interiors

RAILWAY INTERIORS INTERNATIONAL **2015**

SHOW ISSUE

Railway interiors EXPO 2015

See the full preview from page 58

Michael Sohn

Talking trends with the head of industrial design at Bombardier's Hennigsdorf facility

Accessibility

The US Access Board is on a mission to update the current guidelines

Eurostar

The cross-channel operator has enlisted automotive design heavyweight Pininfarina to boost comfort and capacity

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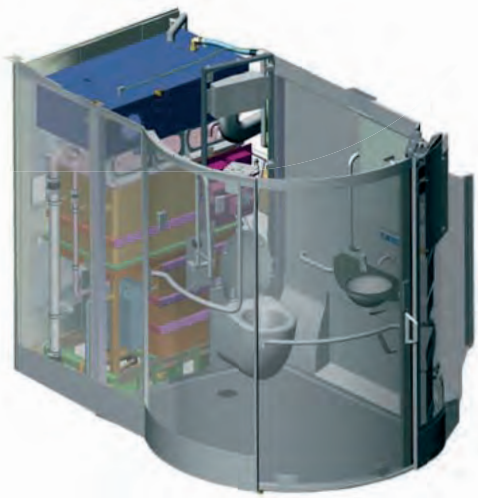

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WELCOME

I still remember the wonder I felt at being in a train traveling underneath the sea when, in my early teens, and only a few years after the Channel Tunnel opened, I traveled by Eurostar to Paris. I probably spent most of the journey listening to some even-then embarrassing pop group on a CD player. Roughly 20 years later, passengers are more likely to be hooked to their smartphones, and therefore, when Eurostar set about creating its new-generation train, the e320, installing wi-fi was a priority.

Overall, the train is designed for increased comfort and capacity. It can also run anywhere in Europe, which will help Eurostar fulfill its expansion plans. When I attended the public unveiling of the train in November 2014, I was struck by the flowing cohesiveness of the interior, which was created in collaboration with Pininfarina. You can read more about the project on page 34.

Looking beyond Europe, on page 50 you can find out how San Francisco's BART managed to involve more than 35,000 people in the design of its new train; and on page 42, the US Access Board details its plans to update accessibility guidelines. For this edition we also discovered how operators around the world approach catering (page 22) and security (page 28).

Other high-profile designs featured include Trenitalia's new Frecciarossa 1000 (page 14) and London Underground's next-generation train (page 68). We found out more about the latter from Mike Ashworth of London Underground, one of 60 speakers lined up for a free-to-attend conference running on both days of Railway Interiors Expo 2015. The Expo will be held in Prague, Czech Republic, on November 4-5, 2015. You can register for your free pass at www.railwayinteriors-expo.com/visitor_pass.php. A full preview of the event starts on page 58, and various speakers share their insights throughout the issue – including Michael Sohn of Bombardier on page 4.

Judging by the experiences and ideas that Sohn, Ashworth and other speakers featured have to share, it will be an excellent conference. I very much look forward to meeting you there.

Izzy Kington, editor

Email your comments: railwayinteriors@ukipme.com

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Michael Sohn Natasha Edwards

Practical magic

Bombardier Transportation's Michael Sohn says his upbringing in East Germany has prepared him well for the railway industry's focus on efficient, functional and long-lasting designs

Michael Sohn – now head of industrial design at Bombardier Transportation's facility in Hennigsdorf, northwest of Berlin – grew up in East Germany. After studying industrial design at Kunsthochschule Berlin in the 1980s, he worked for five years at a state-owned design consultancy, VEB Design-Projekt. There he was involved in the design of consumer products, agricultural equipment and railway station furniture, before moving into train design.

Sohn began working on the Hennigsdorf site in 1990, when it was known as LEW/AEG Schienenfahrzeuge. "I knew the chief designer, who was looking for new staff after the unification of East and West Germany," he says. "AEG founded the site in 1910 and there is a long tradition of designing steam locomotives there. After World War II, Hennigsdorf was part of East Germany and so the company was nationalized. After the fall of the Berlin Wall, the Hennigsdorf facility reverted to AEG, then was known as Adtranz until the takeover by Bombardier. So we have a long history in railway design; we have an ongoing continuity in dealing in the railway business and technology."

ABOVE: One of Sohn's recent projects, the C30 metro for Stockholm

Fashion didn't have a role in industrial design in East Germany; it was about taking a long-term approach, which is still valid for the railway industry

Michael Sohn at Bombardier's Hennigsdorf facility, where he has worked since 1990

Hennigsdorf is one of four Bombardier design studios, along with Derby in the UK, Brisbane in Australia and Saint Bruno in Canada. Each deals with a different region of the world – Hennigsdorf is responsible for Central and Eastern Europe, the Commonwealth of Independent States (CIS), Turkey and Israel.

Optimizing resources

Sohn believes that growing up in East Germany has prepared him well for dealing with current design issues. "Resources were always short," he explains. "That meant we learned from the very beginning to create the most of what was available. With the world's environmental and social challenges, this approach is helpful."

Sohn heads a team of around 17 people at Hennigsdorf, and also collaborates with outside designers and consultants. "We work on all aspects of train design – external and internal, the driver's cab and passenger areas," says Sohn. "Unlike in the car industry, where the design studios tend to be much bigger, our team is much more integrated. We have some people who work more on the driver's desk or the toilets, but this happens almost unintentionally, because they have done it before. We don't have specialized designers."

Diverse design

One thing that immediately stands out is the sheer diversity of projects handled by the team. Sohn is particularly proud of his work on the Zefiro 380. "It's Bombardier's first very high speed train," he says. "This project was new for the whole company and we are very proud of the award-winning result."

Sohn is also proud of the C30 metro created for Stockholm, Sweden. Soon to enter production, he describes the metro as "an

We learned from the very beginning to create the most of what was available. With the world's environmental and social challenges, this approach is helpful

ABOVE: Seats on Stockholm's C30 metro

SEAT TRENDS

Sohn has noticed the design of train seats evolve. "The shape of a seat is defined by ergonomic and functional considerations," says Sohn. "We ask, do we need a handle? Do we need a magazine rack? There is also a wider tendency for seats to look slimmer than in the past."

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STOCKHOLM METRO

With the C30 metro for the Red Line in Stockholm, Sweden, Michael Sohn's task was to adapt the Bombardier Movia family to reflect the identity of Stockholm. The Movia family has been customized for cities all over the world, including Shanghai in China, Bucharest in Romania, Bangkok in Thailand, and London in the UK.

"Mass transport systems belong to the communities they serve and so we need to encapsulate that place's identity in the design," says Sohn. "For Stockholm we sought to create a very special Scandinavian design."

To express the city's identity in the train's appearance, Bombardier went through a long process of workshops with the customer and local designers. "You need to involve local people who understand the city's soul," says Sohn. "Stockholm is very connected to the countryside, islands and water. Also, the train frequently goes in and out of tunnels and over bridges, so we created what we call 'urban nature'."

The result is an interior that is very light, with large windows, a broad gangway and yellow grab handles. The designers aimed to speed entry and exit by widening the vestibule. There are also designated priority zones for passengers with reduced mobility, including people using wheelchairs, and those traveling with strollers and large pieces of luggage.

"There are also elements inspired by a famous square in the city," says Sohn. "We took a pattern used on the ground there and used it on the seat fabric."

RIGHT AND BELOW: To help the C30 metro feel connected to Stockholm, Bombardier reused a pattern from one of the city's squares

CENTER: The C30 metro has a striking U-shaped exterior light

excellent example of a high-class customized design with a very local touch and a number of new elements".

Other current projects include the exterior and driver's cab for Deutsche Bahn's new-generation ICx intercity train (a collaboration with Siemens, which is responsible for the passenger carriages); and the S-Bahn rapid transit system for Hamburg, Germany.

Regional differences

"The train sector is so diverse, ranging from mass transport in big cities, to long-distance or intercity services and regional transport," says Sohn. "Added to this, the expectations and needs are completely different in Europe to what they are in Asia or the Middle East; there is no one answer. For example, in emerging countries, there is massive demand for improved transport in big cities. They want design that is effective. The metro system in China sometimes has to fit 10 people per square meter – that is never asked for in Europe. Asia is also focused on advanced technology, so the metro systems in Singapore and Hong Kong run automatically. In Europe, there is more a demand for comfort and improving facilities, for example adding wi-fi and enabling bikes to be taken on to city trains, which was very unusual 15 years ago."

Interoperability

Sohn says an area that has increased in importance is interoperability, particularly in Europe. "There are differences between English, French and German rules for driving, but we have developed a set of design rules for new driver's desks, as part of an EU project, to overcome these differences in the future," says Sohn. "In passenger areas, we have standardized requirements for people with reduced mobility. For long-distance and regional trains for instance, we have to meet regulations in terms of the length of step, height of step and height of the ceiling (1.95m)."

This created a challenge on the Swiss Twindexx double-decker, which is now in production. "On the upper level the roof is rounded,

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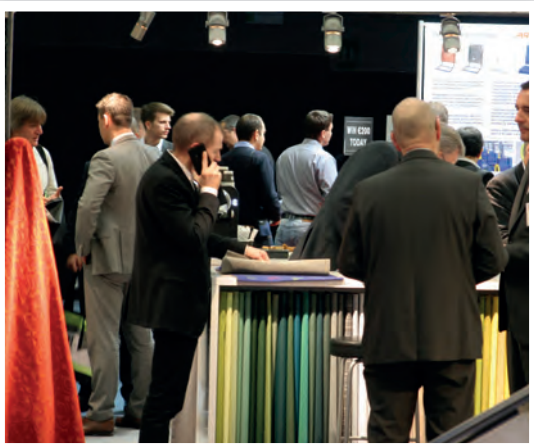

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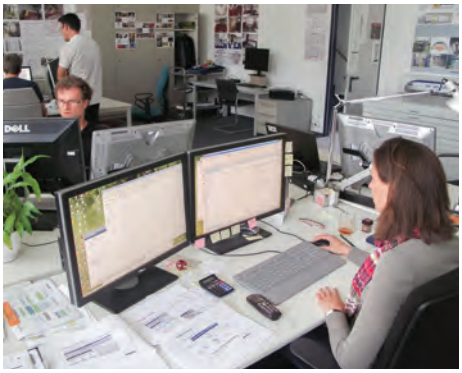

There is a lot we can do, as interior designers, to make people feel safe using public transport

not square, so it was very challenging to integrate all the necessary air ducts and cables in the ceiling," says Sohn.

Environmental concerns are another factor. "Bombardier has a special engineering department dedicated to environmental responsibility, which advises which materials are unsuitable and addresses the question of recyclability," says Sohn. "Their recommendations influence our designs."

Design cues

So where does Sohn find his inspiration? "It is important that we also look at what is happening in the automobile and air transport industries," he says. "I also look to residential interior design. Many developments originated there, including LED lighting. We regularly welcome interior design interns, who bring us ideas. We also have magazines around the office for research."

However, there are key differences between the industries. "The mindset of the car industry is very, very different; its goal is to create a sexy product," says Sohn. "Buying a car is an emotional decision. The train industry is quite the opposite – buying decisions are made by companies and politicians, not by the users, so it's a different world."

Again Sohn feels his upbringing in East Germany comes in useful in serving the unique requirements of rail industry. "Fashion didn't play a role in industrial design in East Germany," he says. "It was about taking a long-term approach, which is still valid for the railway industry. This is very different from the trendy approach in the automotive industry."

Feeling safe

One area that Sohn sees as becoming increasingly important is the contribution of design to the feeling of well-being. "Safety is more and more important in public transport," he says. "People have to feel safe. There is a lot we can do, as interior designers, to make people feel safe using public transport. Operators have to design trains with a feeling of transparency, with open and wide corridors, no hidden corners, huge windows, and gangways between cars. It costs money, but I think making people feel safe is a vital aspect of better transport."

However, this is just one of many aspects Sohn and his team have to get right. "A good design can only have an impact if you've made sure all the technical aspects are right too – including the cleanliness, vibrations and the noise level."

TESTING TIMES

The studio tests its designs at various stages, a crucial bridge between the computer design and the eventual physical design.

"You can test the interior physically and virtually," says Sohn. "There is one level of 3D data in the early stages. Later you need physical tests, then we create mock-ups, or sometimes soft mock-ups made from foam. For aerodynamics, Bombardier uses computational fluid dynamics software, as in the automobile industry. We key in the exterior geometry of the train and test it in a virtual wind tunnel. We also use models and put them in a real tunnel, depending on what stage we're at with the product."

TOP LEFT: 3D visualization can be a valuable tool during the design process

TOP RIGHT AND INSET: Sohn works with a team of 17 designers at Hennigsdorf

CONFERENCE SPEAKER

Michael Sohn is set to deliver a presentation on the SBB Twindexx Express design at 12:35pm on the first day of Railway Interiors Expo 2015's Conference. Railway Interiors Expo 2015 will be held in Prague, Czech Republic, on November 4-5, 2015. The free-to-attend Conference will run on both days of the Expo, and feature 60 speakers. Visit www.railwayinteriors-expo.com/visitor_pass.php to register for your free pass.

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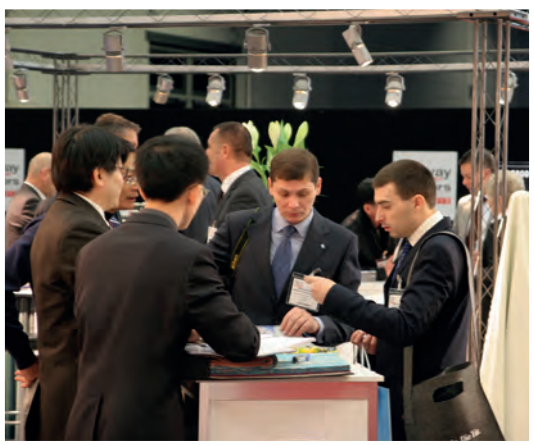

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Trenitalia Natasha Edwards

Italian style

Trenitalia's chic new long-range high-speed train has four levels of service and a modular layout designed to accommodate changes easily

Trenitalia

The executive carriage features 10 seats and a private meeting room

Its long red nose immediately defines the image of the Frecciarossa 1000 – or Red Arrow – Italian operator Trenitalia's new flagship train.

The 202m-long bidirectional train has a top speed of 400km/h and a maximum commercial speed of 360km/h. As well as connecting Italian cities including Bologna, Milan, Naples, Rome, Salerno, Turin and Venice, the train also meets interoperability requirements. Its multivoltage traction system enables it to run on high-speed lines in France, Spain, Germany, Austria, Switzerland, Belgium and the Netherlands, and it can switch between fuels and signaling systems.

Team players

Following a tendering process, the €1.6bn (US$1.8bn) contract to develop and supply 50 Frecciarossa 1000 trains was won by a partnership of AnsaldoBreda and Bombardier Transportation in 2010. The train also goes by the names Zefiro V300 and ETR 1000.

AnsaldoBreda and Bombardier Transportation also brought in Milan-based Bertone Design for

IN NUMBERS

4 levels of service

8 carriages per train

457 seats

2 wheelchair spaces

50 trains ordered

25 years of expected service

360km/h top commercial speed

97% of the materials used are estimated to be recyclable or reusable

LEFT: The train has two wheelchair spaces, in the third carriage

BELOW AND BOTTOM LEFT: The executive seat, which can swivel to face the direction of travel

BOTTOM: There are overhead passenger information screens in every carriage

WHEELCHAIR ACCESSIBLE

The creation of two places for wheelchairs in the third carriage was an important element of the design. As well as spaces for the wheelchairs, the area features folding seats and a wide wheelchair-accessible corridor that gives direct access to a dedicated toilet and to the adjacent bistro section.

The carriage's vestibule is fitted with a wheelchair lift that is close to both the compartment and the service facilities.

the interior design, exterior design and aspects touching on technology, including noise and aerodynamics. The design house is particularly famous for its car designs.

Four levels of service

The train is eight carriages long and has seating for 457 passengers, plus two wheelchair spaces. Analysis of passenger flow and customer data from Trenitalia and the manufacturers was used to optimize the layout. The decision to incorporate four levels of service (executive, business, premium and standard) was made after the initial tender bid. The first design had two levels.

"Following the evolution of our service on other Frecciarossa trains, four levels were also implemented on the Frecciarossa 1000 project," says Pietro Diamantini, Frecciarossa 1000 project manager at Trenitalia. "Afterward, the standard level was made even more comfortable with the introduction of face-to-face places, which were not in the original plan."

Throughout the train, the design focus is on the seats. The design features neutral, hard-wearing and graffiti-resistant materials and soft indirect lighting on the walls and ceiling. The main, centrally controlled light beams are focused on the central aisle. Amenities include power sockets built into the tables and adjustable individual reading lights.

Competing with airlines

The train's long-distance mission made optimizing seat comfort very important. The seat design was developed at Bertone's ergonomics department and tested at seat manufacturer FISA, in northeast Italy. While the business, premium and standard seats share a similar aluminum structure, the executive (first) seat involved a totally new design aimed at an elite luxury market, echoing first class airline offerings.

