking seats, aisles, entrance areas, and so on – resulting in safety and operational problems such as fewer available seats or higher dwell time.

What design improvements do you propose?
By reducing the number of seats in a considered way, and installing well-designed baggage storage areas, these problems can be reduced. Dwell time will be much shorter and many more seats will be available – increasing efficiency.

What is your argument for making airline baggage drop-off a part of the train journey?
To reduce greenhouse gases, and for other reasons, the EU is focusing on replacing short-distance feeder flights with train trips, through special cooperations. Airlines that offer such code-share journeys in trains want to ensure the shortest possible connecting time at the airport, ideally equivalent to a transfer between aircraft.

How might it be done?
An Austrian consortium of relevant players researched how to handle baggage drop-off on the train. The first results show that there are realistic options that recognize the passengers' needs, as well as all rail and air operational requirements and safety issues. Our first ideas will be shown at the conference.

Dr Bernhard Rüger's two presentations will both be made on Day 2 of the conference, Wednesday, November 15

PLASTIC EXTRUSIONS

MATERIALS

Those looking for plastic extrusions for their railcar interior projects should head to **Certified Thermoplastics**' booth, as this has been the company's business since 1978. It specializes in the extrusion of high-temperature materials designed to pass strict flame, smoke and toxicity requirements including EN 45545-2; and offer weight savings versus metal alternatives.

The company says its custom extrusions are the perfect solutions for lightweight seat track covers, moldings, LED lighting tracts and lenses, ducts and conduits, and that it has had great success replacing semi-structural aluminum interior parts with glass-reinforced engineering thermoplastic extrusions, saving customers weight and cost.

The family-owned company is located in California, USA, and ships worldwide to customers including Bombardier Transportation, Airbus, Boeing, Lockheed, Thales, Keysight, Zodiac and Diehl Transportation.

Stand 3027

FIRE TESTING

READY FOR EN 45545-3

Navigating the development and approval of materials covered by fire regulations calls for the kind of specialist knowledge to be gained on **CREPIM**'s stand. The company provides a complete set of fire testing methods to characterize how materials and assemblies react to fire. For European railway applications, CREPIM offers fire testing according to EN 45545-3, with fire resistance methods developed for technical cabinets; and according to EN 45545-2, including annexes A and B for seats and C for smoke toxicity. For the French railway, fire testing can be conducted according to NF F 16 101/102 and 201, and for the USA, according to NFPA 130, including the ASTM E 162 radiant panel test.

Stand 1055

FREE TO ATTEND!

RUBBER FLOORING

Durability, slip-resistance and safety are just a few of the requirements for rail flooring, says **nora systems**, which will show its customized solutions. Its products include nora nTx, which consists of sheet rubber flooring with a pre-applied, solvent-free self-adhesive.

The company has also developed a new inlay technology to boost the quality of inlay elements and expand design possibilities. The shape of the desired inlay is milled into a rubber floor covering using a CAD-controlled router. The inlay is cut to exactly the right dimensions and then glued into the groove.

The process also enables the insertion of phosphorescent elements and light strips, as well as the precise cutting of contours over long stretches of flooring, to the nearest millimeter.

Stand 4030

WIDE RANGE

Schliess- und Sicherungssysteme will showcase everything from partitions to handrails (including models with antimicrobial powder coating), refuse containers, luggage racks, interior doors, driver's cab doors and tables. The company also offers locking systems and hardware, components for access and gangway systems, and exterior components.

Meanwhile, stand partner **GETA** will highlight its expertise as a producer of interior design elements and system components, including coated molded and sandwich construction parts. GETA's product range includes tables, floor systems, air ducts, ceiling systems, toilet systems, door covers and sidewall covers.

Stand 3045

BIG ANNIVERSARY

Ruspa Officine is celebrating its 80th anniversary this year by showcasing its capabilities in the design and production of interior and exterior equipment, including seats.

The company is based near Turin, Italy, and has extensive experience in the transport industry. In developing its products, Ruspa Officine focuses on safety, adaptability, reliability and quality, to ensure a long life.

Stand 2055

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Hosted by tangerine

FREE TO ATTEND

DESIGN WORKSHOPS

After hosting a series of popular and well-attended delegate workshops on the value that design can bring to rail as part of Railway Interiors Expo 2015 program, global strategic design consultancy tangerine this year returns to Prague to offer a new series of interactive sessions.

The sessions will help to identify, address and encourage fresh thinking around some of the key challenges for rail. The workshops, run by leading designers and industry experts, will focus on how to create a seamless, end-to-end passenger experience through design. Train operating companies, rolling stock manufacturers, key suppliers and industry stakeholders alike will gain insights into how design can improve the customer experience and their bottom line.

Tangerine's chief creative officer, Matt Round, will also be giving a talk at the conference about how a passenger-centric approach to designing for rail can differentiate a service from competitors, improve the customer experience and drive commercial value into a business.

With more than 20 years' cross-sector experience creating products, services and experiences for global brands including British Airways, LG, Toyota, Virgin Australia and Heathrow Express, Round will show examples of how design can transform rail's offering today, and concepts that present a vision for the future.

RECRUITING AT THE SHOW

ENGINEERING SERVICES

As well as highlighting its engineering services and solutions, **Cyient** will use the show to interview potential recruits. The company has various rail transportation engineering and technical documentation positions open. Potential applicants should visit the company's website for more information on the roles available, or email Zuzana.Filipova@cyient.com to arrange an in-person meeting.

The company is based in Prague, Czech Republic and has more than 25 years of experience, collaborating with global players including 22 Fortune 500 and 27 Global 500 blue-chip companies. Cyient has a network of more than 14,000 associates across 38 locations, and delivers engineering designs for a variety of industries.

Stand 2075

MATERIALS

INTERIOR COMPOSITES

ITSA, a specialist in composites for railway interiors, offers new technologies intended to increase quality, creative design and competitiveness for clients. In addition to its sheet molding compound (SMC) and hand lay, CNC robots, wet coating and assembly expertise, the company recently introduced light resin transfer molding (RTM) and powder in mold coating (PIMC) technologies.

According to ITSA, by means of equipment for mixing and the automatic application of resins, the RTM process enables the manufacture of polyester parts for low-to-medium-range projects, without large investments.

The company goes on to say the robotic application of PIMC directly in the manufacturing process guarantees a finished product with higher resistance to scratches than using

conventional paints, and that overall, light RTM and PIMC technologies guarantee a high-performance manufacturing process, flexibility, cost containment and optimum quality, along with ensuring compliance with the highest international quality requirements.

Stand 2060

NEW PRODUCT

PED-FRIENDLY TRAY TABLES

Seat tray tables that facilitate hands-free use of PEDs are available from **SmartTray Rail & Bus**, which works with companies around the globe to integrate and deploy these patented solutions in the transportation sector. The tray tables are also designed to provide enhanced ergonomics, better space management and improved comfort over conventional tray tables.

The company has begun the registration process for ISO:9000 and AS9100. Each seatback or in-arm solution comes in a wide field of envelope sizes. SmartTray Rail & Bus has the flexibility and the in-house resources to create a custom tray for each customer. Customers include United Airlines, Interjet Airlines and Princess Cruises America, which operates a rail line in Alaska.

Stand 2030

NEW PRODUCT

SOFT FURNISHINGS

Individualized train seats, ready-made seat covers and new leather collections will be on show at **Boxmark**'s stand. One of the new collections is the leather Duke, which is available in 55 stock colors and with a minimum order quantity of only one skin (approximately 5m^2) per color. The company says that, as with all its railway leathers, Duke fulfills all physical testing standards relevant to the rail sector – including EN 45545. The leather is 0.9mm-1.3mm thick and weighs less than 800g/m^2. Boxmark's customary easy-care finish is designed to ensure easy cleaning and ideal resistance to soiling.

With 8,200 employees at nine sites, Boxmark can offer services ranging from research and development to design and leather manufacturing, up to the finished product. The company can also create foam models, perform foam reconstructions and add upholstery to existing seat systems and add-on components. Besides the rail sector, the Austrian company also supplies the automotive, aviation, maritime, domestic and contract sectors.

Stand 1000

FREE TO ATTEND!

NEW PRODUCT

DIGITIZED SEWING

Industrial sewing machines selected specifically for the production of transport interiors will be shown on **Juki**'s stand. There will be a strong focus on digitization and Industry 4.0, both on the booth and in a conference presentation to be made by in-house expert Andreas Korz – Seams in the time of Industry 4.0 – on Conference Stage 2 on Wednesday, November 15.

A highlight of the machines on show will be the new flagship model, the LU-2828V-7. This is a semi-dry, direct-drive, sewing system with vertical-axis 2.7-fold-capacity hook, thread trimmer and digitized interface. The machine has been digitized to enable settings including the feed mechanism, thread tension and feed locus to be adjusted easily through a touchpanel or Juki Smart App for Android. The optimum adjustment values required to produce high-quality seams are stored in the machine's memory, and can be reproduced with ease across a production line.

Stand 2073

HEAVY-DUTY FLOORS

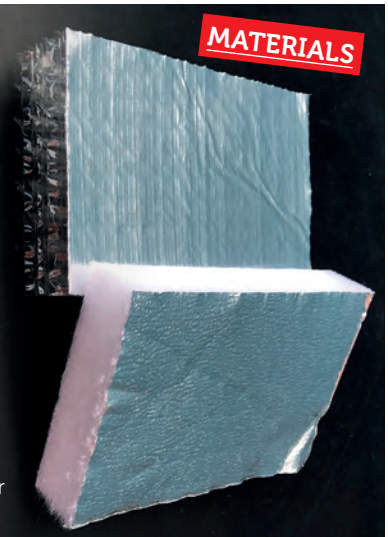
FLOORING

Floors need to be particularly hard-wearing and safe on trains; so **wineo** has developed a special product to deal with these high requirements. Purline Rail is fireproof (EN 45545 approved), non-slip and designed to be extremely long-lasting, being resistant to chemical and mechanical influences and offering maximum UV resistance. The company also says Purline Rail reduces impact sound greatly, is lightweight, the décor can be tailored and it boasts strong ecological credentials.

Stand 2012

LIGHTWEIGHT INSULATION

MATERIALS



Moniflex, an insulation material for train coaches, will be the focus for **Isoflex**. The company says key advantages of its product include its weight (13kg/m^3), ability to drain condensation, low environmental impact and longevity of up to 30 years. The material is non-fibrous and designed to be easy and economical to cut and handle.

Isoflex also makes insulation sandwich combinations and can deliver pre-cut batches according to drawings.

Stand 4002

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SPEAKER SPOTLIGHT

Guillaume Craveur, fire safety engineer at SNCF, will discuss efforts by France's national carrier to meet the requirements of EN 45545-2 ahead of schedule

What challenges arose with the publication of EN 45545-2?
For a railway operator, the challenges presented with the publication of EN 45545-2 are to standardize the products we install in old and new rolling stock. We have been working on the application of this standard for five years.

How is EN 45545-2 impacting the industry?
EN 45545-2 is making a huge impact on the railway industry. For French applications, a lot of products were compliant to NFF 16-101 and NFF 16-102. Some of these products are now not compliant with EN 45545-2, so manufacturers must develop new products that are. Moreover, some of the threshold values of EN 45545 were decided at the beginning of 2000 and do not account for the EU's REACH regulation, which concerns chemical hazards. This means that currently, few products are compliant with EN 45545-2's hazard level 3.

What are you looking forward to at the event?
I'd like to meet manufacturers and see how their products comply with EN 45545-2.

Guillaume Craveur and his colleague Thierry Dupré will make their presentation on Day 1 of the conference, Tuesday, November 14, on Conference Stage 1

THERMOFORMING MATERIALS

Metzeler Plastics, part of VitasheetGroup, will present thermoforming materials. It is developing thermoplastic sheet material according to EN 45545-2R6 for the railway industry.