The executive area is in the first carriage and features 10 seats. They are 74cm wide and arranged in 1-1 layout on either side of a 1.5m-wide central aisle. The seat features champagne-colored leather, thick padding, power

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LEFT: The train has a top commercial speed of 360km/h

CENTER: The executive meeting room

DRIVER'S CABIN

The principles of comfort and technology, which informed the design of passenger areas, also applied to the design of the driver's cabin. Ergonomic studies were conducted to ensure the driver's comfort in the central seat, while wind tunnel testing was used to optimize the structure and shape of the cabin, to minimize air resistance.

sockets and twin LED reading lights integrated into the headrest. Reclining back and leg-rest extensions are controlled via buttons connected to the electronic control box. Each seat can swivel to face the direction of travel. "A lever on the armrest enables partial rotation by passengers, and a second is hidden inside the armrest, permitting total rotation by service personnel," says Luca Giantin, export sales manager at FISA.

Meetings on the move

The executive carriage also contains a private five-seat meeting room, with upright desk-style chairs around a central table and a wall-mounted color screen that can be connected to a computer.

The remaining carriages feature wide overhead luggage racks and luggage space between the seats. Seats are upholstered in leather in business and premium, and eco-leather in standard.

The business area is located in the second carriage and half of the third, which is also the location of the wheelchair-accessible area. The other half of the third carriage is used for the bistro/bar. The business seats are laid out in a 2-1 configuration and are 69cm wide. The aisle is more than 1m wide. The section has a blue and gray color scheme and tinted glass partitions between rows to give additional privacy.

The fourth carriage is used for the premium service. The seats are laid out in a 2-2

FAR LEFT: The business area has a 2-1 layout, with partitions to create a sense of privacy

LEFT: There is one carriage dedicated to premium service

FRECCIAROSSA 1000 TIMELINE

Trenitalia launches tender for 50 trains	AnsaldoBreda and Bombardier Transportation win the tender	Full-scale mock-up unveiled	First trains delivered for testing in Italy and the Czech Republic	Night testing on high-speed lines in Italy	Official inauguration by Italian President Sergio Mattarella	Commercial service entry	Expected entry into service of 50th train
November 2009	**August 2010**	**August 2012**	**August 2013**	**2014**	**April 2015**	**June 2015**	**2017**

MOVEABLE FEAST

"Food is a precious aspect of our culture – which is why we have to ensure that the quality of our country's products is promoted to all travelers," says Carlo Cracco, who began working with Trenitalia in 2014 to bring gastronomic allure to executive service.

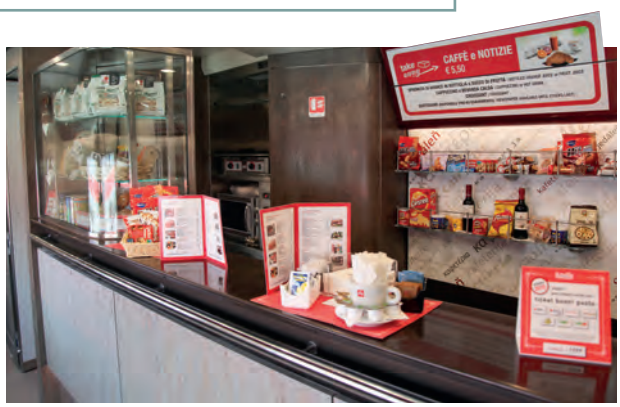
Cracco is a master of contemporary Italian cuisine, and has a two-Michelin-star restaurant in Milan. His signature dishes are available on the lunch and dinner menu in Frecciarossa 1000's executive carriage. Executive service also includes breakfast and snacks, all served at the seats. The menus focus on seasonal and regional fare.

The train also has a bar/bistro, where passengers can buy food and drink. They can also pay for refreshments to be brought to their seats.

LEFT: Wine, beer and soft drinks are served in the executive car

RIGHT: The bar/bistro

BELOW: Four cars are dedicated to standard service



The modular solutions we adopted guarantee the interior can be reconfigured easily

Pietro Diamantini, Frecciarossa 1000 project manager at Trenitalia

configuration, mainly face-to-face. The carriage has a predominantly red color scheme and features additional luggage racks.

The four remaining carriages are occupied by 300 standard seats in 2-2 configuration. Around 70% of the seats are arranged face-to-face. The seats are finished in a gray eco-leather with orange stitching.

Train connections

Another feature that evolved during the design process was the wi-fi. "During the last stages of the project and the early tests, it was decided to strengthen the wi-fi, telephony and passenger information systems, to upgrade them to the latest technical developments, such as the use of 4G-LTE," says Diamantini.

Passenger information, including travel news, is regularly updated and displayed on overhead screens in each carriage. There is also an onboard entertainment system that can be accessed on passengers' computers, tablets and smartphones. The entertainment includes music channels and free and pay-to-view films.

The trains are being manufactured at Bombardier's factory in Vado Ligure, Italy, and AnsaldoBreda's facility in Pistoia, Italy. The first entered commercial service on June 14, 2015, and the last is due to be completed by 2017.

Maintenance matters

The Bombardier-AnsaldoBreda partnership has been awarded a 10-year maintenance contract for the trains, which have a planned 25-year life. Care has been taken to ensure adaptability over the years to come. A modular system has been used throughout to facilitate quick changes of layout or renovation. Each seat is supported on a central post that is attached to a floor rail by four screws.

Similarly, the integration of the reading lights into the seats rather than the overhead luggage racks was intended to enable passengers to personalize their lighting, and also for easy modification of the layout. Pared-back vestibules and wide entrance doors are intended to ensure easy access.

"The Frecciarossa 1000 has a useful life in commercial service of 25 years," says Diamantini. "Obviously, during this time the interiors will need to be updated, improved and maintained. The modular solutions we adopted guarantee that the interior can be reconfigured easily, enabling it to continue to meet our business needs, however they may evolve."

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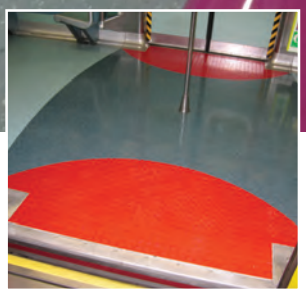

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 Angela Singleton

Taste of success

The methods employed by long-distance operators to edge their catering offerings ahead of the competition include dine-in cars, restaurant inspired cooking techniques, brand tie-ins, and the use of sustainable, local and organic ingredients

MAIN: VR Group's new restaurant car for long-distance intercity routes

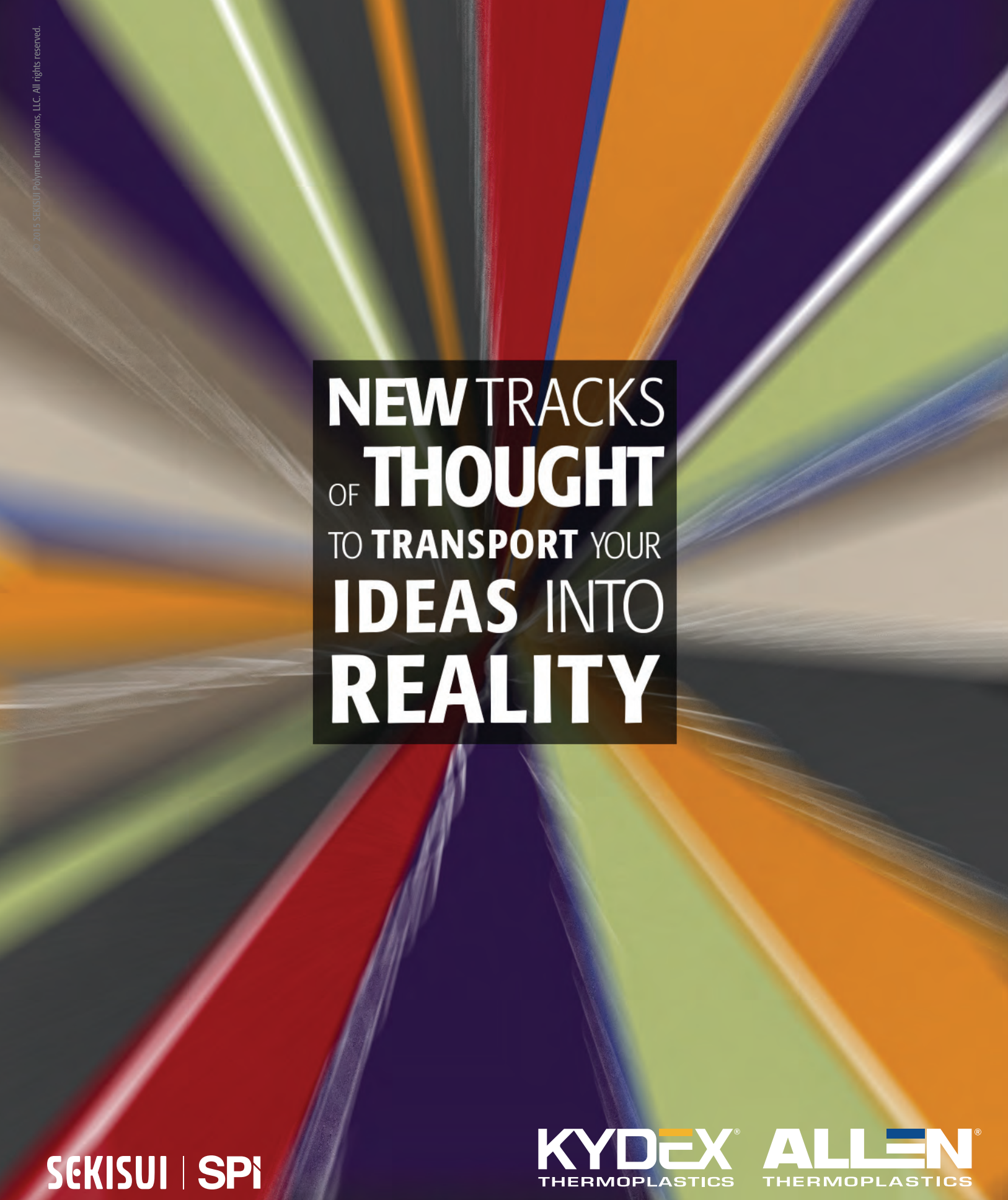
VR Group/Brendan Delany Fotozone

Space is precious on a train, so any given over to accommodate catering facilities rather than seats has to be used wisely. "Catering space inevitably reduces the number of seats available, and seats generate far more revenue than food service, despite the importance to the customer of this provision," says Ciaran Foley, managing director of rail catering specialist Rail Gourmet. "We are providing catering from ever decreasing space, and increasing innovation in equipment, service and technology will be key to delivering food services on board into the future."

In 2014, VR Group introduced a restaurant car on double-deck, long-distance intercity trains operating on several routes in Finland. The lower deck is a 40-seat DuettoPlus restaurant with a kiosk that can be opened in peak hours, while on the upper deck there is a passenger car with 29 seats and a 12-seat conference compartment.

VR ordered 26 of these cars from Transtech, at a cost of around €3m (US$3.4m) each. The operator recently conducted a survey of its family services and found that the catering was well received. "We surveyed nearly 800 people and got a lot of good ideas to further develop the services," says Pia-Mari Sotavalta, service development manager at VR. "While some children like to travel with their own snacks, we found that families traveling with children also like to use the train's restaurant services, with 60% of respondents saying they had used them to eat in or to make a purchase. The most popular items are coffee, beer and cheese sandwiches/rolls. The most popular warm meal is Finnish meatballs with mashed potatoes."

VR's onboard catering is operated by Avecra, a subsidiary. "How a restaurant area is designed plays an important part in food provision," says Marjukka Nousiainen, marketing coordinator at Avecra. "It's very important to know how customers move in a restaurant car – from which direction they



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arrive, and so on – so that we can position furniture, products, price lists and promotional notices correctly. When designing our Duetto cars we made a mock-up of the restaurant car to make sure that the design worked."

Avecra also provides catering services for VR's Allegro trains, which provide high-speed, cross-border links between Helsinki and St Petersburg. These trains offer complimentary meals in first class, a retail restaurant and a café bar.

Another operator offering complimentary meals in first class is Thalys, on its high-speed lines linking Paris, Brussels, Amsterdam and Cologne. Standard-class passengers can purchase meals, snacks and drinks in the Thalys Welcome Bar.

Local delicacies

Thalys prides itself on its organic and sustainable menu. An online survey the company conducted in the second quarter of 2015 found that 72% of its customers are happy with its catering in first class. "Since 2007 we've taken a sustainable approach to our onboard catering, serving food created with organic, regional and seasonal products, favoring white meat and fish from verified sources," says Bérengère Vuathier, product PR coordinator at Thalys. "Vegetarian menus are always available as well."

Meanwhile, Swiss Federal Railways (SBB) has restaurants and bistros on its IC and ICN intercity trains. They have been offering menus devised by the Swiss National Culinary Team since July 2013. Local dishes including curried rice and minced veal are popular hot meals. All dishes are prepared using produce sourced primarily from Switzerland. Local wines, beers and soft drinks are also on the menu. Lavazza coffee is served by SBB stewards to passengers in their seats. Croissants, sandwiches and snacks are also available on InterCity and some InterRegio services. SBB's first-class passengers traveling in the six-seat compartments in the dining car on tilting intercity trains can also order food to be brought to their seats.

SBB's catering subsidiary, Elvetino, operates 103 railway dining cars and 121 minibars throughout Switzerland, Germany, Italy and France. "Passengers are generally looking for fast food solutions," says Barbara Lang, manager of marketing at Elvetino. "Many are traveling for less

When designing our Duetto cars we made a mock-up of the restaurant car to make sure that the design worked

Marjukka Nousiainen, marketing coordinator at Avecra

TOP LEFT: VR's Duetto cars have a restaurant and a kiosk on the lower deck

ABOVE: Hot meals, snacks and drinks can be bought in the Duetto cars

TECHNOLOGICAL REVOLUTION

One product of the internet age is e-catering. An example is Rail Rider, a company that enables Indian Railways passengers to pre-order and pre-pay for meals to be delivered as their train pulls in. The meals are created in local restaurants. The service is available at more than 100 rail stations across India and on trains such as the Jaipur Express, the Bhopal-Gwalior Intercity Express and the Flying Ranee from Mumbai to Surat.

Operators are also harnessing modern technology. Examples include enabling passengers to pre-order food through their websites and using onboard wi-fi for card payments. Some are also using apps to gather feedback – both on everyday service and product trials – as well as for food ordering.

LEFT: The dining car on Amtrak's Silver Meteor

BELOW: A breakfast roll, one of the offerings available in NSB's café cars

than an hour. It's important to offer foods that can be quickly prepared and easily reheated. We are constantly thinking about new food concepts."

Some operators, including Norwegian State Railways (NSB), use vending machines, taking food service from fast to instant. NSB has these on shorter intercity lines, offering hot and cold drinks and snacks. On longer intercity lines, NSB trains include a café car, serving hot meals, snacks and drinks.

Brand power

Some operators partner with big brands. The first Starbucks on a train launched in November 2013 on an SBB InterCity from Geneva Airport to St Gallen in Switzerland; the second, in May 2014. Simon Redfern, director of communications at Starbucks, says bestselling drinks in the "very popular" cafés are coffee with cream and latte macchiato. Sandwiches and snacks are available.

Many passengers are traveling for less than an hour. It's important to offer foods that can be quickly prepared and easily reheated

Barbara Lang, manager of marketing, communication and PR at Elvetino

RIGHT: Mitch Tonks talks to passengers enjoying a menu he created for First Great Western's Pullman restaurant car

In the UK, the brand partnership approach has been taken by First Great Western for its Pullman restaurant service, developed with restaurateur Mitch Tonks. In the USA, Amtrak has enlisted the help of celebrity chefs including James Beard, Michel Richard and Sara Jenkins to create "exciting, flavorful food with a regional focus".

On Amtrak's hourly Acela Express route from Washington, DC, to Boston, business-class passengers can choose from main courses including sea bass with saffron broth, and desserts including mocca verrine (a chocolate dessert layered in a glass). There are three menus, which are rotated on a six-weekly schedule. Since 1995, Amtrak has also used the sous-vide cooking technique, more often associated with fine dining, on its long-distance trains. It involves cooking vacuum-packed ingredients slowly in water at a controlled temperature.

Looking to the future, European operators that wish to offer a catering service on board their trains will need to heed new legislation, coming into effect at the end of 2016, that will require them to publish full nutritional information for all their offerings. This development follows earlier EU legislation – which came into effect in December 2014 – requiring train operators to list allergenic ingredients.

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 Angela Singleton

UK operators including Southern work closely with the British Transport Police

Crime stoppers

From phone apps that enable crimes to be reported in real time, to body-worn cameras that are used to film incidents on board, operators are coming up with new ways to make passengers feel more secure

In the UK there is a national police force dedicated to the railways. The British Transport Police works in cooperation with operators, patrolling stations and trains and responding to incidents across the country.

One such operator to enjoy a close partnership with the British Transport Police is Southern. "We liaise with them regularly on matters requiring a joined-up approach," says Chris Hudson, a spokesperson for the operator. "We have a Safer Travel Team that comprises 32 Southern neighborhood officers and British Transport Police officers. The team patrols trains and responds to incidents that occur on our network."

"Passengers tell us that the best deterrent against crime is a visible staff and police presence on trains and at stations," says David Sidebottom, director of independent watchdog Transport Focus, which represents the interests of rail passengers in the UK.