VitasheetGroup specializes in the manufacture of custom-made extruded thermoplastic sheets and rolls. Its ViSpec range includes performance-based products designed to offer flame-retardant, UV-stabilized, weather-resistant, high-impact and scratch-resistant characteristics.

VitasheetGroup has production facilities in various places around Europe to enable it to react quickly and efficiently to the demands of the local market.

Stand 4055

PHENOLIC AND EPOXY RESINS

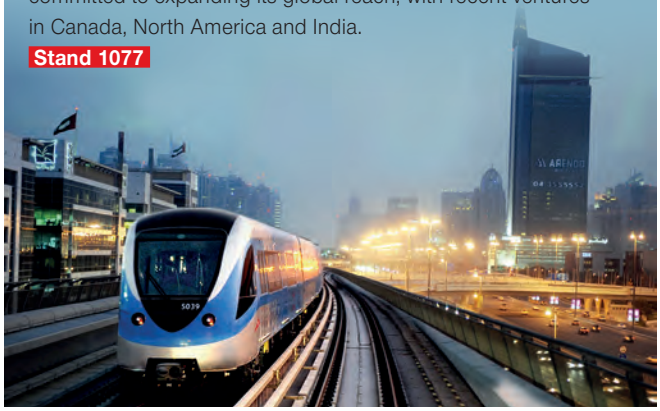
As well as Cellobond phenolic resins, Phencat catalysts, Epikote epoxy resins and Epikure epoxy curing agents, **Hexion** will showcase processing techniques including resin infusion, VARTM, prepreg and hand lay-up. The company says that phenolic systems offer superior flame, smoke and toxicity performance, adding that phenolic composites allow manufacturers to meet stringent flammability regulations, including EN 45545-2, at a lower cost than alternative materials that require flame retardant coatings. New ultra-low emitting phenolic resin systems (free formaldehyde below 0.1%) combine the performance and fire safety of traditional phenolics with enhanced safe handling and processing.

Stand 1075

CHEMICAL SOLUTIONS

FST resins, gel coats and adhesives will be the hot topic on **Scott Bader**'s stand. The chemical company manufactures these solutions for a variety of industries, including rail. Established in 1951, the company now employs more than 650 people across six manufacturing sites and 11 offices. It is committed to expanding its global reach, with recent ventures in Canada, North America and India.

Stand 1077



SPEAKER SPOTLIGHT

Dr Emmanuel Matsika, research associate at Newcastle University's NewRail, will discuss the potential of standing seats on commuter trains

Are standing seats growing in popularity?
We have seen an increase in their use in open standing areas on metro and light rail vehicles – these areas are also used as wheelchairs spaces. Currently, they come in the form of continuous longitudinal seats connected to the sidewall. The emphasis of this paper is the idea of transverse standing seats, a compromise between the comfort of seating and the capacity gain of standing space.

What do designers need to bear in mind when including them?
The first consideration is the category of train; standing seats are best suited to commuter applications. To provide a reasonable degree of comfort, human factors and ergonomics must be considered. The other factor is the desired passenger density; standing seats offer a lower capacity than standing spaces, but more comfort, safety and security. With ingress and egress playing a major role in efficient train operations, the standing seat layout must be designed to enable a smooth flow of passengers. In addition, the configuration should take account of the needs of people with reduced mobility. Finally, to make standing seats economically competitive, they need to be manufactured economically.

What are you looking forward to at the event?
I am looking forward to networking with train interior and door designers, as well as material manufacturers, who could promote the implementation of our research on standing seats. I would also like to network with research institutions interested in furthering the idea.

Dr Emmanuel Matsika will make his presentation on Day 1 of the conference, Tuesday, November 14, on Stage 1

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Conference program

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CONFERENCE **STAGE 1**

Day 1: Tuesday, November 14

Keynote presentation
Peter Köhler, CEO, LEO Express, Czech Republic

Can design encourage positive passenger behavior?
Paul Priestman, designer and chairman, PriestmanGoode, UK

Commuter trains standing seats: consideration for persons with reduced mobility
Dr Emmanuel Matsika, research associate, NewRail, Newcastle University, UK

Use of technical specification to complete EN 45545-2 at SNCF
Thierry Dupré, fire safety expert, SNCF, France

Guillaume Craveur, fire safety engineer, SNCF – Direction du Matériel, France

Re-energizing the Enterprise fleet
James Alton, head of industrial design, SNC Lavalin Rail & Transit, UK

This presentation will be delivered in Czech

Význam uživatelské přívětivosti dopravních terminálů
Petr Šlegr, project manager, Centre for Efficient Transport, Czech Republic

This presentation will be delivered in Czech

Moderní služby pro cestující jako podmínka konkurenceschopnosti
Miroslav Vyka, president, Czech Public Transport Passengers Association, Czech Republic

AeroLiner3000 – the capacity booster for British railways
Andreas Vogler, director, Andreas Vogler, Germany

Total solutions for making EN 45545 composites: HL, injection, infusion
Paul Wartenweiler, BU manager composites, Walter Mäder Composites, Switzerland

Integrated development – the power of cooperation
Daniel Huber, managing partner strategic design, Spirit Design – Innovation and Brand, Austria

Seams in the time of Industry 4.0
Andreas Korz, business development, Juki Central Europe, Poland

Day 2: Wednesday, November 15

Fire-retardant materials for railway applications and European standards
Franck Poutch, president, CREPIM, France

Transformation not disruption – creating tomorrow's passenger experiences
Matt Round, chief creative officer, Tangerine, UK

Air-baggage drop-off during train ride to the airport
Dr Bernhard Rüger, researcher, Vienna University of Technology, Austria

How to ensure good design to attract passengers in Scandinavia
Johan Larsvall, industrial designer/CEO, Idesign Sweden, Sweden

Innovative floor system with high sound reduction and heating
Klemens Wesolowski, managing director, Metawell, Germany

High-performing passengers, and rethinking boarding and alighting
David Watts, managing director, CCD Design & Ergonomics, UK

Born from knowledge: R&D design-driven innovation approach
José Rui Marcelino, CEO, Almadesign, Portugal

Thermal and acoustic isolation through easy-to-assemble light panels
David Cnockaert, head of engineering and project management, Groupe Stratiforme-Compreforme, France

Renovation of coaches from La Compagnie Internationale des Wagons-Lits
Kristof J Blomme, CEO, Ostende Vienne Orient Experience, Belgium

Developments of PET MC multicore sandwich solution
Stefan Reuterlöv, technical manager, Armacell, Sweden

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CONFERENCE **STAGE 2**

Day 1: Tuesday, November 14

EN 45545 material solutions – prolonging service life and protecting equipment
Faizan Nasir, market development manager, Rogers Corporation, USA

Measuring robotic to test the quality of railway interior
Günther Battenberg, managing director, Battenberg Robotic, Germany

January 2018: transition period over – mandatory use of EN 45545
Beth Dean, technical leader, Exova Warringtonfire, UK

SmartTray PED tray tables: enhancing the passenger experience
Jay Esty, chief operating officer, SmartTray Rail and Bus, USA

EN 45545 – floating floor and HVAC noise decoupling systems
Stephanie Noll, application engineer, Getzner Werkstoffe, Austria

Exploring the future of sustainable seating materials
Alex Bennett, business unit director, E-Leather, UK

Unlocking the door to European grant funding
Graham Gibbons, business development, GH Associates UK

Safety in and around the railcar: a multifaceted manufacturer's challenge
Axel Hollstamm, key account manager, Southco Manufacturing, UK

Rail technology – a solution or a problem?
Christian Wollmar, award-winning writer and broadcaster specializing in transport, Christian Wollmar, UK

Day 2: Wednesday, November 15

EN 45545-2: test methods, classification criteria and impacts on materials
Raphaël Lorigny, fire safety engineer, CREPIM, France

OLED – a new technology for integrated lighting and signage
Dr Christian May, division director, Fraunhofer FEP, Germany

Bonded build-ups improve strength-to-weight ratios of thermoplastic components
Rich Cort, business manager - mass transit, Sekisui SPI, USA

The challenge for flame retardants in transport and mobility
Karyn Wallaert, business development manager, Devan Chemicals, Belgium

Passenger-friendly and operationally efficient rail vehicle interiors
Dr Bernhard Rüger, researcher, Vienna University of Technology, Austria

Multifunctional modular train floors – project COMMUTE
Antonio Coelho, R&D director, MCG Mind For Metal, Portugal

Touchless toilet on board
Han Phan, vice managing director, Petech Corporation, Vietnam

Manufacturing of EN 545545-2 HL3-compliant composites parts with phenolic resins
Pat Colclough, business manager north Europe and composites, Hexion UK

*This program may be subject to change

Hot topic

Manufacturers share the lessons they have learned from using phenolic resins to create composite parts meeting EN 45545-2 HL3

Until now, fire safety regulations for rail interiors varied across Europe, meaning manufacturers had to contend with a range of requirements. However, the new interoperability of the Trans-European High-Speed Rail System Directive 2008/57/EC aims to harmonize rail systems throughout the EU. The fire safety requirements for rolling stock are laid down in the forthcoming fire safety standard EN 45545. This directive regulates material selection for trains and their interiors, depending on the train and track type. Materials are generally specified such that they resist burning long enough for passengers to escape.

EN 45545-2 assigns specific rail applications to three hazard levels – HL1, HL2 and HL3 – to account for different design and operating considerations. “New and refurbished trains for use in Europe must meet these new rules, which place more stringent controls on the manufacture of rail components than ever before,” says Sara Frattini, global market segment leader for composites at Hexion. “Operators need to reconsider their material selections and re-test all parts and materials. They need to be able to warrantee safety on their trains in an economically viable way.”

Common ways in which manufacturers are addressing the issue of EN 45545’s higher fire, smoke and toxicity (FST) requirements are by using aluminum or other metal structures, composites manufactured with polyester or epoxy resins with flame-retardant fillers and intumescent gel coats, or composites made with phenolic resins that can meet fire safety performance requirements without fire-retardant additives or intumescent gel coats.

Phenolic systems

Hexion has developed Cellobond phenolic systems designed to enable the cost-effective manufacture of composite parts that fulfill the strictest of these new fire safety regulations, including the HL3 classification. Cellobond resins have been used for exterior parts – including train fronts, roofs and doors – for decades. They have also been used for interior parts including ceilings, flooring, side panels, window surrounds, standbacks, luggage racks, drivers’ desks, toilet modules and heat shields. Cellobond products can be used in combination with Phencat catalysts for processing by vacuum infusion, resin transfer molding (RTM), hand lay-up and pultrusion.

Railway interiors EXPO 2017 EXHIBITOR Stand 1075

LEFT: Phenolic resin-based composites can be used to create many interior parts, including components for trains categorized as HL3

ABOVE: A door covering made for a Bombardier DRL train in London, UK

LEFT: A sidewall panel for a Siemens Avanto train

CELLOBOND PROJECTS

Cellobond phenolic systems have been used by manufacturers Mtag Composites and Qantos for a variety of rail projects.

Mtag Composites has produced fiber-reinforced phenolic mouldings for projects including interior panels for Virgin's West Coast Main Line Class 390 Pendolino trains; fire-protection paneling at Canary Wharf, a London Underground station; cab interiors and underframe cooling ducts for Bombardier's new Aventra trains; and interiors for Hitachi Rail's Class 800 trains.