In the USA, police partnership is also key to Amtrak's security policy. The operator works closely with the Amtrak Police Department on a range of frontline and behind-the-scenes security measures, including passenger searches and baggage inspections. Amtrak police also carry out random onboard ID checks.

In Australia, Victoria Police will recruit more than 1,000 protective services officers by mid-2016, to increase commuter safety at 212 metropolitan railway stations and four regional stations from 6:00pm until the last train.

One of the British Transport Police's initiatives is a text service that enables passengers to report crimes or incidents as they happen, discreetly. The text service is monitored 24/7. In 2014/15, 8,926 texts were received – nearly 750 a month.

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In one incident, a passenger used the text service to alert police about rugby fans on a train whose behavior they found intimidating. Police met the train and two men were arrested. In another incident, a passenger spotted a man carrying a weapon and reported the incident via text, resulting in another arrest.

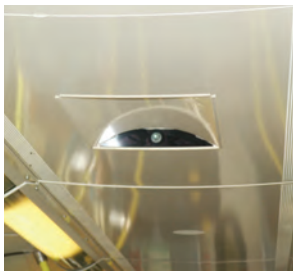
Southern also has an email-based reporting system designed to combat low-level crime such as antisocial behavior. "Passengers can send an email if they see anything they would like us to know about," says Hudson. "These emails are collated and the information contained can inform us of hotspots that require attention."

The app approach has been taken by Bay Area Rapid Transit (BART), which serves the San Francisco Bay Area in the USA. Local police launched a smartphone app that allows passengers to report crimes, as well as suspicious items and activities on trains.

FIGHT CAMS

Smart CCTV cameras that alert police before a crime even takes place are becoming a reality. Developed by researchers at Cardiff University in the UK, the system alerts CCTV operators and police officers when fights seem likely to break out in the city center.

According to Professor David Marshall from the university's computer science unit, the surveillance system uses sophisticated technology to analyze how crowds move in public, triggering an alert when a fight is anticipated. "It could be adapted for use on trains relatively easily if different behaviors were programmed into the system," says Marshall.



ABOVE: CCTV on a Southern train

BELOW: The British Transport Police is focused purely on policing the UK's railways

Passengers can use BART Watch to send a text description of what they are seeing and/or attach a picture

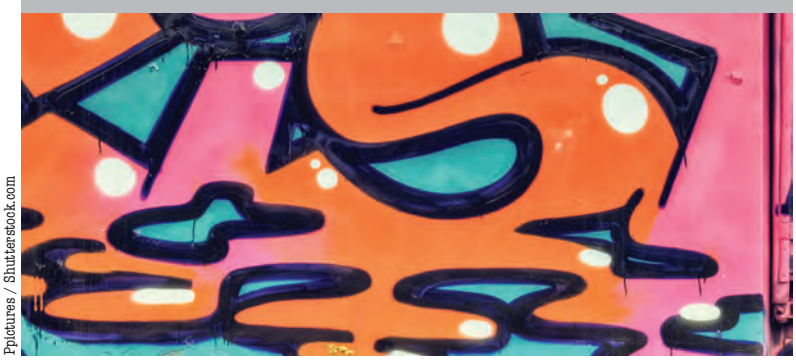
Kenton Rainey, chief of BART Police

TACKLING GRAFFITI

In Australia, Sydney Trains is trialling a new spray paint sensor on selected trains, aiming to catch graffiti artists in the act. Graffiti is one of the top complaints of Sydney Trains' passengers. Cleaners remove around 11,000 tags from the operator's trains each month, at a cost of AUS$30m (US$21.2m) in 2014.

The system is nicknamed Mousetrap. An electronic chemical sensor detects the vapor of both spray paint and marker pens on carriage surfaces and sends live CCTV footage to Sydney Trains staff. So far, it has led to the arrest of more than 30 graffiti vandals.

"We know it's early days for Mousetrap, but its success has been in enabling Sydney Trains to move from a strategy of removing graffiti to one where we stop it as it happens," says Howard Collins, chief executive at Sydney Trains. "Our message to graffiti vandals is clear – spray the paint and run the risk."



Ppictures / Shutterstock.com

"Passengers can use BART Watch to send a text description of what they are seeing and/or attach a picture," says BART Police chief Kenton Rainey. "There is also a one-tap button that will connect the passenger with BART Police by phone. Text reports may be sent anonymously. If they are in an area without cellular service, the report will be stored and delivered as soon as there is service again."

A mobile app to report rail incidents has also been developed and is being trialed on Indian Railways' Northern Railway. "Based on the experience gained and the feedback received from passengers, this will be extended to all railways soon," says Suresh Prabhu, India's railway minister.

Zooming in

CCTV is commonly used by operators to keep an eye out for criminal activity onboard trains. "We have CCTV on all our stations and trains," says Southern's Hudson. "The CCTV systems at stations are digital and live images are sent to our control center. On our trains, CCTV images are stored on the train's system and can be downloaded if required."

The British Transport Police's 2015 report reveals that although crime on the UK's railways dropped by 8.2% overall, the number of violent and sexual offences rose. The Rail Delivery Group (RDG) says that investment in security measures, including CCTV, is vital. "While overall crime levels on the railway have continued to drop for the 10th successive year, even one crime is one too many and

RIGHT:
A British Transport Police officer

FAR RIGHT:
ScotRail is trialling body-worn cameras

will not be tolerated by operators," says Paul Prentice, senior media officer at RDG. "That's why millions of pounds are spent funding the work of the British Transport Police, improving CCTV at stations and hiring additional security staff."

Women-only carriages

Indian Railways' Western Railway is also investing in CCTV. It recently installed a CCTV system inside women-only compartments on a Mumbai EMU rake. Each compartment has up to eight cameras and the system has the capacity to record for 30 days. "It will hopefully deter criminals and reduce crime rates in trains," says Sharat Chandrayan, Western Railway's chief spokesperson.

The CCTV cameras have been customized to withstand shocks and vibrations on suburban railway trains, which often reach around 100km/h. Western Railway also plans to install 90 cameras in three more EMU rakes.

"The cost of installing CCTV cameras is about Rs100,000 (US$1,505) in each rake," says Shailendra Kumar, divisional railway manager of the Mumbai division, Western Railway.

REVENUE PROTECTION

For operators, efforts to increase security can go hand-in-hand with revenue protection. UK-based operator London Midland has been redesigning its approach this year, targeting known offenders who had been observed by conductors. The initiative led to a British Transport Police award. "The revenue team has cemented a solid working relationship with London Midland conductors and British Transport Police in Liverpool and this award demonstrates the real difference we are making," says Debbie Mills, London Midland's lead revenue protection manager.

London Midland is also working on a new approach to fare dodging across its network, which stretches from London to Liverpool and across the West Midlands. Almost 200 penalty fares were issued in a clampdown in Birmingham recently.

"The new approach is all about being flexible, so fare dodgers will never know when and where they might be challenged," says Darren Hanley, head of revenue protection at London Midland. "You could say we want to keep people on their guard so that cheating is never worth the risk. Our new approach is already being welcomed by fare-paying passengers. It will drive down antisocial behavior, and because we are working with other agencies, people may get picked up for offenses other than fare dodging."

We are carefully reviewing feedback before taking decisions on the next steps for the technology

David Lister, sustainability and safety assurance director for the ScotRail Alliance

Body-worn cameras

Scottish operator ScotRail is combining a staff presence and camera technologies. On some of its busiest routes it is trialling the use of body-worn cameras. The operator believes the technology has the potential to improve safety and security by helping deter antisocial behavior. Audio and video footage from the cameras could potentially be used as evidence in court.

Around 130 station and on-train staff took part in an initial 11-week trial of 21 cameras. ScotRail has launched a second trial on trains in the Central Belt area, including Strathclyde, to gather more data to help it make a decision about whether to introduce the cameras permanently.

"While crime has fallen for 10 consecutive years on Scotland's railways, we're determined to make rail travel feel even more comfortable for customers and staff," says David Lister, sustainability and safety assurance director for the ScotRail Alliance. "Body-worn cameras are one element of this ongoing commitment, and we hope that customers will find them to be a reassuring presence. Throughout the trial phases we are carefully reviewing feedback from staff, customers and industry partners before taking decisions on the next steps for the technology."

Staff only turn the cameras on when doing so could help prevent or document incidents, says ScotRail. A yellow symbol is displayed on the front of the devices when video and audio is being recorded. The footage is encrypted and cannot be viewed by frontline staff. A constant looped pre-recording system makes footage available from 20 seconds before the camera is turned to record mode.

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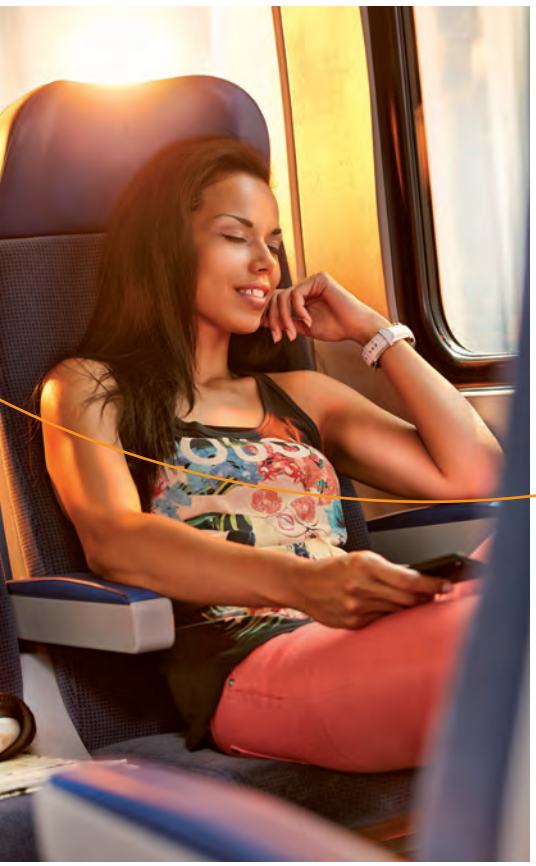

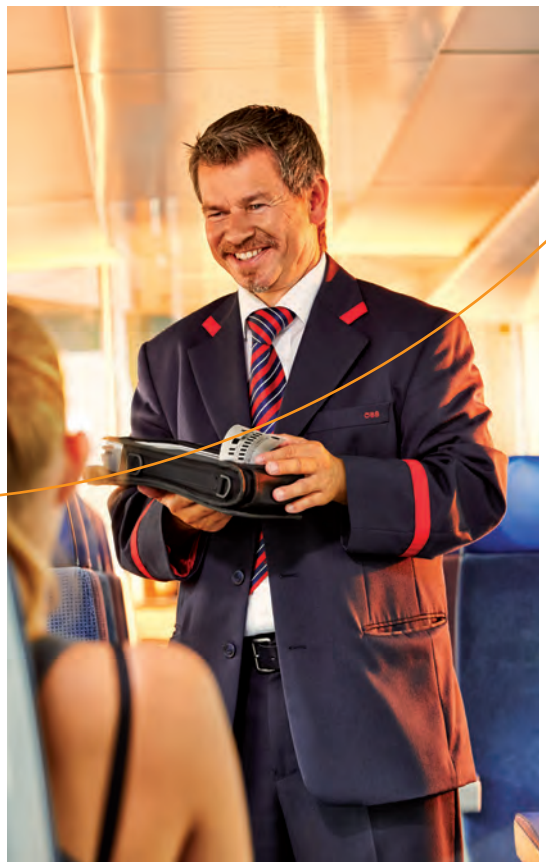

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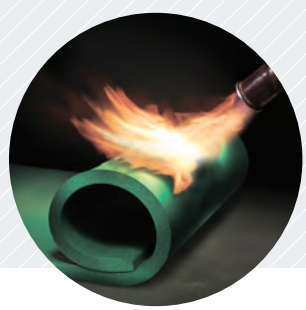

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Continental shift

Expansion is the name of the game for Eurostar – its new trains will enable new routes, greater capacity and more space at each seat

Just over 20 years have passed since Eurostar began operations, using the Channel Tunnel to offer a high-speed rail alternative to flights between London, UK, and select destinations in mainland Europe.

Eurostar operates with a fleet of 27 Alstom EMUs, which have a top speed of 300km/h. These 18-car trains can make the trip from London to Paris, France, in two hours and 16 minutes; to Brussels, Belgium, in two hours; and to Lille, France, in one hour 22 minutes.

In May 2015 Eurostar launched a new route connecting London with the southern French cities of Lyon, Avignon and Marseille. The operator also plans to operate another new route from the end of 2017 – linking London to Antwerp, Belgium, before heading to the Dutch cities of Rotterdam, Schiphol and Amsterdam. However, its current fleet is not capable of running on that line.

Partly to enable it to expand its route network and partly to increase capacity and comfort, Eurostar has ordered 17 new 16-car trains from Siemens. They will be able to run anywhere in Europe. Including station improvements and the refurbishment of the original trains, the investment totals £1bn (US$1.5bn). The new trains are based on Siemens' Velaro platform and are being made in Krefeld-Uerdingen, Germany. They have a top speed of 320km/h, hence their moniker e320. The new coaches are wider, taller and about 10m longer than the original ones. The first is scheduled to begin operation at the end of 2015.

MAIN: Standard class on the e320

ABOVE: Eurostar's CEO, Nicolas Petrovic, at the new train's unveiling in November 2014

IN NUMBERS

- 17 trains ordered
- 894 seats
- 4 spaces for passengers using a wheelchair
- 20% capacity increase
- 3 classes of travel
- 2 galleys
- 13% extra luggage space per passenger
- 320km/h top speed

The interior and livery designs were created by Italian design firm Pininfarina, best known for its work in the automotive world.

Fabio Filippini, design director at Pininfarina, says the brief was to add 20% more seats per train (to accommodate 894 passengers), while providing greater comfort. "The role of a designer is to try to sort out those contradictions," he says. "We are quite used to working on functionality while creating elegance and emotion. Public transport designs are evolving not only toward greater efficiency, but also toward creating more of an emotional experience for the customer."

Free wi-fi

The functionality most requested by passengers was wi-fi, so it was a must-have on the new trains. The service is free across all classes of travel, enabling all passengers to connect their personal devices to the internet. The system relies on 3G mobile networks to ensure constant service, with antennae on the roof.

Passengers can also access Eurostar's wi-fi portal – which includes news, destination guides and weather information – on their devices. They don't need to be on the internet, as the system is hosted on the train; the servers are housed in equipment cabinets at the end of each car.

It was important to offer the same quality and efficiency to all customers

Fabio Filippini, design director at Pininfarina

The trains also feature new TFT screens, which display information including current location and speed. The screens have the ability to display video, but Eurostar is unlikely to use this feature because it wants to eliminate unnecessary announcements and other distractions, to provide a peaceful experience for customers.

There are also small displays above the seats that indicate if that seat is reserved.

Unified aesthetic

The train has three classes, but with a consistent feel throughout. For example, the same seat model is used for all classes, albeit with some functional differences. "There is very good coherence between the three classes," says Filippini. "It was important to offer the same quality and efficiency to all customers."

MAIN: There are two restaurant cars, one on each side of the central galley

LEFT: The carpet has a ribbed, corduroy-like pattern – just a visual effect, so as not to make trolley service more difficult

BELOW: A universal access toilet on the e320

In Business Premier and Standard Premier, the seats are laid out in a 2-1 configuration. They are designed to recline without encroaching into the space of the person seated behind. Each seat has individual armrests, a leg rest, a niche for a laptop or phone, a mirror, a cup holder, a reading light, a USB socket and UK and continental power sockets. Where there are facing seats, there are tables with sliding fold-out panels.

In Standard class the seats are laid out in a 2-2 configuration, with slightly smaller tables. The seats have less recline than in the other classes, and are the same width but have shared armrests. Of the seat functions included in the other classes, Standard seats retain only the UK and continental power sockets.

Eurostar wanted to give its passengers more room at every seat. A thinner seat design was created to enable this. "The seats are lightweight and very thin to leave more leg room, but they are shaped in a highly ergonomic way and are very comfortable," says Filippini. "Also, the rear shell has soft edges, so it doesn't interrupt the visual flow of the environment."

Two tones

With the aim of creating a cocoon-like environment for passengers, the color of the front of each seat is the same as the color of the back of the one in front of it. Two colors are

LIGHTING, LUGGAGE AND LAVS

Siemens developed the LED lighting system for the train. A consistent daylight scheme was chosen rather than a changing one. There are also blue lights in the luggage racks, which come on when the train stops, to visually remind departing passengers not to forget their luggage. Eurostar offers luggage racks at the ends of every coach in addition to overhead racks.

Also bearing in mind the length of some of its routes, there are plenty of toilets – 24 standard and one universal access toilet in each half set. In each standard pair there is one with a baby-changing table. All the toilets feature touch-free taps.