Meanwhile, Qantos has finalized many projects using phenolic resins, including side-wall paneling, skirt flaps and boarding door paneling for the Avanto used in Paris and Mulhouse, France; the driver desk and driver cabin paneling for Desiro DMUs; interior paneling for the VAL 208 in Rennes and Toulouse in France, Turin in Italy and Uijeongbu in South Korea; interior paneling for RET in Rotterdam, the Netherlands, and the DLR in London, UK; roof equipment paneling for the Eurostar Velaro D in Turkey; driver cabin paneling, WC paneling and exterior paneling for the Thameslink Desiro in the UK; and boarding door paneling for the Desiro RUS in Russia.

Manufacturers using Cellobond phenolic systems include Mtag Composites and Qantos. "The advantage of phenolic-based composites is the ability to mold complex shapes while being able to reconfigure the structure of the panel," says Nick Maltby, managing director at Mtag Composites. "Weight and costs are also lower than most other options. This resin system offers low viscosity with no added fillers, and surpasses all the rail industry's common fire requirements. Phenolic composites are also very durable and stand up to harsh environments, such as underground train interiors."

Qantos began working with phenolic resin systems in 2003. "EN 45545-2's HL3 qualification can be reached with phenolic resins, where alternatives mostly fail," says Josef Wolf, construction/development leader at the company. "We specialize in small-to-medium production quantities, so the RTM process is very important to us. To fulfill the new fire safety requirements, other resin systems often contain large amounts of fire-retardant additives, usually in powder form, which strongly reduce system flow. Because of phenolic resins' better flow properties, a higher glass content can be achieved, resulting in mechanical properties comparable to highly filled polyester resin systems. The resin costs are also in the same range. Our customers no longer have reservations."

Wolf adds that phenolic resin-based composites can be around 10% lighter than high-filled resin systems, and are as color stable as other resin systems. "Most parts must be coated to match the color of other components," he says. "Thus, phenolic composite parts are

LEFT: A door cover part with grab handle, made from Cellobond J2027 by Mtag Composites for a Hitachi intercity train

BELOW: Qantos used RTM to make this front flap from Cellobond J2027, for a Siemens Desiro Thameslink train

SAFETY FIRST

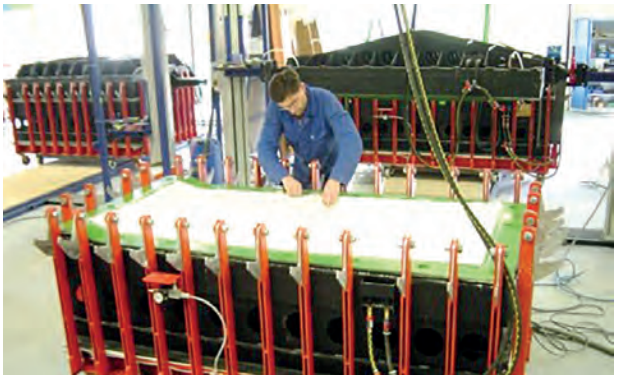
Hexion says a common misconception about phenolic resins is that they are unsafe. "They actually make trains safer through their intrinsic fire resistance, low flame spread, and minimal smoke and toxic emissions," says Sara Frattini of Hexion.

The company has also developed Cellobond ULEF resins to address customers' concerns about formaldehyde emissions. "Free formaldehyde levels in these liquid resins have been further reduced, to below the hazard threshold of 0.1%, offering lower-emitting processing options," says Frattini.

Regarding handling, Nick Maltby of Mtag Composites had heard many concerns. "However, after gathering the facts and implementing the supplier's advice, I found phenolic resins to be no more restrictive than standard polyester processing," he says.

Qantos's initial concerns have also been allayed. "By working with a closed process/tooling, the employee hardly has any contact with the resin," says Josef Wolf of Qantos. "Nevertheless, all safety regulations should be respected – for example, the workplace must have good ventilation. Our employees wear respirators during demolding, as they also do for other systems."

Wolf says regular measurements of workplace emissions have shown that phenolic resin emissions are well below the permitted limits.



RIGHT: The RTM process in action at Qantos

BELOW: A washtable wall created for a Siemens Desiro Thameslink train

protected from UV radiation. As a high-cross-linked plastic, phenolic resin has excellent aging and chemical resistance properties."

Processing methods

Mtag uses infusion, injection and hand lay-up methods to produce phenolic composite moldings. "The processes for phenolics are very similar to standard polyester processing methods," says Maltby.

For Qantos, RTM with a heated tool is usually the first choice. "The process involves hardening the resin under heat," says Wolf. "However, this has an advantage as well: very long injection times are possible, and thus complex and very large parts can be created, if the heating is started when injection is completed. The temperature stability of phenolic resin-based parts is also very high. At the same time, corrosion-resistant equipment is usually required to process phenolic resins and hardeners, which must be considered in systems engineering (injection system) and choice of tooling materials."

Wolf adds that in the RTM process, it is often necessary to have a defined geometry on the back of components as a contact surface or for mounting metal holders. "Closed mold tools allow us to work with high pressure, which counteracts pore formation and enables the mold to be filled much faster," he says.

Wolf's main advice for ensuring the best quality is to ensure tooling is good. "Injection under pressure requires tools with sufficient stiffness," he says. "A uniform temperature and sufficient form-building materials are also very important. Resin-rich zones should be avoided because unreinforced resin is very brittle."

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Look lively

The color, light reflectance and sound-absorption properties of interior furnishings can make a big difference to the customer experience

In 2014, UITP recorded 57.6 billion public transport journeys in the EU – surpassing the previous peak in 2008 and equating to 152 journeys per year by the average EU citizen. "People can travel further and are taking more and longer journeys," says Bob Summers, key account manager at Forbo Flooring Systems. "The combination of this increasingly competitive environment and the rise of social media platforms – which give passengers a voice – means transport operators must now do more to satisfy the rising demands of their customer base. The rail industry is no longer just about function, it is experiential and increasingly design-led."

One of the trends Summers notes is that operators are taking light and sound into consideration more when developing train interiors. "Research shows that on sunny days, people feel better and are more helpful, and that emotions are intensified in bright light – people found positive words to be even more positive in brighter settings," he says. "Natural lighting has a very calming effect and dark environments can trigger depression. As passengers spend longer on public transport, the environment has a greater impact on their wellbeing. Lots of natural lighting can encourage passengers to be more engaged in and receptive to the journey they've had."

Window dressing

Although research into the impact of light on passenger experience is limited, there is clear evidence on social media. In the UK, the #saveourwindows Twitter campaign has led to operator Northern removing graphic wraps from its vehicles.

"Covering windows with advertising graphics has a big impact on the amount of light coming in, and the passenger's visual experience," says Summers. "We all like to be connected to the outdoor world, especially on journeys where you can see views of the beautiful countryside."

On reflection

Considering a material's light reflectance value (LRV) can also be important, so Forbo Flooring Systems notes this on all point-of-sale materials. "Using paints, wall coverings and floor coverings that have a good LRV can enhance the passenger experience, as they create a brighter, more inviting space," says Summers.

Another factor that can impact the passenger experience is sound. "If the passenger's environment is too noisy, it can create discomfort," says Summers. "Noise is generated by the vehicle and other passengers, but can also be affected by the materials used inside the train. Operators should consider the acoustic properties of flooring, wall coverings and windows."

Color psychology

Color clearly plays a massive role in creating a recognizable brand. For example, most passengers will instantly recognize a Virgin train by its red branding. "All Virgin Trains' advertising and train interiors

LEFT: Bob Summers on a Virgin train, for which Forbo Flooring Systems supplied its Tessera FR floor covering

RIGHT: Marmoleum FR installed in Dutch Rail vehicles in The Netherlands

CO-CREATION

With the prevalence of social media, customer service has little room for error these days. Bob Summers of Forbo Flooring Systems has noticed that public transport operators are beginning to include passengers in the design process. "This enables the provider to tailor its services to customer needs and to strengthen relationships," he notes. "When customers are listened to, they feel valued and generally happier."

Greater Anglia, a UK operator, is developing trains to enter service in 2019. As part of its public consultation process, the company has stationed a full-size mock-up of the train at its depot in Norwich. This is enabling Greater Anglia to gather timely and relevant feedback from invited customers and partners so that it can gain a real understanding of its customer base and adapt the design to meet their needs.

and exteriors feature this special hue, engaging passengers in the brand," says Summers. "The operator has also made the shade a talking point, with its #RedHot online campaign."

The colors operators use in their trains can also affect passengers' mood. Summers has some suggestions tailored to pleasing two types of customers – those traveling for business, and those for pleasure.

Work and play

For commuters, who may like to use their journey as an opportunity to get on with some work, Summers recommends yellow, blue, violet and orange as colors that can enhance productivity. "Yellow, the easiest color to see, is associated with optimism and is said to encourage innovation," he says. "Blue is the color most commonly cited as people's favorite; it is calming and increases focus and productivity. Violet is associated with power and pride, and brighter hues increase creativity and lift the mood. Finally, orange is one of the more vibrant colors and is typically associated with excitement, so it can bring energy and stimulate activity."

Meanwhile, when people are traveling for pleasure they typically use their journey to read a book, watch a film, listen to music or even enjoy a meal. For this group, Summers recommends a range of more calming hues to aid rest and relaxation.

"Green symbolizes nature and is said to soothe the mind," he says. "Blue is also a good choice for pleasure travelers, because it is associated with serenity and reduces tension. Pale shades of violet are known to bring inner peace and encourage relaxation. And while gray has been dubbed a boring color, paler shades can create a soothing and cooling atmosphere."

All these elements of design create a more memorable experience for passengers, argues Summers. "If operators get it right, customer satisfaction levels will be high, enabling them to stay competitive and attract repeat business – a win for all," he says.

E-Leather is engineered for maximum performance, from natural raw material

Clean and green

Transport operators looking to improve the passenger experience while also boosting their green credentials should consider composition leather

RIGHT: E-Leather is often specified for hygiene reasons

The importance to train passengers of a seat being clean and comfortable is easy to appreciate. Such a simple offering can often come down to the material selection and seating design. For example, light-colored fabric would not be the most hygienic-looking or durable solution for a headrest or seat cover. In an industry where passenger traffic is increasing, decisions on seating become ever more important.

Despite different stakeholder objectives, there is one common theme among all suppliers – improving the customer experience. Some designers have suggested taking rail seating closer to aviation designs, to offer greater luxury. Meanwhile, operators want to offer their passengers quality, but not at the expense of commercial objectives. "Most rail operators are focusing on the customer experience, with the aim of adding value to rail journeys through enhanced comfort, cleanliness and better onboard services," says Alexandra Bennett, global manager for ground transport at E-Leather. "We have been working hard to find ways to make it easier for operators to achieve this."

E-Leather is a UK-based environmentally friendly materials technology company that supplies a range of products specifically engineered for interior and seating applications, to a diverse variety of sectors worldwide.

Bennett summarizes transport operators' top-four considerations as design innovation, cleanliness/ease of maintenance, long-lasting performance, and a quality look and feel. "While most materials will address one or two of these criteria, not all can meet every need – and passengers today do not expect compromise," says Bennett.

Promoting rail

In addition, she says many businesses in the transport industry are including a fifth element in the form of environmental responsibility and sustainable contributions. "Encouraging people to commute by public transport services, or even bicycles, is a hot topic in many European countries," says Bennett. "In a recent interview in *De Standaard*, the transport minister for Belgium, Ben Weyts, shared his plans to continue investment in new buses and trams on additional routes to support the country's goal of increasing non-car transport. What's interesting is the investment being made in the vehicles' interiors, which will use higher-quality materials, including our leather fiber composites, to ensure customers have a hygienic and comfortable journey, and are therefore more likely to select that mode of transport again."