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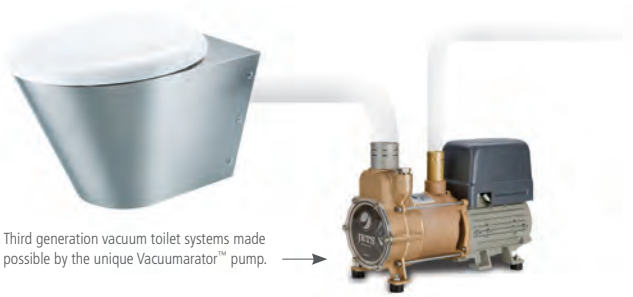

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LEFT: The Business Premier coach

BELOW: Two colors were used in each cabin to visually break up the space

LIKE NEW

The base design of Eurostar's new trains was also interpreted for the refurbishment of the original fleet. One difference, though, is that the seats on the refurbished trains were supplied by Compin, whereas the those for the new trains ones are from Grammer. The refurbishment was performed by the Barat Group.

alternated in each class – dark and light gray in Business Premier and Standard Premier, and dark gray and Eurostar's corporate blue in Standard. "It gives the feeling of different spaces instead of just one boring block of seats," says Filippini. "When you sit in your dark gray zone you feel that it is your space, separate from the blue zone in front of you."

Responding to customer feedback, Eurostar opted for cloth covers rather than velour for the seats. Vinyl, being easy to clean, was chosen for the headrests.

For safety reasons, components including grab and door handles had to be a very vibrant yellow. Pininfarina worked this into the design, tweaking the shade to match Eurostar's corporate yellow, and even applying it to other areas including stitching on the seats in Standard class. "Reusing the safety color for the stitching gives a contrast that you don't expect," says Filippini. "The contrast stitching also introduces a human touch, a hint of craftsmanship influenced by our work in the luxury car industry."

Food glorious food

The main differences between the classes are in service. One of the highlights of Business Premier is the food and drink, which is served direct to passengers' seats. Michelin-starred chef Raymond Blanc worked with Eurostar to create breakfast, lunch, afternoon tea, café gourmand and dinner offerings. He even created videos to instruct the onboard staff on how to prepare the food.

In Standard Premier, passengers are served a light meal and drinks. There is no food service in Standard, but passengers can

When you sit in your dark gray zone you feel that it is your space

Fabio Filippini, design director at Pininfarina

OFFICE SPACE

A popular feature of Eurostar's original train design was its private office cubicles, so the operator has also included some in its new interiors, with an update to make the space brighter and more welcoming.

The cubicles can be used by elite (very frequent) Eurostar customers as a quiet place to take an important phone call or hold a meeting. The spaces can also be used by the British Transport Police in the course of their duties.

The new trains can operate anywhere in Europe, and have a top speed of 320km/h

EUROSTAR TIMELINE

Channel Tunnel opens	Eurostar launched, with routes from London to Paris, Brussels and Lille	10 e320 trains ordered from Siemens	Seven more e320 trains ordered from Siemens	Launch of route from London to Lyon, Avignon and Marseille	Expected entry into service of first e320	Expected launch of route from London to Antwerp, Rotterdam, Schiphol and Amsterdam
May 1994	**November 1994**	**2010**	**November 2014**	**May 2015**	**End of 2015**	**End of 2017**

We tried to smooth down all corners throughout the train

Fabio Filippini, design director at Pininfarina

ABOVE LEFT: Raymond Blanc developed the food served in Business Premier

LEFT: The cars are separated by glass fire doors, which open automatically

buy from a range on offer in the restaurant cars. Passengers can even pre-order cakes for special occasions.

Food is prepared off-site; hot meals are heated on board. There are two galleys, equipped with ovens, fridges, coffee machines and recycling bins. Fridge capacity has been increased on the new train, bearing in mind the longer routes.

One of the galleys is situated between Business Premier and Standard Premier. The other is in the middle of the train, flanked on either side by a restaurant car.

Smooth cornering

The restaurant cars themselves have a minimal, sleek design, with lots of standing room and sweeping, curved counters. "We studied the movement of passengers and tried to smooth down all corners throughout the train," says Filippini. "This was done not only for practical reasons, but also for visual ones, so that your eye moves through the train and you can see exactly where you need to go."

One challenge in this respect was the partitions, a necessary addition given the strict fire safety requirements for trains using the Channel Tunnel. "The partitions are transparent but at the same time they need to be seen for safety reasons, so to create the right balance of transparency and opacity we designed a subtle pattern for them," says Filippini. "The challenge throughout the train was to fulfill the very strong technical, economic and safety constraints typical of public transportation while delivering a sophisticated and refined style. It might seem contradictory, but that's what we were able to do."

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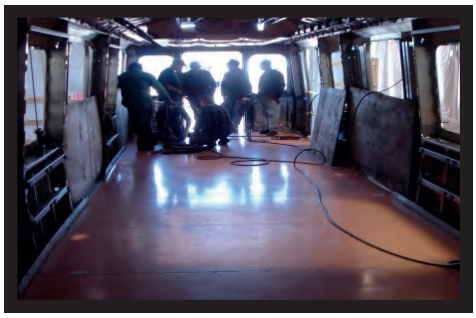
Transit Bus Floors



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Accessibility

Angela Singleton

MAIN IMAGE AND RIGHT: All trains operated by Utah Transit Authority (UTA) are accessible to people using wheelchairs

Rights of access

The US Access Board is working with disability groups and the industry to update guidelines that aim to make rail travel accessible to everyone in the USA

In 2015, the Americans with Disabilities Act (ADA) turned 25 years old. The wide-ranging civil rights law was passed in 1990 to help stop discrimination based on disability. "The law was very detailed in its provisions, particularly in respect to accessible design in the realm of the built environment and transportation," says Dave Yanchulis, coordinator of public affairs at the US Access Board.

The Access Board is an independent agency that promotes equality for people with disabilities through accessible design. It supplies the design criteria that form the basis of legal standards issued by US agencies including the Department of Justice and the Department of Transportation.

After the ADA was passed, the Access Board was given the vital task of establishing minimum accessibility guidelines for buildings and facilities, as well as transit systems. The Access Board's ADA Accessibility Guidelines (ADAAG) were issued in 1991.

"The original guidelines set out national design requirements across all types of sites and facilities, including places of public accommodation, commercial facilities and state and local government facilities," says Yanchulis. "They

Alstom Transport/The Lighthouse – M. Brega

also address the manufacture of transit vehicles, including buses, vans and railcars."

Fixed rail updates

Planned updates to the criteria for buses and vans have already been released for public comment, and now the Access Board is overseeing an update of the ADA's guidelines for railcars on fixed guideway systems, including rapid, light, commuter, intercity and high-speed systems.

The Rail Vehicles Access Advisory Committee (RVAAC) was assembled by the Access Board in 2013 to review current provisions. It includes representatives from advocacy organizations, transit operators, railcar manufacturers and other stakeholders. Members include the Disability Rights Education and Defense Fund (DREDF), the National Association of Railroad Passengers, Center for Inclusive Design and Environmental Access, Bombardier and Alstom.

"These committees can have 30-40 members and enable us to benefit from the expertise of people who are very familiar with the subject matter and who have had a lot of real-world experience of usability," says Yanchulis.

"We worked very well together with the RVAAC," says Melissa Anderson, transportation engineer at the Access Board. "It was nice to have all the members in the same room so that they could understand each other's points of view."

Room for improvement

The RVAAC has taken two years to review the existing ADAAG and has identified key areas it recommends updating. These areas include passenger communication, which could be enhanced through the use of hearing induction loops, visual message systems and tactile signs;

ABOVE AND BELOW: Level boarding and an accessible toilet on Alstom's Coradia Meridian train

BELOW RIGHT: Siemen's new Velaro D/ICE train for Deutsche Bahn has a hydraulic lift for wheelchairs on each side

FIVE OF THE RVAAC'S RECOMMENDATIONS

Announcements
When announcements are made on board the train, dual-mode communications should be employed so that they are accessible to all passengers. The placement of the visual announcements should be clear and all audible announcements should be compatible with hearing aids.

Seats
When seats are temporarily removed or reconfigured on intercity and high-speed railcars to allow a group of people with disabilities to sit together, any group rate surcharges should be modest.

Securements
Mobility device securements (straps and tethers) are not required on rail vehicles. If provided, it shall be the rider's decision as to whether to use them.

Service animals
If service animal spaces are provided at certain seating spaces on railcars, the rail provider may not impose a requirement that passengers who have service animals are restricted to using those seats.

Intercity-like rail service
When companies other than Amtrak operate a very similar service (a situation not addressed in the 1990 ADA), the Department of Transport should consider how it can require such companies to comply with the same non-discrimination rules that the ADA requires of Amtrak.

It was nice to have all the members in the same room so that they could understand each other's points of view

Melissa Anderson, transportation engineer at the US Access Board

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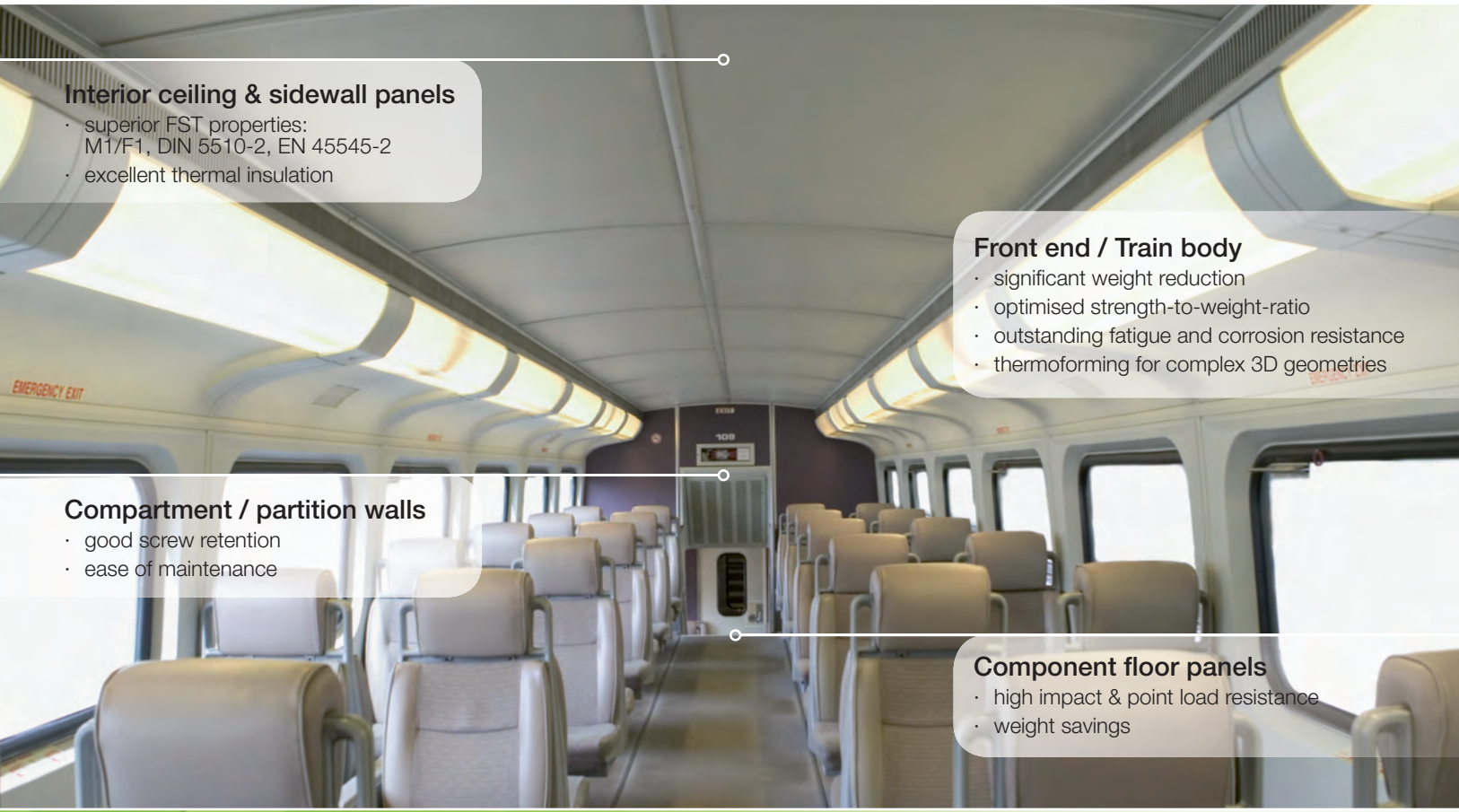

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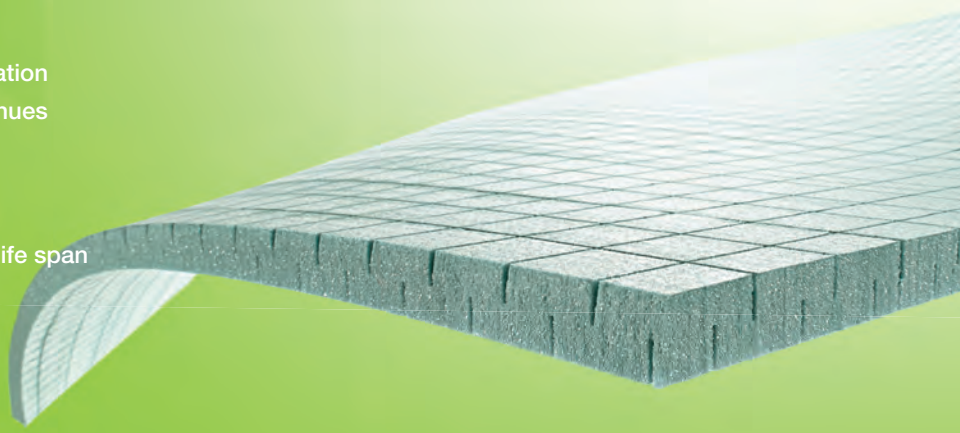

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LEFT AND ABOVE: Accessible seating areas on UTA trains

The public gets a chance to weigh in and say what they like and what they don't like

Dave Yanchulis, coordinator of public affairs at the US Access Board

LEFT AND CENTER: Signs, seat numbers and car numbers are provided in braille on Siemen's new Velaro D/ ICE train for Deutsche Bahn

greater use of level boarding; reduced gaps between vehicles and station platforms; and improved toilet area design.

Next steps

On July 29, 2015, the RVAAC submitted its final report to the Access Board. "We will now review and digest that material," says Yanchulis. "At a later date, the Access Board will propose updates to its ADA vehicle guidelines based on the committee's report, but we might raise some additional issues or questions before it's made available for public comment."

The public consultation is the next step after the Access Board's review. "The public consultation is an important part of the process," says Yanchulis. "It's when the public gets a chance to weigh in and say what they like and what they don't like."

But what about the operators; are they as keen to embrace change? "Transit systems need to work for everyone," says Paul Beatty, who was part of the team responsible for overseeing the RVAAC and also works for the Office of Technical and Information Services at the Access Board. "Operators know that accessibility is a necessary ingredient – the only thing they need to establish

ACCESS IN THE USA

July 1990	September 1991	July 2010	May 2013	November 2013	July 2015
Americans with Disabilities Act (ADA) passed	US Access Board publishes the ADAAG for transportation vehicles, adopted by the Department of Transportation as its ADA vehicle standard	The Access Board proposes updates to the bus and van sections of the ADAAG following a review	The Access Board establishes the RVAAC to recommend updates to the railcar sections of the guidelines	The RVAAC holds the first of seven review meetings	The RVAAC submits its final report to the Access Board for review and eventual public consultation

ABOVE AND RIGHT:
A universal access toilet designed by DCA and Hitachi for the UK's IEP

Alstom Transport/The Lighthouse – M. Brega

Some operators are already very good on accessibility but are poor at communicating it to passengers

Paul Beatty, accessibility specialist at the US Access Board

WHAT'S HAPPENING IN EUROPE?

The Technical Specifications for Interoperability for persons with reduced mobility (PRM TSI) came into force on January 1, 2015, replacing a previous version from 2008. It sets out guidelines for accessibility and applies to the whole European network.

According to the European Railway Agency (ERA), member states are obligated to adopt national implementation of the TSI – that is, coordinated plans to apply the TSI to existing rolling-stock fleets and passenger stations.

Member states have until January 1, 2017 to develop their plan. "Plans are national, meaning that the strategy, the criteria for upgrading stations and rolling stock, and the extent to which the TSI will apply, are all decided at national level," says an ERA spokesperson. "A European advisory body has been created to monitor the development of the national plans and exchange best practice."

ABOVE LEFT:
A wheelchair securement point on Alstom's Coradia Meridian

BELOW: For boarding, Amtrak can provide a ramp or, as shown, a mobile lift

Amtrak

is how it's achieved," he says. "We also have the issue that some operators are already very good on accessibility but are poor at communicating it to passengers."

Beatty says one of the biggest challenges to accessibility is old infrastructure. "100-year-old rail systems obviously have more constraints," he comments. "Usually, the newer the system, the better the level of access," says Anderson. "If we were building everything from scratch, accessibility wouldn't be an issue. But the problem is that we just don't build a lot of new stations and our railcars are lasting for 30-50 years. Even when new cars come in and they are accessible, they are still operating in older stations that may not pair up very well."

The updated guidelines might take several more years to reach publication, but it is hoped that when ready, they will advance the Access Board's mission of ensuring independent access for all people wishing to use the railway. "One of our goals is equivalence, whereby an equivalent level of access is provided to everyone," says Yanchulis. "We also want accessibility in a way that precludes the need for any kind of assistance from anyone else."