Offering a clean and comfortable seat is a step in the right direction. However, design is also becoming an important factor in seat material choice. Bennett says operators are looking to

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We manufacture high-performance leather fiber composite from traditional leather fibers; this has prevented more than 5,000 tons of waste from going to landfill over the years

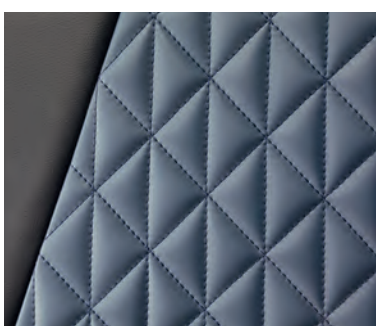
Alexandra Bennett, global manager for ground transport, E-Leather

HOW IT'S MADE

At E-Leather's facility in Peterborough, UK, leather fibers and a high-performance core material are combined using a process called hydro-entanglement.

The process uses 100% zero-carbon electricity. In addition, 95% of the water used is recycled, and waste streams are converted into energy that is fed back into the process.

"The result is an eco-friendly material that outperforms traditional leather, synthetic leathers and fabrics," says Alexandra Bennett of E-Leather. "We partner with leading brands in the aviation, rail, bus, coach and automotive sectors to meet and exceed their business goals while ensuring compliance with industry safety regulations and helping to create better experiences for their customers – all done through a unique, sustainable process."



ABOVE: E-Leather works to ensure long-lasting quality

BELOW LEFT: Bespoke colors are available for brand consistency

BELOW RIGHT: The product offers many design opportunities

differentiate by offering something on-trend that stands out and complements the brand.

"We have seen rail operators placing more focus on customers' specific needs or interests; providing them with functional yet inspiring spaces to commute in," adds Bennett. "These projects tend to be all about design, so a high-performance material that will look great as well as being practical is high on their criteria."

Longevity in service

A seating material that is easy to clean and maintains its high-quality appearance without scuffing or going saggy is a real advantage in the rail industry. Nordbahn Rail, located in Hamburg, Germany, selected composition leather to enhance the quality and longevity of its seat covers in service.

"We have used E-Leather on our seats for three years now and they still look as good as they did on installation," says Sven Böttcher, head of Nordbahn Rail's technical department. "Ease of cleaning has improved our maintenance schedule, as well as ensuring customers receive the best travel experience time after time."

Green credentials

"Another subject we are immensely proud of is our passion and commitment to making the most of the world's natural and limited resources," says Bennett. "Using a smart and patented process, we manufacture high-performance leather fiber composite from traditional leather fibers; this has prevented more than 5,000 tons of waste from going to landfill over the years."

E-Leather has received numerous awards and recognitions for its contribution to sustainable manufacturing and clean technology, including the Global Cleantech 100 awards for three consecutive years and an ACM Greener Pathways Award for Zero Waste To Landfill.

Since entering the rail market in 2007, the company has seen growth in the UK and mainland Europe, acquiring prestigious interior seating projects. This success has enabled E-Leather to focus further investment in Europe and expand its team to support rolling-stock manufacturers and operators in the APAC and Middle Eastern regions.

Under cover

Huge projects on the underground networks of London and Singapore are keeping flooring specialist Treadmaster busy

The UK's Crossrail project – also known as the Elizabeth Line – is big on numbers and has broken some truly staggering records. It is one of the largest civil engineering projects in the world, involving the creation of 42km (26 miles) of fresh tunnels as part of London's already congested subterranean landscape. It is expected to yield a £42bn (US$55bn) boost to the UK economy and bring an extra 1.5 million people to the capital within 45 minutes.

Treadmaster Flooring can share some equally impressive numbers with relation to the project. It is supplying more than 26,000m^2 (280,000ft^2) of its highest-category fire-resistant flooring, TM7, for the new fleet of 66 nine-car Aventra trains being built by Bombardier Transportation in Derby, UK, for the line.

"TM7 was specifically developed for underground and metro applications where there should be no compromise on fire safety," says Simon Andrews, business development manager at Treadmaster. "We are extremely proud to have been selected for this iconic project and to continue our association with both Transport for London (TfL) and Bombardier Transportation in Derby."

TfL commented that Bombardier selected Treadmaster Flooring to meet TfL's demanding requirements for the Elizabeth Line trains because it is a tried-and-tested product used on current London Underground rolling stock and meets the most stringent of fire standards – BS6853 Cat 1a – when tested as a system with the flooring composite.

"As the incumbent flooring supplier to London Underground's rolling stock, we know how seriously fire safety is taken for passenger trains traveling underground and we have one of the highest fire-rated flooring products on the market," adds Andrews.

As well as BS6853 Cat1a, TM7 meets the new European standard EN 45545-2 (HL3) and has been tested as a composite system, not just as a product on its own.

ABOVE: Treadmaster's TM7 flooring will feature on the UK's new Elizabeth Line rolling stock

RIGHT: TM7 has also been chosen for the Jubilee Line train refurbishment

LEFT: The flooring specified for the Elizabeth Line complies with BS6853 Cat 1a and EN 45545-2 (HL3)

Railway interiors EXPO 2017 EXHIBITOR Stand 2035

As the incumbent flooring supplier to London Underground rolling stock, we know how seriously fire safety is taken for passenger trains traveling underground

Simon Andrews, business development manager, Treadmaster Flooring

Treadmaster also developed a special fire-retardant sealant for the project, the color of which was matched to the flooring.

As well as being specifically engineered for metro applications in terms of fire safety, TM7 is designed to be highly durable, slip-resistant and easy to clean. These attributes are important because the Elizabeth Line nine-car train sets are 200m (656ft) long with walk-through carriages, and passenger numbers are expected to reach 200 million per year.

"TM7 also offers industry-leading lifecycle costs, which makes the product very competitive when considering that the lifespan of rolling stock can be more than 30 years," says Andrews.

Jubilee Line refurbishment

Treadmaster is also working on the mid-life refurbishment of 63 seven-car trains dating from 1996, used on the Jubilee Line. This is the third-busiest line on the London Underground network, carrying more than 200 million passengers each year

Treadmaster is supplying more than 10,000m^2 (107,640ft^2) of TM7 for the project, which is being carried out at London Underground's depot in Stratford, and will run until 2019.

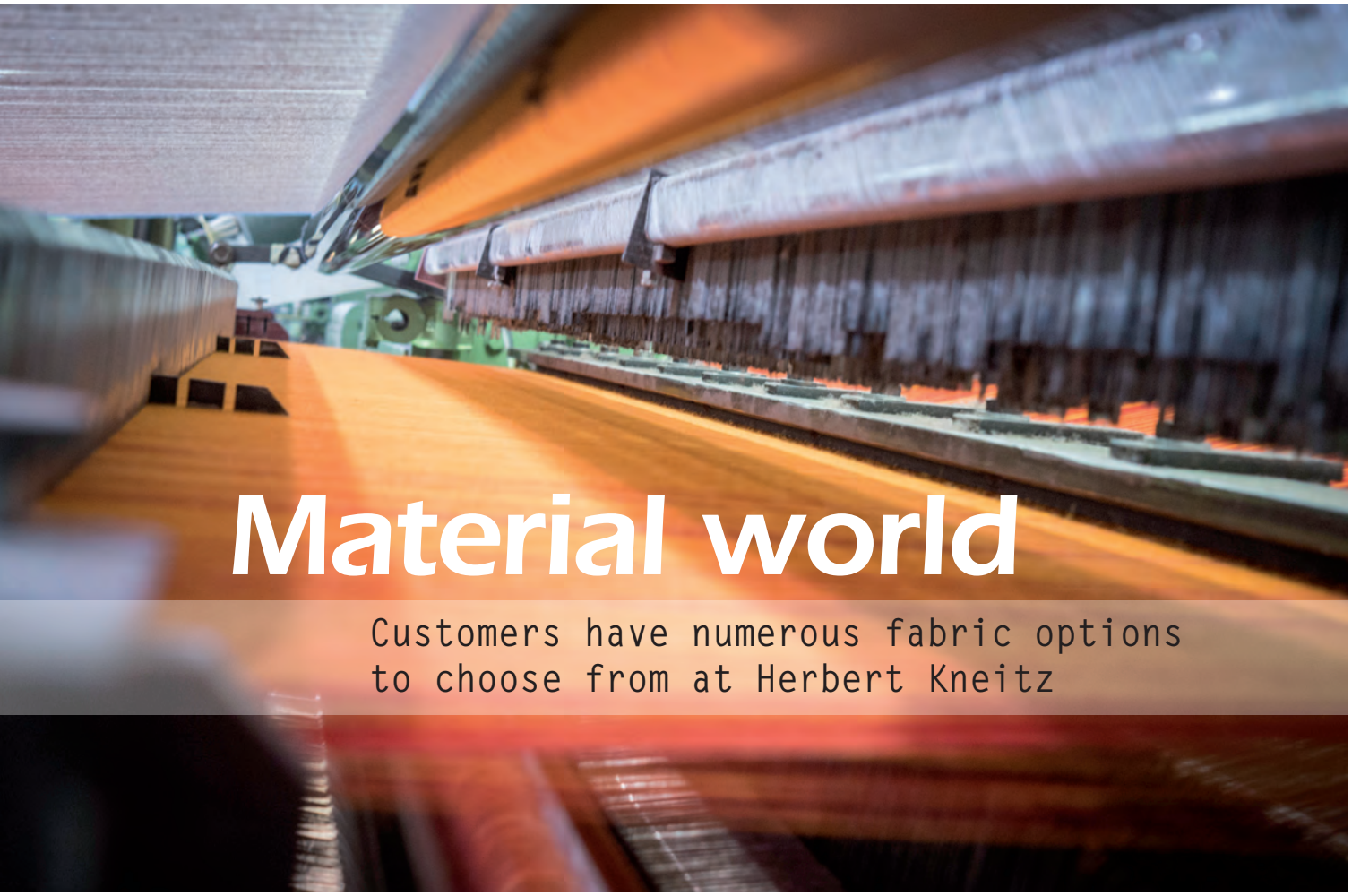
The aims of the refurbishment include improving the ambience inside the cars, and accessibility for people with reduced mobility. "The flooring is being supplied in two colors – light and dark gray – which will help contribute to improve the passenger experience on the refurbished trains," says Andrews.

Singapore metro

On the other side of the world, Singapore metro operator SMRT has ordered a further 12 six-car C151C metro trains from Kawasaki Heavy industries/CRRC Sifang in Qingdao, China, for use on the North-South and East-West Lines (NSEWL).

Treadmaster is supplying more than 4,000m^2 (43,056ft^2) of TM7 in a mid-gray color for the project. The new trains are scheduled to commence service in 2018.

"It has been an incredibly busy year for Treadmaster and we have won some considerable new projects, which are just starting and will run for a number of years," says Andrews. "Having a presence at the core trade shows – including Railway Interiors Expo and InnoTrans – has helped us win new business and get in front of a global audience. We are also exhibiting at AusRail Plus 2017 in Brisbane, Australia, as historically this has been an important market for us and there are lots of new rail projects happening there."



Material world

Customers have numerous fabric options to choose from at Herbert Kneitz

Long-time transport fabric supplier Herbert Kneitz is benefiting from an €18m investment in 2017, following its acquisition by Getzner Textil in March 2016. The money is being spent on new production and administration buildings, a new finishing department and new weaving machines, which will increase the company's production capacity at its facility in Bad Mitterndorf, Austria. Herbert Kneitz is now a 100% subsidiary of Getzner Textil. Josef Lampert, CEO of Getzner Textil, and board member Rolf Gottmann, have joined the company's existing CEO, Bernhard Deutinger, on the management team.

Stock options

The company specializes in providing a wide array of proprietary fabrics for the automotive, rail and coach industries. As well as seat coverings, curtains and drapes, fabrics are available for walls and panels. There are numerous in-stock options for piece- and yarn-dyed dobby velour, yarn-dyed jacquard velour, and flat-weave and dobby fabric. These are offered with a standard lead time of four to six weeks from the date the order is placed.

"The big difference between Herbert Kneitz and our competitors is that we offer a wide variety of material compositions, to accommodate customers' technical requirements and the application," says Thomas Recknagel, head of transportation at Herbert Kneitz.

Available velour compositions include 100% fire-retardant polyester, 85% wool/15% polyamide, and 70% polyester/30% wool. Recknagel says the latter is the most popular option for bus and rail applications in Europe because it offers the highest durability and color-fastness and is the easiest to clean. "This composition also fulfills the EN 45545, DIN 5510-2 and PN-K combustibility standards," he adds.

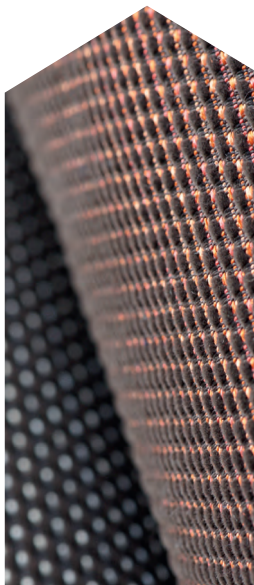
Mix it up

Because of its extensive involvement in the automotive industry, Herbert Kneitz offers a wide range of material compositions for its flat-weave ranges. The mix most commonly used for rail applications is 85% wool/15% polyamide. For coaches, Recknagel recommends 100% polyester mixed with flocked or polyurethane-coated yarn.

The company's fabrics can be finished with anti-stain and anti-bacterial treatments, even for small-quantity orders. "The chemicals we use fulfill the highest environmental standards," says Recknagel.

Herbert Kneitz also offers coatings to protect fabrics intended for high-use areas, along with various anti-vandalism and anti-cutting solutions. "We are constantly expanding our offering in line with customer requirements," says Recknagel.

Customers include the UK's Stagecoach, Plaxton and Virgin Trains. Projects begin with the customer's detailed design brief, linked to technical specifications and a project timeline. "Herbert Kneitz follows these guidelines throughout the development, and creates samples and technical test reports for the customer," says Recknagel. "Some customers ask us to create individual design



LEFT: The company has numerous looms on site, to produce jacquard and dobby velours, and jacquard and dobby flat-woven fabrics

RIGHT: Kneitz's facility in northwest Styria, Austria

BELOW: With a new manufacturing complex, Kneitz will double the size of its premises by Q1 2018

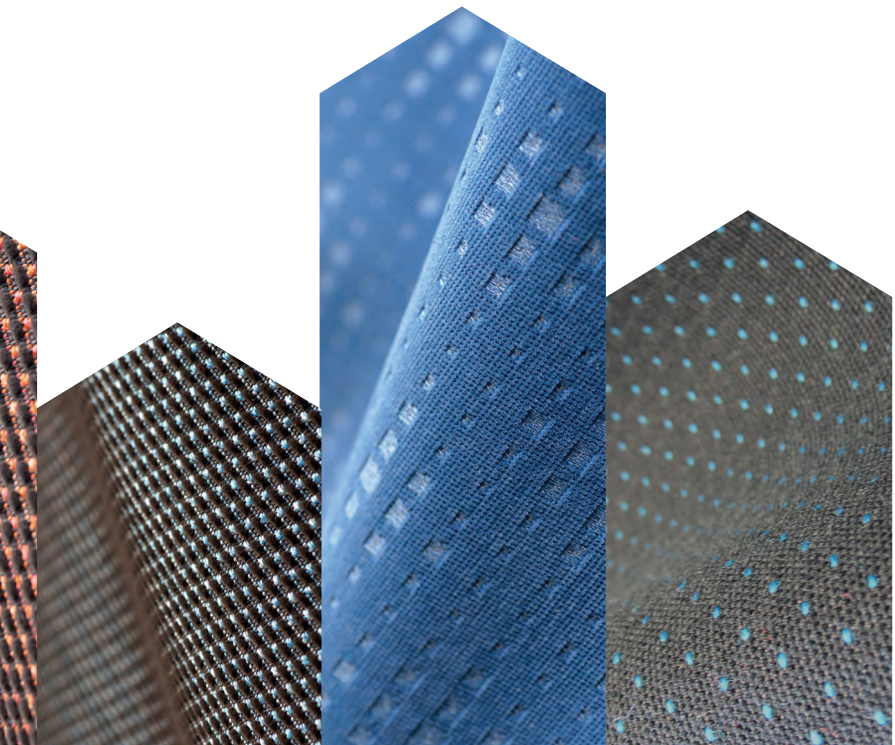
NEW PARENT

Herbert Kneitz's new parent company, Getzner Textil, specializes in making fashion fabrics. Seeking to broaden its field of operations, Getzner Textil concluded a couple of takeovers in recent years, to build a stable value chain for technical textiles. As well as Herbert Kneitz, these include Meyer-Mayor, which processes low-elongation, high-tenacity yarn; TFE Textil, which makes filament fabrics; and Klingler Textil, which specializes in functional, elastic and technical fabrics.

Getzner Textil has its headquarters in Bludenz, Vorarlberg. It achieved sales of nearly €200m in 2015.

ABOVE: Kneitz invests in employees and the latest production technology to drive quality

BELOW: Some of Kneitz's textiles for premium automotive and transportation interiors



proposals. In these cases, either our designers visit the customer or they come to us and we create the design in-house. We use visualization software to make it easier for the customer to see how the interior will look."

The customer is king

Herbert Kneitz is very focused on meeting customers' requirements. "They appreciate the whole package – great design, product quality, reliability, short lead times and aftersales service," says Recknagel.

In the UK, Herbert Kneitz's exclusive wholesaler is Boyriven, an independent supplier of fabrics for the automotive, marine, rail and contract markets. Its customers include Aston Martin, Fairline Yachts and Stagecoach Services. "Whether the project is large or small, Boyriven can provide the best-quality products, help and advice on fabric selection, fast turnaround and great prices," says Philip Espinasse, managing director at Boyriven.

Vinyl and fabric

The company's offer includes vinyl, sidelining, leather, Alcantara, carpet and hooding. "All our automotive vinyls meet the FMVSS 302 automotive standard, and our contract materials meet the Crib 5 fire standard," says Thomas Symons, sales team leader at Boyriven.

The average vinyl width is 137cm, but some lines are available in widths up to 180cm. Roll lengths range from 20m to 100m. Boyriven stocks more than 50 styles and more than 500 colors. The vinyl is manufactured in lots of places around the world, including China, India, the UK, Holland and Canada.

"When P C Espinasse established Boyriven in 1913, his founding principles set the standards that we uphold more than 100 years later: to provide the highest quality products and to offer unparalleled personal service," says Phil Barnard, sales director at Boyriven. "Today, the company is led by Philip Espinasse, and – with the same passion for providing a first-class service as his grandfather – we continue to forge lasting relationships with customers worldwide."

LEFT: Satek's SAMO II can be set up as a universal or standard sanitary cabin

Mix and match

The next-generation modular sanitary cabin was developed by Satek to offer great flexibility

The market for rail vehicle manufacturing has changed tremendously. "All market players are now dealing with small projects that involve different customer requirements and design wishes," comments Christine Kaiser, engineering – technical documentation specialist at Satek. "They must offer short development times, high flexibility, low lifecycle costing (LCC) and low repair and maintenance (RAM) costs. Manufacturers are also under intense price pressure because of overcapacity from the Asian market."

Satek believes that the only way the European rail industry can withstand this is by offering intelligent solutions and optimizing their production processes. The company is based in Salach, Germany, and specializes in the development and production of system components, particularly sanitary cabins for rail vehicles. The people in charge have more than 20 years of experience in this area.

The company recently replaced its existing sanitary module cabin, SAMO, with SAMO II. Various modular units are available, for example enabling the construction of a universal sanitary cabin that can be accessed by a person using wheelchair or with other disabilities. The cabin can also incorporate a baby-changing table or be set up as a standard sanitary cabin with a smaller footprint.

Modular flexibility

"The modular concept allows for short project start-up times and flexibility in terms of equipment," says Kaiser. "The concept is so flexible that basically any floorplan can be implemented. Clean and clearly defined interfaces enable simple and compact integration into the vehicle, and low integration costs. Furthermore, the design offers very good accessibility for maintenance and repair, lowering LCC and RAM costs."

SAMO II also includes an integrated water supply and disposal system, regardless of whether the fresh and waste water tank is to be made of stainless steel or plastic, or whether a bioreactor for sewage treatment is to be used for the wastewater.

LEFT: Various add-on modules are available

RIGHT: The new sliding door can be operated manually or by pressing a button

Satek spent more than two years adapting the first-generation SAMO in line with the changing needs of the market. One of these needs is flexibility, which Satek has catered for in numerous ways. For example, colors and decor can be easily and quickly adapted. Specially developed sandwich materials are used for the walls, but these can also be exchanged, at least in part, by other off-the-shelf materials – although the rework required usually makes this more cost-intensive. Special aluminum profiles and connectors have been developed for the static knot formation at the corners and edges, to absorb any forces, and to enable fast adaptation of the space.

Customers can assemble their own configuration of modules, or choose from module kits that have been pre-configured for specific functions. Extra functions can be added through independent functional modules (for example the baby-changing table), which in principle can be selected freely for integration on the inner walls of the sanitary cabin. Ease of integration was also an aim in developing the closing systems for inspection doors and flaps. "These can be replaced at a later stage without great effort," says Kaiser. Different locking systems can be integrated within a WC cabin, without much effort, thanks to a cleverly devised adapter system.

Easy access

Ensuring easy maintenance was a key focus during the development. In particular, it was important that maintenance could be conducted from inside the cabin. For example, all maintenance work on the specially developed sliding door system (Samove) can be completed from inside. With Samove, the sliding door leaf can be simultaneously operated (driven) and manually operated without additional system interventions – passengers can operate the door using a push button or manually.

All water-carrying pipes are also accessible from the inside. "If there are any leaks, the water is contained inside the sanitary cabin, which is safer than it running into the interior of the train and minimizes damage," says Kaiser. "This is just one way in which SAMO II helps meet operators' LCC and RAM requirements."

Satek developed SAMO II to comply with all the technical specifications of TSI PRM 2014, UIC and Eurospec. "The response to the new system – from the vehicle industry, operators and passengers – is consistently very positive," says Kaiser.

STADLER PROJECTS

The SAMO II sanitary cabin was launched at InnoTrans 2016 and has already been installed in various Stadler vehicles. For trains in Valle d'Aosta, Italy, universal sanitary cabins were used. They were specified with an integrated tank system consisting of plastic tanks and piping up to filling and suction boxes. A similar configuration was used for ZwenZwoka and Connexxion trains in the Netherlands.

For GySEV in Hungary, standard and universal sanitary cabins were chosen, each with integrated tank systems, including filling and suction boxes made of stainless steel.

Finally, for SOB in Switzerland, standard and universal cabins were used with an integrated fresh water tank system made of stainless steel and a bioreactor for waste water including piping up to filling and suction boxes.

BELOW: SAMO II configured as a standard sanitary module with a reduced footprint

Access all areas

Universally accessible toilets, soon to be required in all heavy rail vehicles in Europe, can improve the experiences of all passengers without sacrificing too much space

The provision of clean, fully functional and pleasant on-train toilets can make or break a train company's reputation. "Across all our public spaces, the standard of public toilets has improved dramatically over the past few years," says Adam Darcy-Wass, global development manager at Precision Custom Composites (PCC). "This is due to a combination of new technology and increased investment brought about by the recognition that many consumers judge the likely quality of a retail store or restaurant, for example, by the quality of its toilets."