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BART Izzy Kington

Crowd pleaser

Through a massive public outreach campaign, BART involved more than 35,000 people in the design of its new cars

LEFT: The final design for BART's Fleet of the Future

The weekday ridership of the Bay Area Rapid Transit (BART) in the San Francisco Bay area of the USA is 430,000 people – a figure predicted to rise to 500,000 in five years' time. At some times there can be as many as 200 people riding in cars designed for approximately 70. Another problem is that the fleet is aging. Of the 669 cars, 439 have been in operation since the early 1970s and were last refurbished between 1997 and 2002. An additional 150 cars were introduced in 1988 and 80 in 1994.

"BART has the oldest big-city fleet of train cars in the USA," says Aaron Weinstein, chief marketing officer at BART. "In addition we need to add capacity to handle the rapidly growing demand we are experiencing."

In 2012 BART ordered 775 new Bombardier cars, its Fleet of the Future, which should be phased in from the fourth quarter of 2016 until 2021. "Our customers are experiencing very crowded conditions, so the new cars will initially be used to build up our fleet," says Weinstein. BART doesn't plan to start retiring the old cars in big numbers until the fleet has been built up to 905 cars.

Capacity gains

BART is not adding capacity by cramming more seats into each car, but by increasing the number of cars and implementing a new control system that will enable trains to run closer together.

There are two car types on order – 40% with a cab for a train operator and 60% without. The cars can be run in sets of three to 10. On average there are 54 seats per car, plus standing room – 4.6 fewer seats per car than BART's current fleet. This decrease is due to the decision to add a third set of doors to each car to ease ingress and egress, and by the need to add safety buffer zones at the ends of each car.

"The seat loss per car will be more than overcome by an increase in the number of cars, and hence the total number of seats in the fleet," explains Weinstein. "When our fleet comprises 905 cars, which it should do in 3-4 years, we will have 26% more seats in the fleet. The eventual aim is to boost the fleet to at least 1,000 new cars – and then we will have at least 38% more seats."

Weinstein led BART's design committee for both the interior and exterior of the new cars. BART also contracted design firms BMW Group DesignworksUSA and Morelli Design, the

latter coming on board at a later stage as the sub to Bombardier. “We wanted the car to be comfortable, easy to clean, spacious and quiet,” says Weinstein.

Perhaps the most important contributor to the design was the general public. “The scale of our outreach effort was probably beyond what most other agencies do,” says Weinstein.

The public consultation began in 2011 with ‘seat labs’. More than 2,000 customers tried out some of BART’s existing seats, which had been modified to offer various dimensions, and seats from other operators. Based on these customers’ feedback, BART decided its seat should be 20in wide (which 90% of participants found acceptable), with 18.3in from the floor to the top of the seat base (which 97% found acceptable), and minimum hip-to-knee legroom of at least 27in (which 97% found acceptable). Bombardier selected Kiel to supply the seats.

Clean sweep

Customers made it clear that they wanted greater cleanliness. “We’ve had fabric seats for many years, which were really hard to keep clean,” says Weinstein. The input was so compelling that BART’s general manager, Grace Crunican, ordered an interim project to replace all the fabric seats and carpet on the current fleet with vinyl seats and non-textile flooring.

The next step was to release renderings by BMW Group DesignworksUSA, to get feedback on aspects including exterior designs, seating types and locations for information screens. Feedback was captured online and at community meetings. At a later stage, BART took prototype seats and a bike rack on tour.

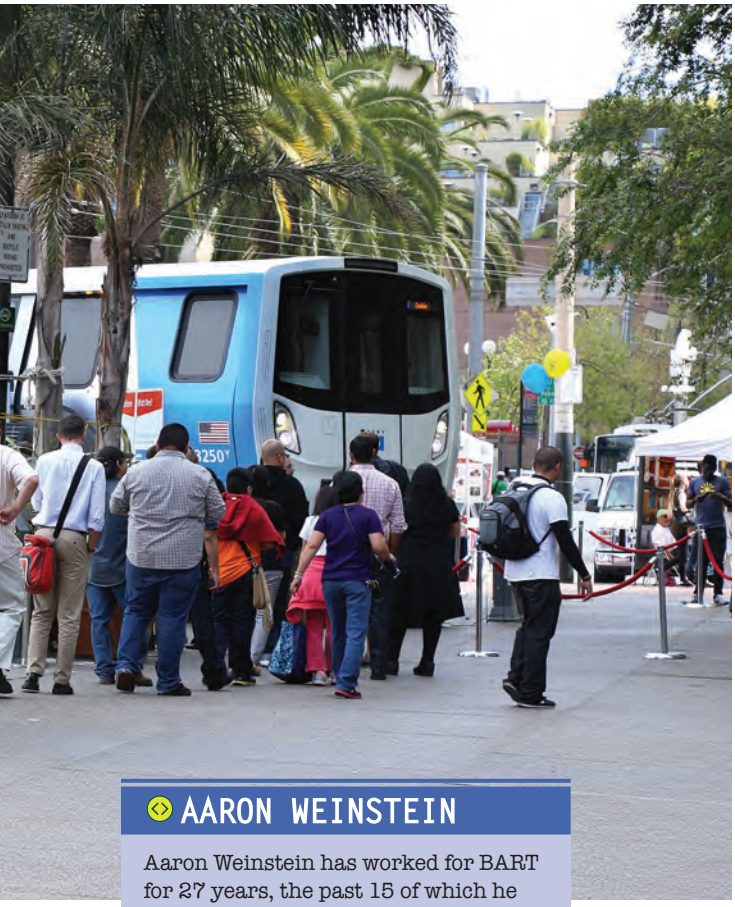
These efforts culminated in a soft mock-up, built by Bombardier, of around 60% of the car. It was made available for the public to experience and comment on for many weeks. “We also invited about 100 randomly selected customers to participate in a simulated ride, to see how the car performed under crowded conditions,” says Weinstein. “In addition we had a special session for people with disabilities.”

BART and Bombardier engineers, along with Morelli Design, then used the consumer feedback to refine the design and create a hard mock-up. “We invited people to experience the hard mock-up, and around 17,000 attended,” says Weinstein. “The purpose was to confirm that all the adjustments we had made were valid. When you

LEFT: BART simulated a ride on the soft mock-up with some of its customers

FLEET OF THE FUTURE TIMELINE

2009	2011	2012	2013	2014
BART issues request for proposals for the new cars	Having reviewed the original proposals, BART issues request for best and final offers	BART selects Bombardier’s offer, and begins the detailed design	Prototype seats and soft mock-up submitted for public review	Hard mock-up exhibited; design finalized



MAIN AND LEFT: The hard mock-up was visited by more than 17,000 people

AARON WEINSTEIN

Aaron Weinstein has worked for BART for 27 years, the past 15 of which he has served as chief marketing officer, in charge of marketing and market research. The role has prepared him well to lead the interior and exterior design of the operator's new cars, especially given the importance placed on community engagement.

"Over the years BART has made a number of changes to its fleet and the operations team has commissioned market research to inform that," explains Weinstein. "Our board of directors likes to review consumer feedback before major design choices are made." When the new car project came along, Weinstein was asked to lead a public outreach effort as well as the design of the cars.

take into account all these phases, as well as the online feedback, well over 35,000 people participated in the design effort."

Expert advice

Specialist groups that were consulted included the BART Accessibility Task Force (BATF), BART's Limited English Proficiency (LEP) Advisory Committee, a bicycle advisory committee and funding agencies including the Metropolitan Transportation Commission and the Federal Transit Administration.

BATF and LEP feedback was very important to the design of passenger information systems. In each car there will be an LED screen on the bulkhead at each end, displaying the next stop. There will also be a 27in LCD screen next to each of the six doors.

The LCD screens will display a system or route map showing current position and the route, along with the next stop. The upcoming station's name will appear beside the word 'next' in several languages in rotation. A corner of the display will be used for information such as delays, marketing programs and other messages – but there are no plans to incorporate advertising.

"The LCD screens are going to be a very big leap forward for the deaf community," says Weinstein. "Most of the information on our old cars is given via audio, with no visual equivalent."

Our board of directors likes to review consumer feedback before major design choices are made

Aaron Weinstein, chief marketing officer at BART

	Scheduled delivery of first of 10 pilot cars and start of testing phase	Scheduled preproduction design review; beginning of production	Scheduled entry into service for first pilot cars	Scheduled first delivery of production cars	Scheduled final delivery; bringing new fleet to 775 cars
	Q4 2015	**2016**	**Q4 2016**	**January 2017**	**September 2021**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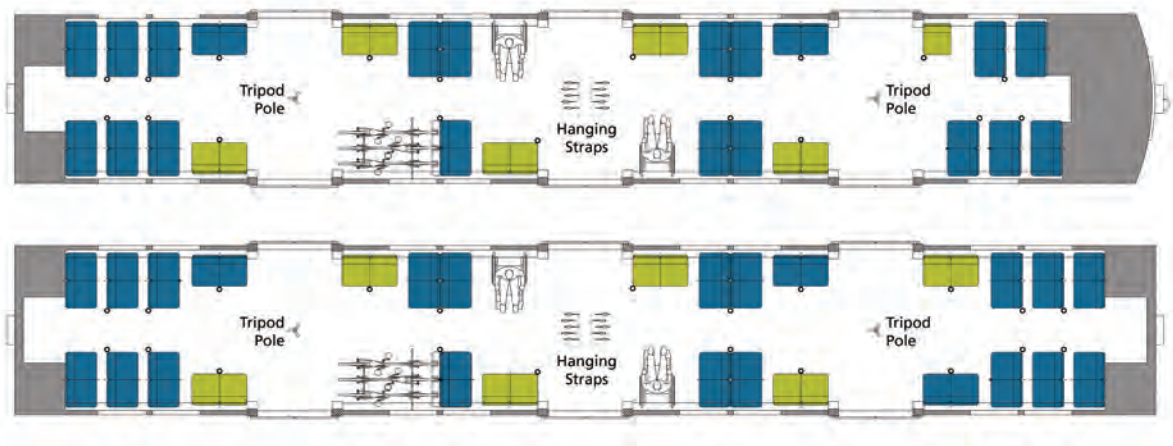
RIGHT: The cab cars (top) will have five fewer seats than the non-cab cars (below)



We established a floorplan where bicyclists and wheelchair users would use different doors

Aaron Weinstein, chief marketing officer at BART

Induction loop

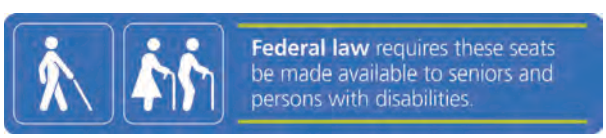
BART will also test an induction loop system for on board the car. "We will be one of the earliest transit agencies in the world to test that," says Weinstein. "All audio announcements will be transmitted automatically to hearing aids and cochlear implants."

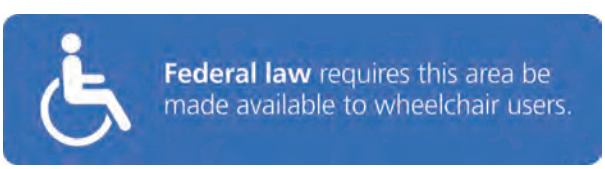
BART is also moving intercoms to more accessible locations, following input from BATF. Instead of two intercoms, one at each end of the car, there will be three, one at each set of doors.

Another of BATF's concerns was that wheelchair users and bicyclists might collide. "To address this, when we adopted the three-door design, we established a floorplan where bicyclists and wheelchair users would use different doors," says Weinstein.

There are 50% more designated seats for senior citizens and people with disabilities – 11 or 12 per car. Weinstein also says customers reported problems with people not yielding these seats to those who need them. "In the past we've used signs, posters and announcements to combat this," says Weinstein. "On the new cars we are going a step further, by making those seats a different color – bright chartreuse. The same color will be used on signage right above the seats, pointing out that federal law requires the seats to be made available to seniors and people with disabilities."

RIGHT: BART has developed new signage to support its accessibility efforts





SAFETY MATTERS

Safety features of the new design include additional reinforcements to the cab cars, quarter posts and a safety buffer zone at both ends of every car to absorb energy in the event of a crash. There are also lots of handholds, to minimize the number of falls.

"One thing that has made this project challenging is that BART has more stringent requirements than most other systems do for smoke, fire and toxicity," says Aaron Weinstein. "Everything we put on the train is subjected to intense testing to those higher standards, which informs the material selection."

Weinstein also says that increasing seat height from 16.5in to 18.3in will benefit senior citizens. "They in particular told us that our old low-slung seats were hard to get up out of," he explains.

Wider aisle

There is also more space to move around. At its narrowest, the aisle is 32in wide, about 3in wider than in the old car. "At the mock-up stages, customers told us the cars feel very spacious," says Weinstein. "I think that is largely due to the wider aisles and the third set of doors. With the colors and lighting as well, we really succeeded in creating a more spacious feel."

The BART network includes two international airports, so luggage space was of particular importance. "We looked at systems around the world that serve airports and saw two models – those that have luggage racks and those that enable customers to keep their luggage near to them," says Weinstein. "Even on systems that provide racks, quite often customers set their luggage close enough to hold or touch, so we looked for opportunities to allow that. One of the ancillary benefits of raising the seat height is that standard carry-on luggage can now fit underneath. In addition, with the wider aisles we have some extra open space."

The spacious new design enabled the incorporation of a horizontal bicycle rack next to the end door of every car, a feature not offered in the old cars. Bombardier designed a tensioned

LEFT: The bicycle rack

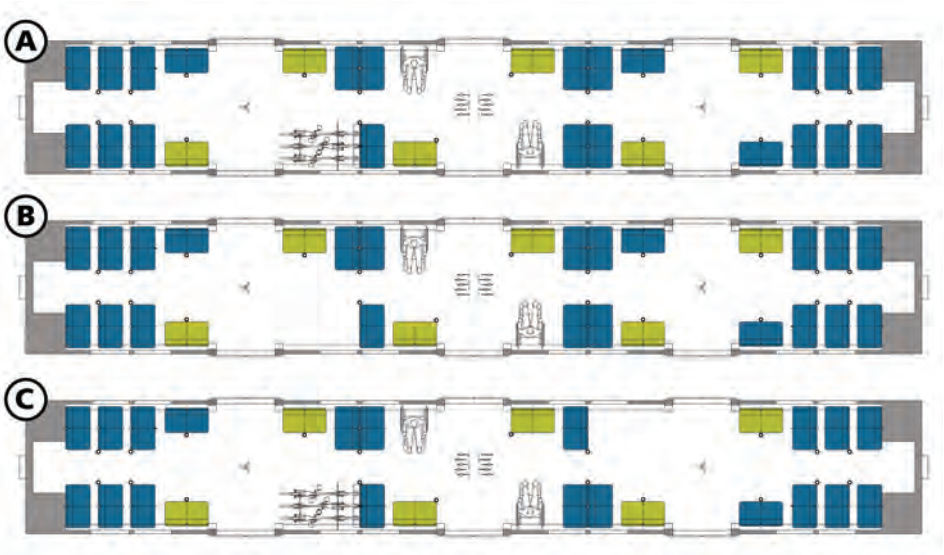
BELOW: There is room under the seats for airline carry-on luggage

wedge that grips one of the bicycle's wheels, keeping it upright. It accommodates three bicycles.

"This gives cyclists a convenient place to park their bicycles, without blocking aisles, seats and doorways," says Weinstein. "We had feedback from cyclists and non-cyclists that the laissez-faire approach wasn't working very well."

Prototypes were tested with the help of a bicycle advisory committee. Refinements included the incorporation of a handle that cyclists can use to secure their bicycles further using bungee cords; improvements to the grip strength of the wedge; and signage to guide people to park front, back, front in terms of the tire configuration, to prevent handlebars from interfering with each other.

BELOW: In its pilot cars, BART will test three options for accommodating bicycles – one layout with a rack, one with a multi-use space, and one with both



BART is also providing more secure bike-parking spaces at many of its stations.

Airy and light

Other improvements include the lighting and air-conditioning. BART's rolling stock engineers chose LED lighting for the interior and much of the exterior. "BART wanted to improve energy efficiency," says Weinstein. "The main lighting is arranged longitudinally down the length of the car, and there is indirect lighting as well, which will brighten the ceiling and make the car feel light and spacious."

Bombardier engineers designed a new air-conditioning system that delivers air at ceiling level throughout the car. "On the old cars the cool air is issued primarily along the windows, which is great for people seated there but not for those standing in the aisles," says Weinstein. "It was designed in the 1960s, when the volumes on BART were much lower and most people were seated."

Another aim, driven by early customer feedback, was to reduce noise. "The new cars will have improved insulation throughout and will also have micro plug doors instead of pocket doors, to get a tighter seal," says Weinstein.

Planning ahead

Weinstein expects the cars to be in service for decades. They have a modular design whereby the seats are attached to rails along the sidewalls and other amenities plug in, to make it easier to reconfigure the seat layout.

The first 10 cars will be used in test mode to confirm reliability and safety before BART authorizes the production of the rest. "First there will be static testing of all the features, then there will be test-track testing, and then BART will run it at night in non-customer service," says Weinstein. "Then it has to get final approvals from the state before it goes into revenue service."