Darcy-Wass cites a recent survey by MURi as demonstrating that good public facilities have become a reason for people to choose certain retailers above others. "Train companies have reacted to this trend with the introduction of great design features in new rolling stock, and by upgrading older vehicles," he says. "The days of a train toilet being an unpleasant but unavoidable aspect of rail travel are hopefully numbered."

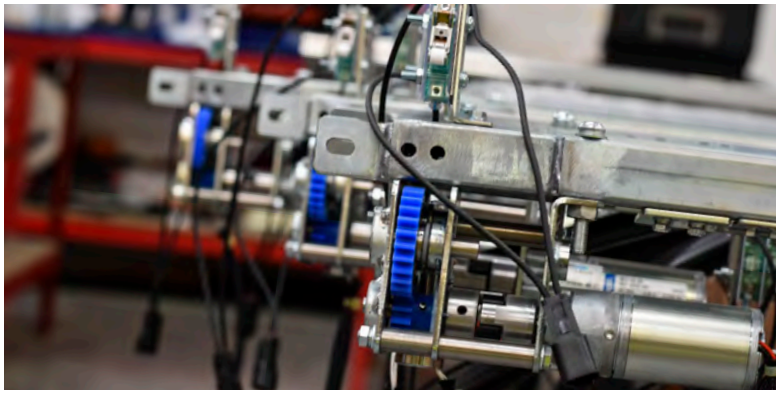
However, a challenge still awaits some EU operators in the form of the binding PRM-TSI legislation, which requires all heavy rail operators to provide universally accessible toilets (UATs) by the end

of 2020. These toilets must be fully accessible for wheelchair users and others with impaired mobility, for example visually impaired travelers. They must also be pleasant and safe for users without special needs. "Traditional toilet compartments are designed as compact spaces to maximize safety on a moving train while minimizing the loss of seating capacity, so the much larger UATs deliver some design challenges in both areas," says Darcy-Wass.

Custom solutions

PCC has specialized in the manufacture of components for rolling stock refurbishment projects for more than 20 years. In 2012, it recognized the opportunity presented by the upcoming PRM legislation, introduced in 2013, and launched its first UAT. Much of the design work involved optimizing the shape and overall footprint of the module. The units are custom-built to precise tolerances to fit a wide range of rolling stock. "The UAT can incorporate operators' colors and design features while delivering quality, reliability, comfort, minimal water use and ease of maintenance," says Darcy-Wass.

The design has been adapted to suit nine classes of vehicle, for 20 fleets, without compromising the unit's footprint or PRM-TSI compliance. PCC has installed more than 225 units for seven UK operators, and offers its expertise across Europe. The company has also now translated the design benefits of the UAT into a standard-size toilet module.



MAIN: PCC's Universally Accessible Toilet (UAT), which has been selected by seven UK operators

ABOVE: Safe-glide gearboxes and doors being built, assembled and tested in-house

RIGHT: PCC produces wiring looms and plumbing in-house, which it pre-tests before installation

Lean transformation

The UAT's success necessitated an increase in manufacturing capacity. In 2016, PCC brought in a new management team, led by managing director Peter Roberts, and overhauled the manufacturing process at its factory in Cwmbran, Wales. The business ran a 20-week transformative program to streamline PCC's manufacturing process, introducing a lean manufacturing methodology. Every part of the manufacturing process was reviewed to identify where streamlining measures could be taken.

ABOVE: PCC provides new and remanufactured parts for newbuild and refurbishment programs

LEFT: Circuitry assembly and testing at PCC

FAR LEFT: During the design stage, PCC can call on in-house pattern making and mock-up design visualization expertise

PCC says that operational benefits were delivered across the supply chain, improving quality, costs, delivery and safety. Capacity and productivity have increased, delivering reductions in lead time and inventory. "The key benefit has been to minimize waste across the multistage manufacturing process, reducing unnecessary costs and delivering improved quality," comments Roberts. "The right-first-time approach has improved the installation process, ensuring that UAT units are installed quickly and efficiently, minimizing rolling stock downtime."

By engaging employees at all levels of the business, PCC has built a culture of continuous improvement and pride. Departmental performance monitors now allow engineering teams to optimize flow through the factory, a measure that PCC says has reduced the build time for each UAT dramatically. The new processes have increased the capacity of the factory to more than 25 UATs per month.

To ensure the good work continues, three PCC personnel were trained as lean champions, and 10 employees in lean awareness. "This enables us to improve our capabilities continuously, to ensure that we achieve the tight timescales required by our customers," says Michael Nesbitt, operations director at PCC.

"With further capacity growth and product advancements in place, we are delighted to present the benefits of our range, including the new standard line, to our existing and new customers this September at TRAKO 2017," says Roberts.

Basis for success

Railway interiors EXPO 2017 EXHIBITOR Stand 2015

An amazing interior begins with an aesthetically pleasing and resilient floor

The importance of the humble floor should never be underestimated. Not only does it provide comfort and ensure the safety of passengers, but it also plays a key role in defining the overall visual appearance of a vehicle interior.

While it may not immediately appear as complex as other components used in a vehicle's construction, a quality transport floor must be multifaceted. It must be compliant, offer long-term durability in the face of unforgiving foot traffic, and contribute to the overall passenger experience through appealing aesthetics.

For UK-based manufacturer Altro, flooring represents a foundation on which to transform everyday spaces. The company has more than 50 years of experience in creating floors purposely engineered to meet the diverse needs of the rail industry.

Altro's established range of transport floors is designed to offer high levels of slip resistance in all weather conditions, while its technical formulation offers long-term durability. In addition, the floors can be welded to create impervious joints, which Altro says protects the vehicle's subfloors from water ingress.

"These qualities made Altro Transflor Momentum a perfect choice for Network Rail's busy Thameslink service and the demands of the 40 million passengers it serves every year," says Serge Townsend, global transport commercial manager at Altro.

Partnership approach

Altro Transflor Tungsten is also engineered for high resilience, and boasts BS 6853 Class 1a classification and EN 45545 HL2 accreditation. However, the decision for Altro Transflor Tungsten to be specified for the Stuttgarter Strassenbahnen (SSB) project in Germany was not purely performance driven.

Altro strives to create a collaborative dynamic with clients from the start, and dedicates experienced transport account managers to add value to projects. "We have known Altro as a reliable supplier for many years," says Werner Benz, master mechanic for interior fittings on the SBB project. "It can provide expert opinion on the latest fire safety guidelines and flooring durability."

The world at your feet

The collaborative approach also means practical advice can be given beyond technical performance. "Altro offers a variety of options that can enhance the passenger experience and brand visibility, or heighten installation efficiencies," says Townsend.

For visual impact, intricate corporate logos and signage can be produced and inlaid into floors directly. Similarly the company offers precision flooring kits that are pre-cut to the dimensions of a vehicle, as well as self-adhesive flooring, to minimize vehicle downtime.

"We've used Altro flooring and the kit-cutting service on various projects and it just makes our life so much easier," says Steve Warren, procurement manager at UK-based Chrysalis Rail.

"Altro's unique mix of global knowledge and local support is seeing its floors used in prominent projects around the world," adds Townsend. "More and more people are realizing that there doesn't have to be a ceiling on interior creativity if you build your vision from the ground up."

MAIN AND TOP RIGHT: Altro Transflor Tungsten on an SSB train

ABOVE RIGHT: Thameslink features Altro Transflor Momentum

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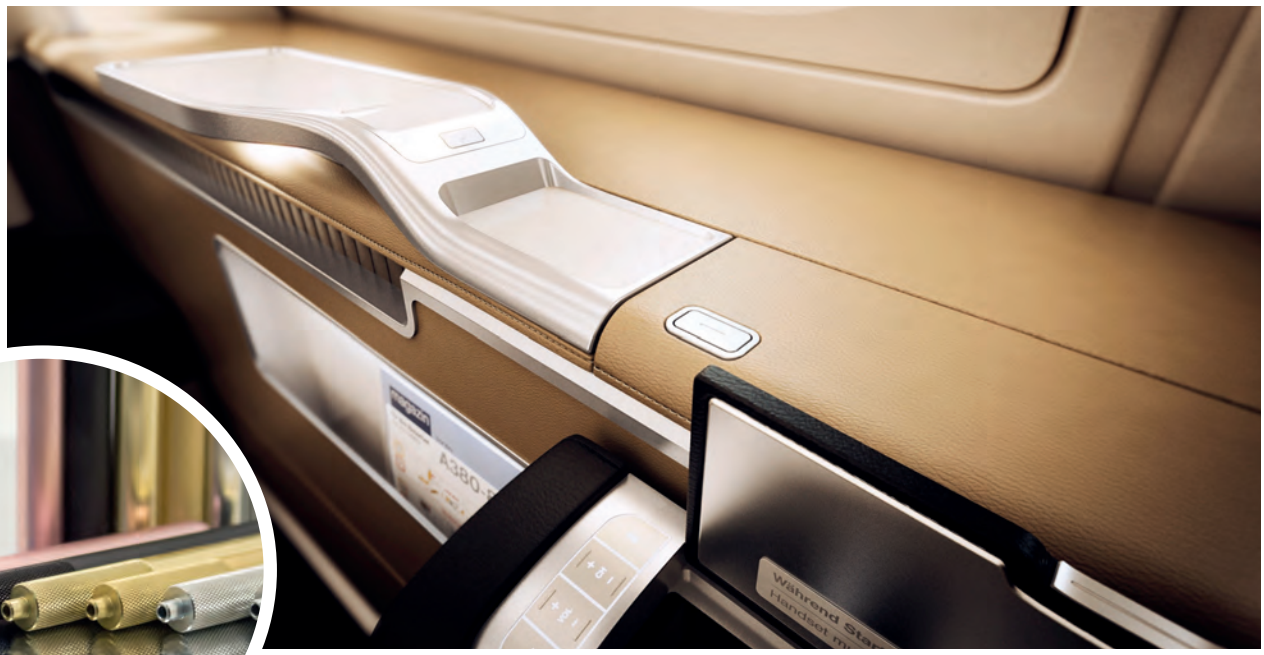
RIGHT: An example of MAF's work in the aircraft interiors sector

BELOW: A selection of MAF's wide range of finishes



Perfect finish

Decades of experience providing interior finishes for aircraft and cars is now being applied in the rail market

With the UK's train fleet set to double in 30 years and half of the new 4,500 carriages already under construction, the question is who will provide the seats, galleys, shelving and other interior components needed to ensure a comfortable journey for passengers. Part of the answer could be a family-run business in the West Midlands that has already achieved the highest accreditations from the UK's Civil Aviation Authority (CAA) for its work in the airline industry. "Majestic Aluminium Finishing [MAF] has become a sought-after company because the quality of finishing takes interiors to the consumer level," says Amir Khan, managing director at the company. "We have also earned a reputation for the fastest turnarounds in the sector."

Flying high

Much of MAF's work is in the aviation sector, applying specialist finishes in aircraft interiors. The business currently works as a supplier to well-known third parties that supply to the likes of British Airways, Air France, Lufthansa and United Airlines. Its metal finishing processes are used on seats in business class as well as economy. The company has also become the only approved metal finisher for a new range of aircraft seating. Beyond seating, MAF also looks after aircraft galleys, walkways and other interior areas.

The workforce's commitment to detail comes from the company's founder, Habib Khan, who has been in the metal finishing business for half a century. Having passed his expertise down to his sons, they now run the business. However, he retains an office at the plant and is as much involved in the production as he has ever been.

"This wealth of experience, passed down through generations, underpins the company's reputation for high quality and has also provided transferable skills for MAF across the transport sector – particularly in the high-end market," says Amir Khan.

Pole position

MAF is also an approved Tier 2 supplier to the automotive sector, working with companies including Aston Martin and JLR. "With both companies at the top of their game, becoming an approved supplier means you must know what you are doing," says Amir Khan. "This includes providing kick plates on the doors – particularly important for high-profile automotive vehicle manufacturers that do not want to spoil the look or style of the vehicle, but need to incorporate practicalities into their stylish designs."