Overall, Weinstein is very excited about the final product. "I'm really happy that we were able to do such a large outreach and tweak so many features to serve consumers," he says. "In the final survey, which had 7,000 respondents, the exterior appearance, floors, digital displays and other features were rated highly by customers – evidence that the design has successfully incorporated their input."

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Railway interiors EXPO 2015

An invitation you can't refuse!

On **November 4-5, 2015**, railcar interior designers and specifiers will head to Prague, Czech Republic, for **Railway Interiors Expo 2015**. Discover more over the next few pages about the very latest interior designs, concepts, components and technologies that will be on show

4 REASONS WHY YOU MUST ATTEND

Tailor-made for you: Railway Interiors Expo is focused on solutions for railcar and mass-transit interiors. If you are involved in the purchase, design, outfitting or management of rail carriages, you cannot afford to miss this event.

Innovations on display: See the latest infotainment systems, seats, lighting, washroom facilities, soft furnishings, flooring, anti-vandalism technologies, catering solutions, HVAC systems, safety equipment, cleaning products, security solutions, and more.

Learn from the experts: The free-to-attend Conference features an impressive line-up of 60 speakers, including representatives from Bombardier Transportation, London Underground, Interfleet Group, NewRail and SNCF. Don't miss out on the discussion.

FREE
TO ATTEND!

SEE MORE RAILCAR INTERIOR TECHNOLOGIES THAN EVER!

60
EXPERT SPEAKERS TO PRESENT AT THE CONFERENCE

Railway Interiors Expo 2015 **Conference**

The largest **free-to-attend** railcar interiors conference ever to take place!

A special feature of Railway Interiors Expo is the **free-to-attend** Conference, which will run on both days of the event. Featuring 60 of the best speakers in the industry, the Conference offers an insight into new product and service innovations and case studies.

Speaker highlights

- **Michael Sohn**, head of industrial design, Bombardier Transportation, Germany
- **Fernando Tellechea**, chief designer, Integral Design and Development, Spain
- **Ivan Windemut**, scientist, German Aerospace Center, Germany
- **Mike Ashworth**, design and heritage manager, London Underground, UK
- **Andy Sykes**, lead rail designer, Seymourpowell, UK
- **James Alton**, head of industrial design, Interfleet Technology, UK
- **Dr Bernhard Rüger**, researcher, Vienna University of Technology, Austria
- **Jose Gonzalez Garrido**, CEO, Aoifes, Spain

THE FULL PROGRAM CAN BE FOUND ONLINE.
REGISTER NOW!

www.railwayinteriors-expo.com

FREE TO ATTEND!
DRINKS PARTY
NOVEMBER 4
5:30PM
ALL WELCOME!

Catch up with your peers: The expo regularly attracts 2,000+ attendees from all over the world, providing a fantastic platform for networking and cooperation. To maximize this aspect for attendees, there will be a free-to-attend drinks party.

FREE TO ATTEND!

INFOTAINMENT PLATFORM

Connected journey solution provider **Icomera** and ICT system integrator **Simac Technik** will co-exhibit to showcase a new onboard infotainment platform for public transport providers. At the expo, Icomera will promote its latest version of X6 series hardware for internet on board. Simac will launch a new daughter company, Passengera, to showcase the new onboard infotainment platform.

Simac and Icomera believe their solution is unique in its ability to provide passenger wi-fi and an infotainment platform from one box.

In 2012, Icomera and Simac delivered a turnkey solution for passenger wi-fi and onboard infotainment services on Pendolino trains operated by Czech Railways. The companies report that the system was a great success, and is now being upgraded and extended to other trains. The companies have maintained the cooperative relationship built on that project and are delivering other projects around the world.

Stand 3092

FIRE LABORATORY

CREPIM will showcase its laboratory services. The company develops, guarantees and qualifies the fire performance of materials and assemblies for the railway, aircraft and marine industries, as well as the building, electrical and textile sectors.

The laboratory works on thermoset and thermoplastic resins, composite materials and fire-retardant paints.

CREPIM's aim is to develop fire-retardant materials that do not release opaque and toxic smoke.

The team of 20 includes many chemists. The company says it is ready to help customers develop and approve materials in line with EN 45545-2, NFPA 130 and NF F 16 -101 standards.

Stand 2105

EXHIBITOR IN FOCUS

Thomas Gamsjäger, product manager, Getzner Werkstoffe

What are your plans for the show?
We will showcase elastic bearing solutions for floating floors, using the new Sylomer FR material. Rolling stock floors mounted on our elastic material, or floating floors, absorb vibrations and shocks that would otherwise be transmitted into the interior. Sylomer FR makes an active contribution to reducing the overall noise level in rail vehicles and also meets the HL3 flammability requirements of DIN EN 45545-2. The bearing is only a few centimeters high and weighs very little, but passengers and staff benefit from greater comfort and a quieter journey. Sylomer FR permits lower floor constructions and exhibits minimal deflection throughout its entire service life. Rail operators also benefit from lower lifetime costs and reduced energy consumption.

Can you detail a recent application?
We were chosen to supply floating floors for the metro in Riyadh, Saudi Arabia, which is currently under construction. We were also chosen by Hitachi as the exclusive supplier for the UK Department for Transport's Intercity Express Programme (IEP). We will equip all the trains manufactured for the IEP with vibration-isolating floating floors, by 2018.

What are you looking forward to at the show?
We are looking forward to making new contacts and also strengthening our existing relationships. Eastern European rail vehicle manufacturers are of particular interest to us, as their expertise and demand is continuing to grow. We are also looking forward to exchanging thoughts with floor manufacturers and design studios – both play a key role in fulfilling comfort requirements.

What is the most challenging aspect of your sector of the industry?
The transfer of knowledge. Our Sylomer and Sylodyn materials always score highly in terms of customer satisfaction. However, other materials that have been around for longer, but are less efficient, still attract a great deal of attention. The industry needs to learn more about the advantages of elastic floor bearings using these ultramodern materials. Any preconceptions concerning non-rigid floor constructions must be eradicated, and we are working hard to make this happen.

How is demand evolving?
Increasing comfort is not solely the concern of industrial nations, and lifetime costs are becoming an increasingly crucial factor.

Meet the Getzner Werkstoffe team on Stand 4055

PASSENGER SEATS

LIGHT WEIGHT

A passenger seat made from high-resistance steel and special aluminum will be promoted by **Romeo Seating**, a division of STA2000. The materials used for the Romeo seat are designed to ensure low weight while maintaining strength and comfort. The seat is also designed to offer modularity and to resist vandalism.

STA2000 says it will also highlight an ability to produce components for the rail industry, importing production and technology systems used in other sectors.

Stand 4000

FLOOR COVERINGS

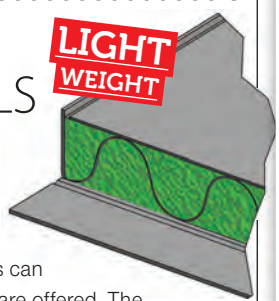
Visitors seeking a carpet should head to **Forbo Flooring Systems**' stand, where its latest rail textile, Coral Move FR, will be on display. This broadloom carpet solution is designed for first and standard class. It offers many customization possibilities to complement any interior design scheme.

Forbo's rail flooring products are designed to combine durability, slip resistance, ease of cleaning, fire resistance and great aesthetics. The portfolio includes entrance systems, linoleum, flocked flooring and textile carpets. The company also manufactures adhesives and supplies accessories and installation tools. Within each product category an array of designs and colorways are available. The company also delivers bespoke solutions.

Stand 3008

ALUMINUM SANDWICH PANELS

LIGHT WEIGHT



The aluminum sandwich panels to be highlighted on **Metawell**'s stand are designed to offer a wide range of design possibilities, low weight and high rigidity. Curved elements for ceilings can be realized, and various surface finishes are offered. The corrugation channels of the panels can be used to integrate heating, cooling or extra sound insulation. The panels offer a 38dB sound reduction with a panel thickness of 11.5mm, or a sound reduction of 32dB with a panel thickness of 6mm.

Stand 3065

Hosted by tangerine Saffron

NEW FOR 2015!

DESIGN WORKSHOPS

For the first time at the expo, there will be an opportunity for delegates to participate in free-to-attend workshops hosted by **tangerine** and **Saffron**. The two creative global agencies aim to inspire delegates with the opportunities that great design and creativity can bring to rail services.

Titled 'De-mystifying Design and Brand', and 'More Bang for your Buck', the hour-and-a-half interactive sessions will be led by designers and brand strategists. There will also be breakout sessions where delegates can engage with advisors and discuss some of the challenges they are facing.

Tangerine's most notable rail projects include the refurbishment of the UK's Heathrow Express, for which the strategic design consultancy was responsible for creating the vision for the new train, particularly the first class experience. Tangerine reports that the train now receives acclaim from passengers and the operator has realized increased revenue.

Saffron helps transform brands, businesses and places. Its clients hail from many sectors, including transport, and include businesses large and small, and from all over the world.

The picture below shows an intercity train designed by tangerine and Saffron, incorporating brand and interior design to create a seamless experience for many groups of passengers.

Matt Round, creative director at tangerine, and Jacob Benbunan, co-founder and CEO at Saffron, will also take to the stage at the conference. Their presentation, 'Why Create Forgettable Journeys?', aims to demonstrate how brand and design can deliver big differences that reduce passenger pain points, while at the same time improving the rail operator's bottom line.

To register for a workshop, visit www.railwayinteriors-expo.com or visit the registration area at the expo.

FREE TO ATTEND, BUT REGISTRATION IS REQUIRED!

FREE TO ATTEND!

SELF-ADHESIVE FLOORING

The self-adhesive flooring system to be shown by **nora systems,** nora nTx, is designed to reduce installation time and the total cost of the project. It is suitable for all areas of the rail and bus industry – including light rail, heavy rail, high-speed trains and subways – and is available for all noraplan products used in the rail and bus industry.

The adhesive is factory fitted, so nTx flooring can be installed in a few simple steps and used immediately, with no drying time. It can be laid on all types of subfloors, as well as directly on top of existing floor coverings. Nora says the result is durable, sturdy and safe.

The system has been installed by Siemens Austria on Riyadh Metro trains, by CAF Spain on Metro Santiago de Chile trains, and by CAF France on Metro Lyon trains (during renovation).

Stand 4060

EXHIBITOR IN FOCUS

NEW LAUNCH FOR 2015!

Rolf Schollmeyer, product manager for composite applications in the aircraft and railway industries, Gummiwerk Kraiburg

What is the newest innovation on your display?
We will show Kraibon, an uncured elastomer that can be incorporated directly into composites. The curing process for the elastomer is the same as for the resin, meaning no additional production processes are needed. Kraibon offers improved acoustic, impact and splintering behavior. Additionally, it is now available in a flame-retardant grade – launched early in 2015 – that fulfills the new EN 45545 R1HL3 as a standalone material.

How is Kraibon being used?
Kraibon is currently being used for applications inside and outside of two rail vehicles under development. Both cases demand vibration and/or impact suppression and a high level of fire resistance. As the new flame-retardant grade fulfills the R1HL3 requirements, in both cases the customers using it could start the design immediately, without the need for testing. In addition, the use of Kraibon is yielding a weight reduction for these customers.

Are composite materials changing the rail interior market?
The railway industry still relies too much on traditional materials, but I am sure that composites will make a big impact in the future. From my point of view, the main advantages of composites are design freedom and weight savings.

What further innovations do you think are possible?
We are already working on new material combinations. We have found a solution for a metal-FRP combination using Kraibon, and some lab tests have indicated other material combinations will be possible.

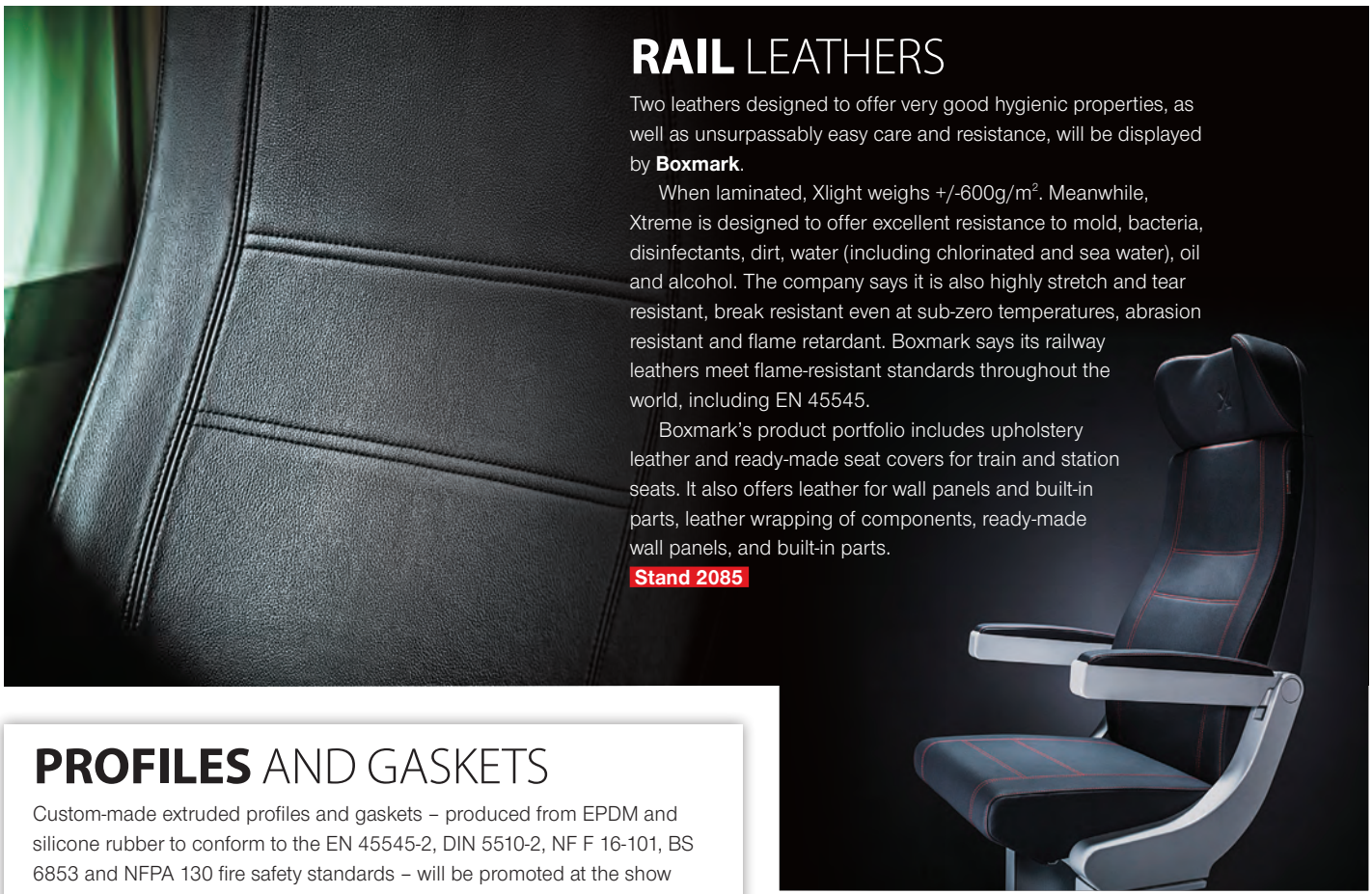
What challenges do you face in creating new products?
It took us about a year of development work to bring our material in line with the EN 45545 standard. Now our challenge is to convince potential customers that Kraibon is the solution to their problems. So our main challenge is not to create a new product; product development is an ongoing process. The challenge is to come together with companies who are willing to leave the traditional path. Innovative companies will be always be the first in line. Others will face strong competition from Asia. Being one step ahead will be essential to our success and to theirs.

Meet the Gummiwerk Kraiburg team on Stand 5050

PLACARDS, SIGNS AND GRAPHICS

Those looking to create rail interior and exterior placards, signs and graphics should go to **Gerber**'s stand. The Gerber Edge production system includes the Gerber Edge FX thermal printer, Gerber Omega software and Gerber 15in sprocketed plotter. More than 30 Edge Ready materials and 75 GerberColor foils are available for the system.

Stand 4075



RAIL LEATHERS

Two leathers designed to offer very good hygienic properties, as well as unsurpassably easy care and resistance, will be displayed by **Boxmark**.

When laminated, Xlight weighs +/-600g/m^2. Meanwhile, Xtreme is designed to offer excellent resistance to mold, bacteria, disinfectants, dirt, water (including chlorinated and sea water), oil and alcohol. The company says it is also highly stretch and tear resistant, break resistant even at sub-zero temperatures, abrasion resistant and flame retardant. Boxmark says its railway leathers meet flame-resistant standards throughout the world, including EN 45545.

Boxmark's product portfolio includes upholstery leather and ready-made seat covers for train and station seats. It also offers leather for wall panels and built-in parts, leather wrapping of components, ready-made wall panels, and built-in parts.

Stand 2085

PROFILES AND GASKETS

Custom-made extruded profiles and gaskets – produced from EPDM and silicone rubber to conform to the EN 45545-2, DIN 5510-2, NF F 16-101, BS 6853 and NFPA 130 fire safety standards – will be promoted at the show by **FP FinnProfiles**.

As well as standard EPDM and silicone rubber profiles, the company also supplies metal-reinforced silicone profiles, which conform to the same fire safety standards. These profiles contain a stainless-steel wire, which is vulcanized inside the profile during the extrusion process.

All the company's products can be supplied in standard meters or as complete vulcanized frames, rings, etc. Additional options include adhesive tapes and coatings, laser marking and die cutting.

Stand 1140

CUSTOM-MADE

INDUSTRY PARTNERSHIP

S&S is sharing a booth with **GETA**. Together, the companies can aid in the development, production and assembly of train interiors.

S&S's products include partitions, handrails and poles, refuse containers, luggage racks, interior doors, driver's cab doors, and tables.

Meanwhile, GETA offers mock-up production, ceilings and roof components, air ducts, interior paneling, partition walls, cupboards and tables.

Stand 2115

FREE TO ATTEND!

LED TUBE LIGHTS

Craig and Derricott continues with its drive to sell LED tube lights into the rolling stock refurbishment market. As a supplier of low-voltage control and switchgear equipment, the company has a history in the UK rail industry spanning more than 70 years. Predominantly involved in the rolling stock sector, Craig and Derricott has worked with blue chip organizations including Bombardier, Hitachi and Alstom on new-build and refurbishment projects, as well as on the design of new components.

Craig & Derricott believes that working closely with clients is the key to developing components and solutions to manage obsolescence. "We offer a wide range of bespoke equipment – from the overhaul and new construction of drum switch uncouplers, to master controls, power break controllers, cab isolation switches and driver key switches," says Jon Beaumont, business development manager at Craig and Derricott.

The company developed its LED tube lights in response to the UK government's decision to make T12 fluorescent lighting obsolete, with T8 tubes expected to follow soon. The LED tube lights are designed to replace current fluorescent tubes using existing fittings, with minimal wiring changes. The product has been trialled extensively, and supplied for major refurbishment contracts, including with Bombardier, Vivarail and Knorr-Bremse RailServices.

Stand 4087

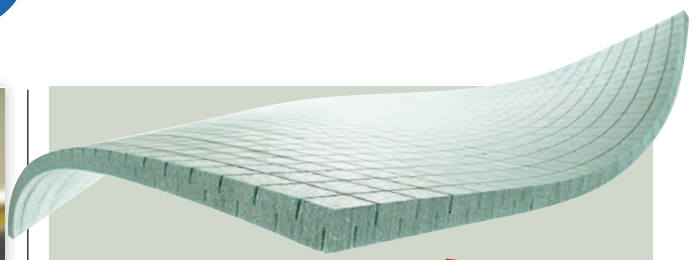
FLOORING SOLUTIONS

One of the flooring and wall cladding systems to be promoted by **Altro Transflor** is its Altro Transflor Met 20/25 flooring solution. It is designed to have a lightweight construction, making it suitable for installation in small or awkward spaces where flexibility is key.

Meanwhile, Altro Transflor describes its Altro Transflor Momentum as a fire, smoke and toxicity compliant safety floor that is light, 100% recyclable, and can be installed quickly. It can be customized to match operators' corporate livery and complement the aesthetics of the train.

Finally, Altro Transflor Tungsten is an acrylic flooring solution designed to provide full fire, smoke and toxicity compliance, as well as enhanced slip resistance. The product is 2mm thick, and the company says it is easy to handle and install in confined and awkward areas.

Stand 3080



STRUCTURAL FOAM CORES

STRONG AND LIGHT

Pictured above is ArmaForm PET, one of two product lines set to be highlighted by **Armacell** – along with Armaflex Rail (pictured below). The ArmaForm PET core range of polyethylene therephthalate-based structural foam cores can be used in railway sandwich applications including floors, doors, toilet cabins and nose cones. The material is designed to offer optimized strength-to-weight ratio, outstanding fatigue and corrosion resistance, and big weight savings.

Armacell says ArmaForm PET's thermoplastic basis allows it to be easily thermoformed into complex shapes, giving new aesthetic possibilities without degrading the properties in case of grid scoring and adding weight and costs through corresponding resin intake. The company also says ArmaForm PET is 100% recyclable and offers a low weight, excellent thermal insulation properties and, with regard to the EN 45545-2 norm, very low smoke and toxicity levels when subjected to fire. Armacell reports that sandwich structures cored with ArmaForm PET, and with appropriate skins, achieve even HL3 classification and can be used for all types of rolling stock, including metros and sleeping coaches.

With Armaflex Rail, Armacell presents a flexible closed-cell insulation material with integrated fire protection for the rail vehicle construction industry, achieving a hazard level rating previously unattained with flexible insulation materials, it says. The company says Armaflex Rail achieves HL2, R1 level and is classified under the national fire protection standards NFPA 130, GOST 12.1.044-89 and DIN 5510-2.

Armaflex Rail SD-C is designed for use in areas requiring HL3 compliance. The product is equipped with a shiny, silver covering. The company says the surface is UV-resistant, protects the insulation material against mechanical impact, and is very easy to clean.

Finally, Armacell describes Armaflex Rail ZH as a halogen-free, closed-cell insulation material that achieves the classification HL2, R1; and Armaflex Rail ZH-C as a material that achieves hazard level HL3, R1 and can be used in Class 4 operation in underground track sections or tunnels.

Stand 3075

METRO MODEL

The full-scale model that will draw attention on **Oliva Torras Railway**'s booth shows the interior of the Copenhagen Cityringen Line metro. The company engineered and manufactured all interior components for the project. Oliva Torras Railway recently obtained homologation from Alstom for the special painting, welding and gluing processes.

The accreditation is the result of the company's ability to approach projects comprehensively and with the flexibility to manufacture both small and medium series to a high level of quality.

Oliva Torras Railway is the division of Oliva Torras Group that specializes in railway interiors. The group has 70 years of experience and is based in Manresa (Barcelona, Spain), where it has a 23,000m^2 engineering and mechanical manufacturing plant.

Oliva Torras Group has a presence in Europe and Latin America, in the mobility, refrigerated transport and leisure sectors.

Stand 3050

SPEAKER SPOTLIGHT

Dr Emmanuel Matsika, research associate at NewRail, Newcastle University, will discuss how to improve occupant crash safety for wheelchair spaces on trains

What prompted you to look into this area?

As a regulated group of passengers (with a legal framework), wheelchair users are relatively new. Since the publication of the EC Technical Specification for Interoperability for Persons with Reduced Mobility (PRM TSI) in 2008, railway vehicles in the EU have needed to be accessible to wheelchair users. While accessibility has been well covered in the regulations, onboard safety in the event of emergency braking and crashing has not been addressed. This is what motivated me to carry out this research – to design railway vehicle interiors with wheelchair spaces that take these safety issues into consideration.

What safety factors are unique to wheelchair users?

Although a wheelchair is used as a seat on a railway vehicle, it is a mobility device used by disabled people as an assistive technology. It is vital to take human factors into account. The basic premise of human factors and ergonomics is to create a user-centered design, based on a fundamental understanding of the user's capabilities, needs and preferences. Important factors to consider include the person's anthropometry, weight, personal preferences, medical conditions, and their ability to interact with both the wheelchair and the train interior.

How can wheelchair design be improved for use on trains?

The four safety-critical areas of concern in the transportation of wheelchair users by train are the boarding process, onboard maneuvers, the ride and alighting. The major wheelchair parameters that influence the interaction between user and wheelchair, and between the wheelchair and the space, are the wheelchair's length, width and height. These dimensions should be optimized to enable the wheelchair to pass through doors and aisles, and to park comfortably in the designated areas, if they exist. The overall mass of the wheelchair should be minimized to reduce the stresses on the boarding system, whether it is a lifting mechanism or a ramp.

In the event of the train braking heavily, or a crash, the angles of inclination of the footrest, seat and backrest play an important role. The likelihood of a wheelchair occupant being displaced in a crash is influenced by the footrest inclination, as well as seat and backrest angles. Also, wheelchair crash motion characteristics are influenced by the coefficient of friction between the wheels and the floor, particularly when the wheelchair brakes are applied.

Notably, compared with manual wheelchairs, electric wheelchairs offer superior control and have greater potential to address human factor concerns specific to people with disabilities. They have better maneuverability and therefore better parking characteristics than manually powered models.

What are your recommendations for train interior designers?

The designer of a train's interior should aim to optimize rather than maximize the dimensions of the wheelchair space. Although you might maximize the wheelchair space in the interests of accessibility, crash safety can be improved by reducing the initial distance between the occupant and secondary collision objects, including partitions, grab poles and tables, so a balance is required. The appropriate geometry and material properties of these secondary collision objects should also be considered. As part of the PRM TSI, the EU should develop a standard that specifies a wheelchair environment optimized for accessibility as well as crashworthiness.

Dr Emmanuel Matsika will make his presentation at 12:10pm on Day 1 of the Conference, Wednesday, November 4, as part of a breakout session on security, safety and connectivity

FREE TO ATTEND!

STRUCTURAL ADHESIVES

Delegates looking for structural adhesives should set a course for **Scigrip**'s booth. The company manufactures methyl methacrylate (MMA) bonding systems for rolling stock producers around the world. Scigrip says three of its key structural adhesive products have achieved the EN 45545-2 2013 fire, smoke and toxicity accreditation, and offer tough and reliable assembly performance.

SG300 can bond metals to metals, plastics and composites, replacing or reducing the need for mechanical fasteners. Possible applications include light cluster assemblies, internal door constructions, and internal and external panel structures. Scigrip says SG300 demonstrates excellent environmental and chemical resistance and is available in a choice of working times.

Meanwhile, SG230 is a two-component, 10:1 mix product for bonding composite and other plastic parts, with little or often no surface preparation. SG230 is designed to offer excellent fatigue and vibration resistance for key structural areas and can bond to metal structures with a simple priming process.

The adhesive is designed to work with a selection of activators to provide a wide range of working times, from 30 to 120 minutes. It is especially suited to bonding big structural components and for filling large irregular gaps, including structural floor parts and front nose cone applications.

Finally, Scigrip says its SG800 range demonstrates excellent environmental endurance and increased resistance to temperatures above 120°C, making it particularly effective for external panel bonding and higher temperature internal panel applications.

Stand 2100

EXHIBITOR IN FOCUS

Panayiotis Pitsikos, CEO, Autostop Europe

What will be the highlight of your expo display?
We will be displaying high-quality leather trim covers on a first class seat that can turn 180°, and on a second class seat. We will also display many other seat covers, mainly made from leather, and with innovative backing materials designed to increase comfort.

When and why did you enter the transportation industry?
The company was founded in 1991, focused on the automotive industry, and we expanded into the transportation market in 1996. The transportation industry is very similar to the automotive industry and we have many innovations and technologies to offer both markets. We have completed many projects for trains, buses, coaches, ferries and commercial aircraft – servicing individual parts and supporting complete overhaul projects.

What trends have you noticed?
I believe that replacement covers will be the major need in the coming years, but I also see increasing demand for comfort on long journeys. We are developing replacement leather covers with advanced backing foam and silicon pads, to meet the need for increased comfort and durability.

Meet the Autostop Europe team on Stand 3000

LED EXPERTISE

The focus at **CML Technologies'** stand will be its expertise in LED solutions. The company offers LED lamps designed to comply with EN 50155 for rolling stock applications, as well as LED spots and LED modules. It has in-house development and laboratory departments to develop bespoke solutions. CML's LED products are used in sectors ranging from railway to public road transport, for applications including driver's cab signals and cabin lighting.

Progress in terms of the intensity and efficiency of LEDs offers many possibilities for the development of specific lighting solutions for railway applications. CML's products are designed to be long-lasting and vibration-resistant, to help reduce maintenance costs.

Stand 5025

MODULAR FLOORING

The sandwich panel to be highlighted by **Amorim Cork Composites** has a Corecork core and aluminum skins. The company says that compared with similar products on the market, the Alucork technical panel offers a weight reduction of approximately 40%, and uses fewer raw materials and less energy in its fabrication, thus decreasing CO_2 emissions and production costs. It also uses a high percentage of renewable materials and is 100% recyclable.

Corecork is a natural cork composite material that Amorim Cork Composites says reduces noise transmission by 5-12dB across the frequency range (up to 5KHz), provides low thermal conductivity (λ=0,040 W/m2C) and long-term durability, which assures efficient thermal insulation throughout the train car's life.

The Alucork floor panel is designed to comply with NF F-16-101 (M1 F1), EN 45545 (HL3) and ASTM E-162/ASTM E-648 and ASTM E119.

Stand 3045

FABRIC CARE

LIVE DEMOS

Fabric care products and services will be showcased on **Unipart Rail**'s stand. The products include Fiber ProTector, a coating for all fabrics, including seat fabrics and carpets, designed to repel liquids and dirt.

The company will make product demonstrations throughout the exhibition, to demonstrate how liquids stay on the surface of the treated fabrics and can be removed very easily and quickly.

Unipart Rail also offers interior refresh products designed to enhance the passenger experience. These include lighting modules, door activation systems, noise reduction products, cleaning and graffiti removal products, and glass systems.

Unipart Rail has seven proposition groups, including supply chain services, engineering technical support, overhaul and repair, manufacturing, product innovation and technology, consultancy and products.

Stand 3094

SPEAKER SPOTLIGHT

Dipl.-Ing. Ivan Windemut, a scientist at the German Aerospace Center (DLR), will present a lighting concept developed for the Next Generation Train (NGT) project

What is the NGT project?
The NGT project involves using an interdisciplinary approach to tackle the key questions of how the high-speed and intercity trains of the future can be made fast, safe, energy-efficient, comfortable and environmentally friendly.

The project's main aims are to increase the certified train speed to 400km/h, halve energy consumption, reduce noise, increase passenger comfort, improve driving safety, reduce wear and lifetime costs, introduce cost-efficiencies through modularization and system integration, and increase the efficiency of development and permission processes.

As part of our work on optimizing onboard systems in terms of energy efficiency and passenger comfort, we developed an innovative concept for lighting passenger areas in double-decker trains.

How did you develop the lighting concept?
We used well-established software – which is normally used to calculate levels of illumination in buildings – to develop a model of a double-decker train and calculate the illumination and energy demand of our lighting concept. Our full-size NGT mock-up was also adapted, by integrating organic LEDs (OLEDs), to verify the model and to investigate passenger acceptance of OLED light. We proved that it is possible to realize an EN 13272-conforming lighting system on a double-decker using OLEDs that are already available. Volunteers deemed the OLED light more comfortable than LED light.

How is your concept different to other solutions?
Lighting systems on trains commonly consist of fluorescent lamps combined with halogen spots as reading lamps. Our lighting system, based on OLEDs, uses half the specific energy of common lighting solutions and gives nearly the same illumination. OLEDs can also be dimmed continuously between 0% and 100%, without steps, so we were able to integrate reading lamps and constant light functions (balanced with sunlight) in the general lighting system.

What other benefits are there to using OLEDs?
The project demonstrated that OLEDs are energy efficient, compact and low maintenance. They are genuine area light sources and produce high-quality diffuse light with no glare and excellent color rendering. OLEDs provide the basis for extremely thin (2mm) and lightweight lighting solutions, which is especially important in double-decker trains. Today, OLEDs enable the creation of free-form lighting sources, and at some stage in the future, large-scale lighting solutions on flexible carrier materials. Currently OLED panels are limited in size (145 x 145mm), so a combination of several panels in a module system is necessary. OLEDs still expensive, because they are produced in small quantities, but that will certainly change in the future.

Dipl.-Ing. Ivan Windemut will make his presentation at 10:55am on Day 1 of the Conference, Wednesday, November 4

FREE TO ATTEND!

Tubular belle

Conference speaker Mike Ashworth of London Underground discusses the interior design for a new fleet of Tube trains

New trains for London Underground's deep-level Tube lines are planned to enter service in the early 2020s, starting with the Piccadilly line.

"Following the successful deployment of the new S-stock trains for the subsurface lines, and the 2009 rolling stock for the Victoria line, London Underground had an opportunity to rigorously review the customer-facing aspects of train design, particularly in the context of our unique Tube railway gauge and profile," says Mike Ashworth, design and heritage manager at London Underground. "This review, looking at how the new trains will look and feel for our customers, concluded that there was a once in a generation opportunity to really consider how the train exterior and interior could contribute to the delivery of the whole scope and specification of the train, in a very demanding operating environment, while raising the customer experience of Tube travel and delivering higher levels of customer satisfaction in terms of both the journey and the brand."

London Underground set about the design in collaboration with Transport for London and design agency PriestmanGoode. The design was unveiled in 2014. "Part of the brief was to

INNOVATIONS

These will be London Underground's first walk-through deep-level trains and the first to have air-handling. "We look forward to seeing supplier innovation to deliver all aspects of the train's specification," comments Ashworth.

PriestmanGoode and Transport for London

PRM COMPLIANCE

The trains will be fully RVAR/PRM compliant. "We have set a high bar in terms of delivering on these requirements," says Ashworth. "All aspects of the train – including the layout, finishes and spatial considerations – were designed for everyone. The trains will have dedicated wheelchair bays and designated seating for passengers who have mobility impairments. There will also be the required range of information and warning systems."

take full consideration of the fleet's technical and operational specification, delivering a reduction in energy consumption, heat output and operating costs," says Ashworth. "The train also had to be a true successor to the many highly successful and visually recognizable London Tube trains we have designed and operated for over a century. The exterior should be immediately recognizable as a London Tube train and should reflect the shape and nature of the interior. In turn, the interior needs to be considered to the last detail so that passengers' use of the train is as natural as possible. This includes the color and material palette, the lighting and the architectural elevations and plan of the car interior."