The business is BS EN ISO 9001:2015 and BS EN ISO 14001:2015 accredited and offers UKAS-accredited metallurgical testing to ISO 17025, plus PCN-certified non-destructive testing. It also provides a one-stop-shop in terms of project management for customers, subassembly work and manufacturing of parts.

The team is currently working on a project for the railway sector. "The crossover from aircraft and automobile to railway interiors is the obvious next step for a company that has kept its business and that of the transport industry on track," says Amir Khan.

Railway interiors EXPO 2017 EXHIBITOR Stand 1085

LEFT: A horizontal scroll compressor designed for transport air-conditioning applications

RIGHT: A vertical scroll compressor

Air support

Size, reliability and the reduction of noise and vibrations were the crucial factors in the design of Hitachi's air-conditioning scroll compressors

In October 2015, Johnson Controls and Hitachi Appliances joined forces to create a joint venture company, Johnson Controls – Hitachi Air Conditioning, focused on the manufacture of air-conditioning compressors and systems for both residential and commercial markets.

The company's diverse product line-up includes the Hitachi scroll compressor for air-conditioning applications in the transportation sector. Hitachi has more than 50 years of experience as a supplier of air-conditioning compressors for the transport industry, and introduced scroll compressor technology in 1983.

The company had its first successes in its domestic market, Japan. It supplied specialized vertical and horizontal scroll compressors for the Shinkansen high-speed train, as well as local trains and metro lines. Hitachi started to export its compressors for use on foreign projects in 2006, and has now supplied more than 90,000 compressor pieces for more than 100 projects in 30 countries. All research, development and design activities are handled at the company's headquarters in Japan. Manufacturing is conducted at Hitachi's factories in Japan and China.

Key benefits

The scroll compressors have been designed to offer a compact size, high reliability, and low noise and vibration.

In terms of size, the horizontal type is especially notable, as it is 198mm (7.8in) long and weighs 34kg (75 lb). The company says this enables HVAC manufacturers to design units that are shorter and lighter than standard units that use a vertical compressor – saving energy and leaving more space for passengers.

Reliability has been maximized by eliminating the need for sliding parts. Instead of using a thrust bearing, the orbiting scroll is pushed by gas into the fixed scroll. The gap between the scrolls is controlled in microns. Hitachi says the gaps are uniform and few, the spaces between components are sealed with oil, and there is no need for tip seals. Because the compressor has few sliding parts, there is little friction and less chance of damage, improving reliability. Hitachi also says there is less chance of the refrigerant leaking.

Grace under pressure

Low noise and vibration benefits arise from the compressor having a high-pressure chamber that requires a thick shell, says Hitachi. Low-pressure gas is suctioned into the scroll portion, while compressed high-pressure gas goes around the motor inside the chamber, exiting from a discharge port. Most areas of the compressor feature high-pressure gas, so a thick shell is needed for safety. This has the beneficial side effect of absorbing sound and vibrations.

The company also offers a range of inverter compressors, which it says can make HVAC units run more efficiently – resulting in energy savings and lower running costs than fixed-speed systems, as well as offering precise temperature control.

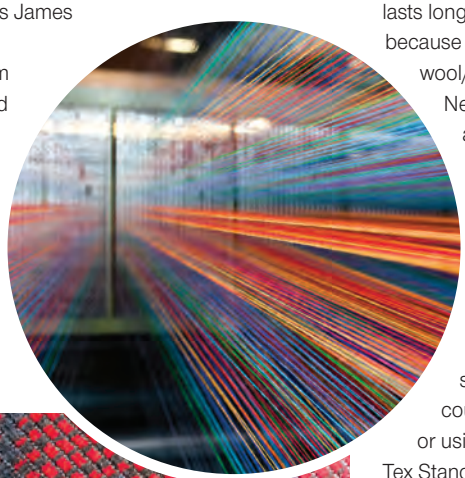
Made to measure

With an in-house design team, Camira can support operators in creating custom textile solutions that fit their design and performance requirements

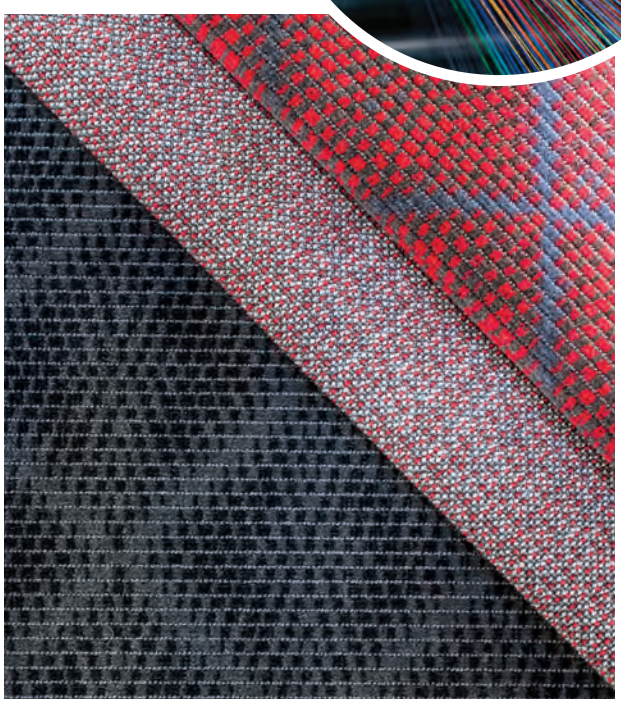
Design, comfort and performance are fundamental elements when it comes to designing a rail interior and creating a memorable travel experience. Design reflects a corporate and brand identity, whereas comfort and performance ensure passenger well-being and safety.

"The overall design of a rail interior is a carefully considered process, with various components to factor in – the flooring, railings, trims, seats and the seating fabric," says James Newton, director of transport sales at Camira, a textile specialist. "Having a designer's input from beginning to end allows interiors to be designed to illustrate both the brand and respond to passengers' needs. Not only that, designers understand the requirements and capabilities of the materials, coordinating colors and patterns to create the desired impact and presentation of an interior."

There are many things designers consider when it comes to material selection, specifically of seating fabrics; not just how it looks or performs, but also its potential impact on the environment throughout its lifecycle.



RIGHT INSET: Camira's transport weaving loom



RIGHT: A selection of custom wire-woven fabrics

Lifecycle factors

"Wool, as an example, is nature's own smart fiber and perfect for use on seats in rail interiors, having many more performance and environmental benefits than other textile fibers," says Newton. "Wool lasts longer in use, resisting wear and maintaining its appearance, because of its cell structure and natural crimp. A hard-wearing wool/nylon blend provides an interior solution built to last."

Newton adds that wool has the lowest energy consumption and CO_2 impact of the major textile fibers: "Lifecycle assessment studies demonstrate that, per kilogram of fiber, wool's CO_2 emissions are 7kg, compared with 19kg CO_2 for polyester and 37kg CO_2 for nylon."

Flammability performance is another vital consideration. "Wool or wool/nylon fabrics have a naturally high level of flame resistance and act to form a strong char to prevent the spread of flame," says Newton. "The environmental sensitivity of the textile may also be a consideration. This could be a question of using natural or synthetic fiber types, or using fabrics with environmental certifications, such as Oeko-Tex Standard 100."

Camira's collection of sustainable textiles is designed to enhance the passenger experience through color and design, as well as meet the fire security standards upheld on public transport.

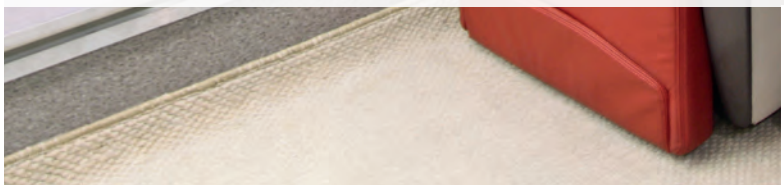
Custom capabilities

The company also has an in-house design team that can develop bespoke fabrics to meet the necessary standards, working in close partnership with professional design houses and operators. "The team works to create custom solutions that add personality and flair to any vehicle interior, while also being mindful of the fabric's construction and environmental properties," says Newton.

Past solutions range from the woven pile moquette featured on Virgin Trains's East Coast trains, to cut and loop pile moquette used on the London Underground and the new Crossrail trains, and flat-woven textiles for SNCB Belgian Railways.

Safety first

Adding to the strength, durability and versatility offered by laminated sheet metal, Metalcolour's Dobel F105 now meets the criteria for the highest level of fire safety



Images: Shutterstock

The laminated sheet metal product Dobel, from Metalcolour, is used for structural applications including wall panels and ceilings in buildings, ships and trains. The most important criteria in these applications is guaranteeing the safety of human life. "Specifiers must choose a material that has the certified ability to reduce the spread of fire, and the necessary structural strength to withstand physical impact," says Ingemar Forsberg, CEO at Metalcolour Sweden. "Safety is the highest priority in the rail market and therefore Dobel F105 series materials are tested and certified according to the highest standards in fire safety – EN 45545-2: 2013 requirements R1, HL3."

Beyond safety and strength, Forsberg says a key advantage of laminated sheet metal is its versatility in terms of shaping: "Dobel F105 enables designers to be creative with their forms while retaining the functional and safety properties required."

Railway interiors EXPO 2017 EXHIBITOR Stand 1050

MAIN: Laminated sheet metal can be used for many train interior components

ABOVE RIGHT: Dobel F105 parts can be used on high-speed trains

Wear and tear

Another key point is durability – both through the production process and in service, where the material will be constantly subjected to UV and other environmental conditions, mechanical wear and cleaning detergents. "Dobel F105 can be bent, stretched, stressed and used for years without any loss of performance or aesthetics," says Forsberg.

The material has a protective layer formulated to resist scratches and chemical detergents. Metalcolour also applies a non-stick foil to protect the laminated surfaces during production – a foil that is easily removed at the end of production, leaving no glue residue.

Metalcolour has optimized its lamination process to enable more materials to be laminated, and to control gloss and color to very narrow tolerances.

This is all part of Metalcolour's focus on flexibility, innovation and high quality. "Flexibility means handling a seemingly impossible assignment," says Forsberg. "Our success is largely based on our flexible organization and loyal employees – this enables us to add a shift to handle a delivery if necessary." With innovation another key focus, the company is constantly questioning how products can be improved, or if techniques can be used in new ways.

Quality and service

"Finally, top quality is an absolute must," says Forsberg. "This requirement influences the choice of raw material and every step of the production process."

Metalcolour has served various segments since 1973, working with carefully selected co-producers. Its head office and one of its production facilities is in Nykøbing, Denmark, and it has further production lines in Singapore and Ronneby, Sweden.

"Our size and production setup make it possible for us to offer superior service and we are setting a market standard for fast delivery, by employing a flexible and 100% customer-focused production and service approach," says Forsberg.

Track record

Birmingham's Solo Rail Solutions has come a long way in 25 years

In 2017, Birmingham, UK-based Solo Rail Solutions is celebrating 25 years designing and manufacturing key components, interiors and doors for the rail sector. When the company formed in 1992, it operated out of an old tram depot in Birmingham, with a workforce of just four people. The company began to work on small contracts for London Underground and Alstom Transport, building components for Class 455 rolling stock.

For Solo, the intervening years have been a remarkable journey and a testament to the resilience and skills of Midlands engineering. Today the company employs more than 100 staff from two operations in central Birmingham, one on Landor Street and the other on Long Acre. It also has support divisions around the UK and an extensive network of local supply chain subcontractors.

As the business grew, Solo Rail Solutions earned a reputation for manufacturing litter bins, sand hoppers and brackets for new-build, refurbishment and retrofit rail clients.

Natural progression

Dave Hunt, Mark Hughes and Rob Swadkin, the originators of the business, had successfully grown it for more than 10 years before deciding to make the move to larger premises in 2002, as part of a push to accelerate growth and increase the scope of what the company produced. With the 2002 move to Landor Street – a 25,000ft^2 (2,323m^2) office and manufacturing site – the company gained its IS0 9001 accreditation.

MAIN AND TOP INSET: Solo has provided ceiling and lighting assemblies for Class 387 rolling stock in the UK

ABOVE INSET: Equipment cubicles specified for the UK's Class 800/801 IEP

It was not long before Rob Pugh, general manager of Alstom's Interiors division, was invited to join Solo as commercial director in 2004. Together with the three other directors, Pugh worked on a program of changes to the company's business strategy – moving from being a component supplier to a complete solutions provider.

Key achievements since then have included the addition of ISO 14001 and ISO 18001 to the company's management system, and the opening of further assembly plants in 2015, including a lightweight bonded structures plant.

Today the company provides complete packages that enable clients to fit high-level assemblies directly into the carriages, the aim being to improve the customer's throughput. Solo is proud to say that it is a Tier 1 supplier of major interior assemblies to UK train manufacturing plants, which includes complete ceiling and lighting assemblies and lightweight bonded cubicle assemblies for current major projects. Solo has also undertaken what it describes as the largest replacement door leaf program in UK history, across multiple fleets of Class 317/319/150 and Class 158 vehicles.

SOLO RAIL INTERIORS

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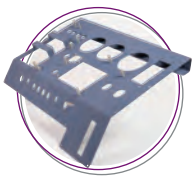
PASSENGER CAR CEILING ASSEMBLY

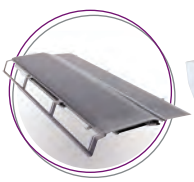
COMPLETE CUBICLE INSTALLATION

Solo Rail Solutions provide interior products to both train builders and train refurbishment companies.

Solo is a tier one supplier of turnkey interior solutions, ready for installation.



DRIVERS INSTRUMENT PANEL



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MADE IN BRITAIN

Grand duke

The latest leather from Boxmark is available in 55 stock colors

Railway interiors EXPO 2017 EXHIBITOR Stand 1000

Those helping quickly help twice. Boxmark, a leather specialist based in Austria, bases its operation on this principle, hence its decision to produce its latest development, Duke, as a stock item. "It happens now and then that our customers require products at short notice," explains Christian Schober, key account manager in the rail department. "With 55 colors always in stock, we can fulfill even the most urgent inquiries."

This warehousing also offers the advantage that the minimum order quantity is only one skin (approximately 5m^2/54ft^2) per color.

Fine details

Concerning the design, Boxmark uses a fine grain for Duke. "Bearing in mind the input of our design department's trend scouts, we decided to develop a smooth leather," says Schober. "The market reality confirms this trend. Recently, inquiries for this design increased significantly." Only European bull hides are used for Duke. The leather is 0.9-1.3mm (0.04-0.05in) thick and weighs below 800g/m^2 (1.76lb/m^2). It comes with Boxmark's customary easy-care finish, engineered to ensure easy cleaning and resistance to soiling. "This means maintenance and cleaning expenses, and thus also costs, can be reduced," says Schober.

The company says the new leather also fulfills all physical testing standards relevant to the rail sector – including fire safety. Boxmark's chemical and physical laboratory is equipped with testing sets including headspace, gas-phase chromatograph and nuclear spectroscope equipment – enabling specialists to carry out exact product analyses. These experts also check the leather's physical properties, to ensure their practicality. "These checks comply with internationally recognized guidelines," says Schober. "A strict incoming goods inspection, and continuous and final material testing during manufacturing, ensures the production of superior upholstery in line with the specifications."

TOP LEFT: Train seats designed and manufactured by Boxmark

TOP RIGHT: The Vienna City Airport Train features seat covers made by Boxmark

ABOVE: The company offers leather in a variety of colors for rail applications

Process partner

However, Boxmark is not only a leather manufacturer. With 8,200 employees at nine sites, the company can cover the whole chain from a single source – from research and development to design and leather manufacturing up to the finished product.

"With its research and development center, Boxmark has been playing a crucial role in the industry for decades," says Schober. "In response to increased demand, we have undergone an extensive expansion and modernization over the last few years, including the acquisition of new technical facilities." These include 3D scanners, new computing systems for virtual prototyping, and CNC-controlled machines, band saws and milling machines. Boxmark can also create foam models, perform foam reconstructions and add upholstery to existing seat systems and add-on components.

Sheet feats

Railway interiors EXPO 2017 EXHIBITOR Stand 3044

Bonded build-up innovations are transforming the way rail interiors look, and last

Thermoplastics are trending up, replacing materials such as fiberglass, according to Sekisui SPI. "Designers are increasingly attracted to thermoplastics for their interesting textures, integral colors and decorative prints," says Rich Cort, business manager for mass transit at the company. "Another benefit is fit and form – thermoplastic parts integrate and mate to give a sleek and seamless look."

Cort also cites weight reduction as a benefit that helps minimize energy consumption and wear and tear on infrastructure and mechanical systems, as well as enabling railcar builders to add other amenities.

A key challenge for Sekisui SPI has been to preserve aesthetics and a low weight while boosting the strength and structural support offered by thermoplastic components. "From time to time, there's a need for more rigidity in certain locations, usually across wide expanses or where fixtures hang," notes Cort.

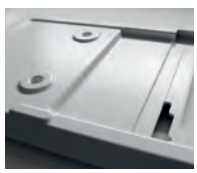
Twin-sheet forming

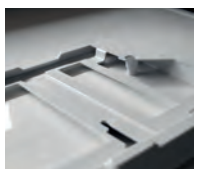
Sekisui SPI has collaborated with material suppliers and fabricators across the industry in this endeavor. One result has been to develop a technique for twin-sheet forming, whereby two sheets of plastic are simultaneously thermoformed, then joined under high pressure, creating welded bonds at strategic points. The result is a two-sided part strengthened with beams along the edges or within.

"This internal structure of bridge-like supports achieves a high degree of rigidity," says Cort. "The mass is low and the parts are light, with an impressive strength-to-weight ratio that can't be matched by a single sheet of heavier-gauge plastic."

Mostly hollow, the air-filled components serve to muffle sound, or can be filled with foam for thermal insulation. Cort adds that twin-sheet parts are economical; because many secondary operations are eliminated, two sheets can be processed like one, and the backs can be made with recycled thermoplastic. "Twin-sheet forming started in the industrial and medical markets, but it's relatively new to rail – and the possibilities are exciting," he says.

A related, evolving technique is to reinforce thermoplastic with a composite such as glass. "Each thermoformed shell becomes a new mold, so there's no wait for curing," says Cort. "What's more, the reduced use of resin makes for lower weight and high glass ratios, and the tough, thermoformed surface resists chips and cracks."




FAR LEFT: The front of a twin-sheet formed part made from Kydex thermoplastics

LEFT: The back part was shaped in a different way, with threaded inserts molded in

BELOW: Parts made mainly from thermoplastic are recyclable

Glass-reinforced thermoplastic components can incorporate core materials including balsa wood, steel, aluminum and foam, which allow hardware, hinges and other 3D structures to be added.

Recycled carbon-fiber backing

Another technique in development is to use a polymer-impregnated, recycled carbon-fiber matting as a backing for the thermoplastic. "Various constructions and layering techniques are being tested to see how thin we can go with the carbon-fiber reinforcement, and we're testing the ability to shape the construction," says Cort. "We're collaborating with thermoformers to determine the most efficient processes to mold shapes using this type of bonded build-up."

Cort says bonded build-up components could be used in sidewall and wainscot panels, window surrounds, seatback shells, partitions and ceiling panels. "There are countless applications that will add strength and reduce weight, while maintaining the contemporary look of thermoplastics," he says.

Light **fantastic**

With extensive experience in the design and manufacture of individual lighting solutions for trains, Teknoware is accustomed to working with project-specific requirements. The company provides lights and lighting systems for new and refurbished vehicles – including LED upgrade projects.

Teknoware's LED solutions for refurbishment projects range from LED tubes to direct-replacement LED lights. It offers LED batten light units, LED spots, LED inserts, LED converters and control systems.

"Our products have full approval for railway use, and fulfill fire requirements including EN50155, EN50121-2-3 EMC, BS6853 and EN45455," comments Jukka Kärkkäinen, area manager and team leader at Teknoware. "An emergency lighting option that fulfills GM/RT2130 requirements is also available."

Kärkkäinen says that direct-replacement LED lights cut lead-time dramatically. "Compared with typical LED tubes, direct-replacement solutions are much better aesthetically and in terms of passenger comfort," he says. "Advanced lighting control systems can be introduced together with direct-replacement solutions, which is not possible with the LED tubes. These control systems lengthen the products' lifetime, enhance passenger comfort and reduce power consumption and maintenance."

TOP: First class on a First Great Western train before the lighting was replaced with Teknoware products

BOTTOM: After the refurbishment

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Smart **seats**

This prototype Smart Sensing Chair was unveiled by THK at the International Contemporary Furniture Fair in New York in May 2017. It is equipped with an intelligent sensor system designed to monitor the occupant's health and the ambient conditions. The seat can measure respiratory rate, heart rate, stress levels and the condition of the surrounding air, displaying all this information on a monitor. The data can be stored and edited in the cloud.

THK's telescopic rails (models FBL56H and 305LS) are installed in the seat to create a hidden compartment for the sensors and the microcomputer. This makes the technology invisible to passengers while also being easy to access for maintenance personnel.

THK says sensing chairs could make public transport more interesting for passengers, who could check their health during their commute, for example. The technology could also be used to monitor the health of the driver.

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READER INQUIRY 517

INSIDE TRACK

Kristof Blomme, CEO of Ostende Vienne Orient Experience (OVOE), gives an insight into an exciting renovation project

Can you give an overview of the project?

Our goal is to save the coaches of the Compagnie Internationale des Wagons-Lits et des Grands Express Européens. OVOE's mission is to take customers back to the 1930s, on board the great express trains that carried kings and celebrities through Europe.

The project involves finding the original coaches, assessing their condition and working out how to restore them. Several coaches will be renovated, so we need to standardize them. At the moment we're adding coaches to our collection, ready to start the renovation in October 2017.

What is your aim for the interior?

We would like to go back to the period of the Interbellum, the inter-war years, so the interior should be the same as then, with marquetry, tables and chairs. I want to renovate the original materials where possible, or replace them with similar materials.

How have modern requirements been met?

Safety features including fire detection and stability are very important. Besides this, Wagons-Lits always responds to what customers need, so these days, we must implement wi-fi and aircon on the trains. Equipment including HVAC channels, wi-fi boxes, modern electricity systems, data connections and fire detection systems will be hidden behind walls.

We will also use modern engineering techniques, for example welding instead of rivets, and will adhere to modern safety practices, for example using less wood for the main construction and applying flame-retardant varnish.

LEFT: Blomme on board a Wagons-Lits coach operated by another company

What is the biggest challenge?

The key challenge is getting the old cars up to modern standards and approved for use on European tracks. We're still working on this with railway engineers.

What advice would you give to others embarking on similar renovation projects?

Be creative, don't give up, keep searching for solutions, think outside the box – be an entrepreneur!

CONFERENCE SPEAKER

Kristof Blomme will share more details of the project at Railway Interiors Expo 2017, a free-to-attend exhibition and conference to be held on November 14-15, 2017, in Prague, Czech Republic. His presentation will be on Day 2 of the conference, Wednesday, November 15, on Stage 1. Visit www.railwayinteriors-expo.com to register for your free pass.

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