A design book was also created, to support the invitation to tender for the rolling stock. "The book delivers the background, context and our aspirations for the next-generation train, including our wish for it to become an icon of London over its service life – expected to be 40 years or more," says Ashworth. "It sets out the thinking behind the aesthetic design and illustrates how it can be delivered, while enabling bidders to look for innovation in terms of how they meet the brief."

The invitation to tender is now underway. "During the bidding process, we will score potential suppliers' responses against the design book," says Ashworth. "Public reaction to the new designs has been overwhelmingly positive."

CAPACITY INCREASE

The trains are designed to accommodate more people than the previous generation. "Capacity has been increased by understanding how the interior space is perceived and used by passengers," says Ashworth. "The layout of door bays has been reconsidered to optimize passenger flow, and the vestibules, set backs and seating bay positions have been modeled carefully. In addition, the layout, color and materials used for elements including flooring, handrails and fixed paneling has been designed to enhance passengers' perception of space and therefore their movement within the car."

CONFERENCE SPEAKERS

Mike Ashworth of London Underground will be joined by Jon Hunter, head of design at Transport for London, to discuss the project at Railway Interiors Expo 2015's free-to-attend Conference. The Expo will be held in Prague, Czech Republic, on November 4-5, 2015. Ashworth and Hunter's presentation will be held at 1:25pm on day one of the Conference. Visit www.railwayinteriors-expo.com to register for your free pass.

Composition **leather**

The purpose of every single train, aircraft, bus and coach in the world is to carry passengers. Without passengers there would simply be no profit and no service. "Now consider how rapidly these quite different modes of transport are converging in terms of seat design and upholstery type and style," says Alexandra Bennett, global business manager, rail, at E-Leather. "This is because all passengers, whatever the mode of transport, want a clean and comfortable interior, and affordable and punctual service."

Bennett believes hygiene is as important to passengers as route information, a modern interior and wi-fi. "Addressing hygiene is therefore very important, but traditionally it increases operating costs," she says. "The next generation of materials – including E-Leather SL7 – offers an alternative that provides improved hygiene, reduced operating costs and facilitates design freedom."

DESIGNERS' TOOLBOX

Products and services designed to meet real needs in the rail industry

Emergency **lighting**

It is obviously essential to have an efficient lighting solution on board to provide lighting for passengers, operators and emergency personnel when normal lighting systems are unavailable.

Teknoware offers great experience in this area – it designs emergency LED lighting systems to meet customers' requirements and the appropriate standards. Using light-level simulation, the company optimizes the number and positioning of emergency light units for each railcar.

Teknoware has also developed an emergency lighting system containing fiber optic Optiline low location lighting, spotlights and illuminated exit signs.

All Teknoware's units use LED lamps as light sources. The company says this is because they are efficient and dependable. Emergency lighting can be provided using separate LED lights or it can be included within the main LED light units. The emergency back-up units are powered by either an internal battery package or super-capacitors.

Trend **Talk**

Andy Sykes, lead rail designer, Seymourpowell

BELOW LEFT: One of Seymourpowell's refurbishment designs created with Angel Trains

What trends have you noticed in train interior design over the past year?

For one reason or another, many manufacturers and operators seem to be falling into the same traps – they're producing the same old stuff and making the same old mistakes. There have been a few recent exceptions that buck this trend, including the Arlanda Express in Sweden and the Munich C2 U-Bahn in Germany. On these projects, the operators invested in up-front design work to ensure their success – they started earlier! It takes a brave and ambitious client to see the value in design and push the boundaries of tradition, with the understanding that their product is the physical manifestation of their brand.

What is always on the client's brief?

In this industry there's such an emphasis on measurable metrics – usually seat numbers – that it can become a case of 'design by spreadsheet', leaving the user experience behind. We continue to encourage our clients to look at the broader context. We observe the experiences of users, who can be the passengers, on-board crew or the cleaners in the depot. Armed with tangible evidence, it becomes easier for clients to appreciate the value of improving the user experience, for example by making the work of maintenance and cleaning crews quicker and easier.

What factors are becoming more important to clients?

As operators become more engaged in brand management we're going to see an increased focus on the train interior as part of a branded experience. Today, the vehicles can seem like an afterthought and passengers can see through this; they're more savvy than ever. To compete, operators are going to need to consider every touchpoint on the passenger's journey, with their rolling stock at the center of the experience.

Angel Trains

Are there any new materials or technologies that have caught your eye recently?

I'm mildly obsessed by the effect lighting has on an interior and the technology that drives it. Changing the color temperature of lighting is common in airline cabins, but hasn't been embraced in rail. We have the technology to condition the ambience of an environment based on factors including the external light, weather, time of day or even the number of passengers. Of course there is a cost implication, but it has the most incredible transformative effect on an interior and improves the wellbeing of passengers and crew.

Are there any recent train designs you admire?

I really admire the Starbucks space created for SBB trains. It's a flexible, casual environment that can be a place for business, socializing or simple relaxation. I like the execution; it's filled with lovely details and uses honest, natural finishes. The low-back seating wouldn't look out of place in someone's home. I can't think of another train you can say that about. It's a credit to SBB that it didn't just fill the space with seats and I really hope it sets an example to operators to do something different.

What innovations would you like to see suppliers working on?

I think it's time we did something about seats. I can't think of a single great-looking off-the-shelf seat. For many projects it's not feasible to create a new seat and I'm tired of seeing trains being filled with boring, predictable seats. You wouldn't want them in your house, so why do we put them in our trains?

CONFERENCE SPEAKER

Andy Sykes is one of 60 speakers lined up for Railway Interiors Expo 2015's free-to-attend Conference. At 1:50pm on day one of the Conference he will explain how Seymourpowell's evidence-gathering approach worked on a range of refurbishment programs for Angel Trains. Railway Interiors Expo 2015 will be held on November 4-5 in Prague, Czech Republic. Visit www.railwayinteriors-expo.com to register for your free pass.

Growth market

With seven rail projects currently in progress, PCT's rail division recently moved into an expanded facility, and is pursuing AS 9100 Rev C and IRIS Rev 02 certification

In the rail sector, Premier Composite Technologies (PCT) has been contracted to supply parts made from fiberglass composite materials for manufacturers including Downer Rail and Alstom.

Most recently, the company embarked on its third project with Alstom. This project, signed in June 2015, will see PCT deliver interior wi-fi boxes for SNCF's high-speed long-distance 3UFC train, from September 2015.

"Fiberglass was chosen for many reasons," says Praveen PC, manager of the rail business unit at PCT. "It is affordable, strong, durable, attractive in appearance, and versatile, offering freedom of design. It is also fire resistant, dielectric, chemically inert and offers great acoustic properties."

That is not to say the material is without its challenges. "While curing, some fiberglass resin system emit toxic fumes and may cause irritation to skin in the case of direct contact," says PC. "To overcome this issue, our workers wear proper safety equipment, including masks and gloves, during the manufacturing process."

For the most recent Alstom project, PCT received build-to-print drawings, and has been tasked with industrialization, tool manufacture, first article inspection, the first installation and serial production. This was also the company's remit for its first project with Alstom – producing vestibule interiors for intercity trains.

RIGHT: PCT's skilled workers carrying out final finishing

MAIN: PCT handles rail projects through a dedicated division with specialist staff

ABOVE: A front end completed for Downer Rail, for use by Transperth of Australia

On the second project PCT has undertaken with Alstom – producing ceiling panels for the pantry cars on SNCF's 3UFC train – the design and development was more of a collaborative process.

The auditing process

PC says Alstom selected PCT after detailed audits, which it has also undergone with its other rail clients. Every large manufacturer has its own standards. "These audits are the basis for entry to a customer's supplier panel," says PC. "The first step is a general assessment, covering all functions, during which non-conformities are picked up and an action plan is formulated and reviewed. Then there are detailed audits of the supplier's ability to control its supply chain and capacity, its ability to develop products and processes in line with the client's specific standards, and its manufacturing processes."

In PCT's case, manufacturing processes audits cover the methods it uses to create fiber-reinforced plastic components – infusion, light resin transfer molding, bagging, etc – as well as painting, bonding and cabling. There are also audits of the supplier's labor standards, ethics, environmental responsibility and health and safety processes.

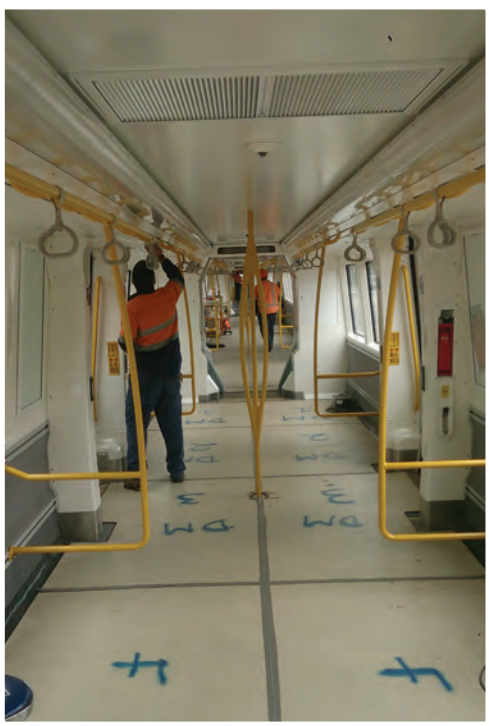
"We achieved very good scores on all our client audits," PC confirms. "This means we are an approved supplier for many major rail manufacturers."

CEILING PANELS FOR SNCF

In early 2014, PCT won its second contract with Alstom. The task was to produce ceiling panels made from composite materials for the pantry cars on 40 of SNCF's 3UFC trains. PCT is responsible for the tooling, manufacture and delivery.

All the ceiling panels are fully insulated to meet the required sound insulation and absorption requirements. The scope of the project also extends to full cabling and wiring for direct LED spotlights and indirect double strip diffused lights.

PCT built dedicated cable kitting, electrical function testing and assembly areas to fulfill the project. Alstom's Supplier Product Quality Development team carried out detailed audits of PCT's cabling and bonding setup before the contract was awarded.



ABOVE AND RIGHT: Interiors completed for the Transperth/ Downer Rail project

TEST PROCEDURES

A lot of testing has to be done for every project, on both the raw materials and the finished components. "Type tests are performed at the start of project and serial tests are performed at specified intervals during the project," says Praveen PC. "In addition to these tests, there are additional validations including a mock-up, the first article inspection and the first installation review."

PCT has some in-house testing facilities, but most of the type tests have to be done at external labs to meet specific standards.

"Each project involves a different set of standards, depending on factors including the operator's needs, where the train will operate and what type of train it is," says PC. "For interior materials and components, the tests mainly cover fire, smoke and toxicity performance; mechanical properties including flexural strength, bending, shock and vibration, and acoustic absorption/insulation; and physical properties including color-fastness. A cross-cut test is used to check the adhesion of the paint on the base substrate. For exterior parts such as front ends, we also test properties including ballistic/impact resistance."

New certifications

The company is also working to achieve AS 9100 Rev C and IRIS Rev 02 certifications. PC says that these certifications will provide assurance of the quality and safety of the company's products.

"The documents necessary to attain AS 9100 Rev C were released in the second quarter of 2015, and the certification audit – to be conducted by TUV Rheinland Middle East FZE – is scheduled for the third quarter of 2015," says PC. "Meanwhile, the IRIS Rev 02 documents are being revised and will be implemented in the fourth quarter of 2015, so we are hoping to attain that certification in the first quarter of 2016."

The company was established in 2006, and set up its rail division in 2011. It is also active in the aerospace, marine and architecture sectors, but has operated a dedicated factory for its rail projects since 2012. The rail division is run by dedicated specialist staff who have wide experience working with the rail industry.

The rail sector accounts for around 15-20% of PCT's overall business. "Demand for our services has grown rapidly in the rail sector," says PC. "In 2012, we had one rail project; currently we are working on seven."

Bigger facility

In August 2015, the rail division moved into a modified facility that is almost double the size of its previous facility, to "meet the fast-growing demands of our clients", says PC. "All our existing equipment – including LRTM machines, the paint booth and recycling machines – were shifted, and in addition we have acquired a second paint booth, full dust extraction system, a clean room and CNC machine."

Long-term, the company plans to continue to grow its aerospace and rail businesses as required to support its customers' needs. It is also looking into gaining TS19649 certification for its automotive business, as well as acquiring ISO 14001 environmental management and OHSAS 18001 occupational health and safety management systems.

Net gains

Once a train is equipped with an onboard IP network, a whole host of applications can be implemented to enhance the passenger experience

The onboard IP platform is not only a means of providing internet access for train passengers, but can also provide the basis for a passenger information system (PIS), screen-based infotainment, audio announcements and an infotainment portal.

"Operators in most areas, especially in Europe, are committed to providing basic journey information, including the next stop and the destination – both on screens and via audio announcements – and ensuring the information is accessible to people with disabilities," says Marc Schrader, head of research and development for PIS at Nomad Digital. "This is the baseline, which is typically funded by train operators."

But this is the tip of the iceberg in terms of services enabled by Nomad's OBIS platform. It can distribute more detailed journey information – for example, on delays and onboard services – as well as destination guides, live news, weather reports, emergency announcements and entertainment content.

ABOVE:
Adverts can help offset the cost of providing comprehensive information to passengers

Business model

Integrated advertising helps to fund the enterprise. "Some of our customers manage to refund up to 50% of their investment through advertisements," says Schrader. "In other projects the whole system is owned by the content provider."

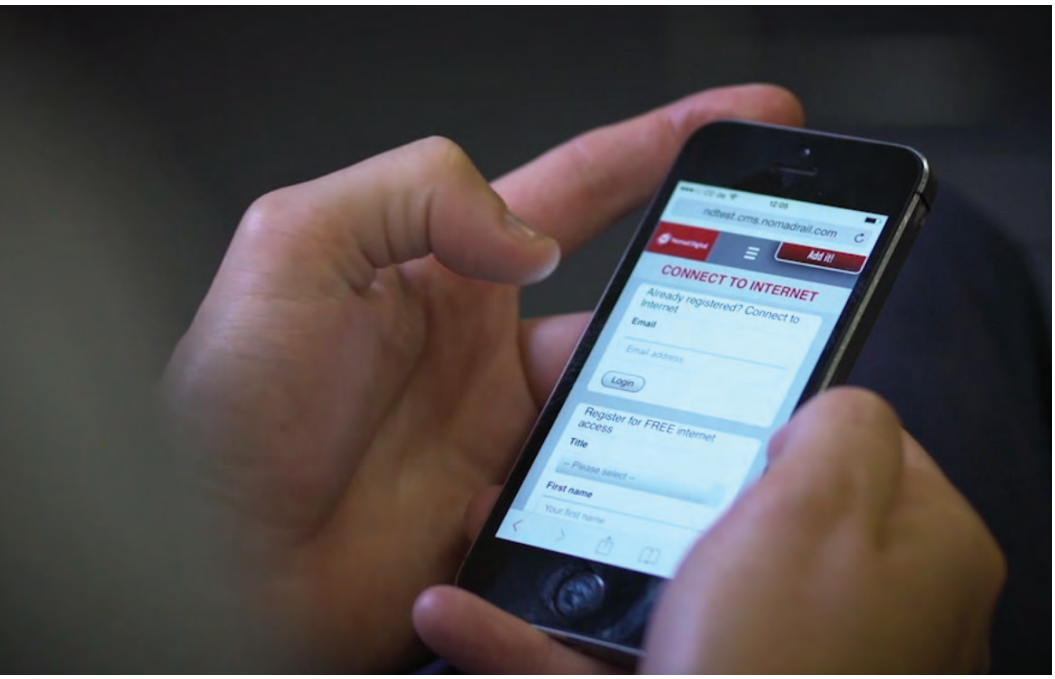
He says most infotainment services are free to passengers, even pure entertainment offerings, which are typically the domain of long-distance trains. "We've found that passengers are a bit reluctant to pay for services, but it's still fairly early days," says Schrader. "Today most of these services are free, implemented purely to provide a better traveling experience."

The content is hosted on board and updated wirelessly. Operators can manage the onboard content from shore-side. On the train it can be displayed on installed screens, or through a portal that passengers can access via their PEDs.

Connecting America

Nomad is now working on a nationwide PIS and infotainment solution for Amtrak in the USA. "It's our largest PIS deployment," says Schrader. "It will provide a comprehensive set of live audiovisual information, but also infotainment services on various channels. This can also be combined with interactive information."

Amtrak already offers some interactive information on portals and wi-fi, enabled by Nomad. The expansion will result in the train gathering and disseminating much more information about the journey – including expected arrival times, onboard services, points of interest along the route, and so on.



LEFT: Nomad is seeing big demand for onboard portals, which passengers connect to via their PEDs

INFORMATION FOR ALL

Passenger information systems can help make journeys smoother for everyone, not least people with disabilities.

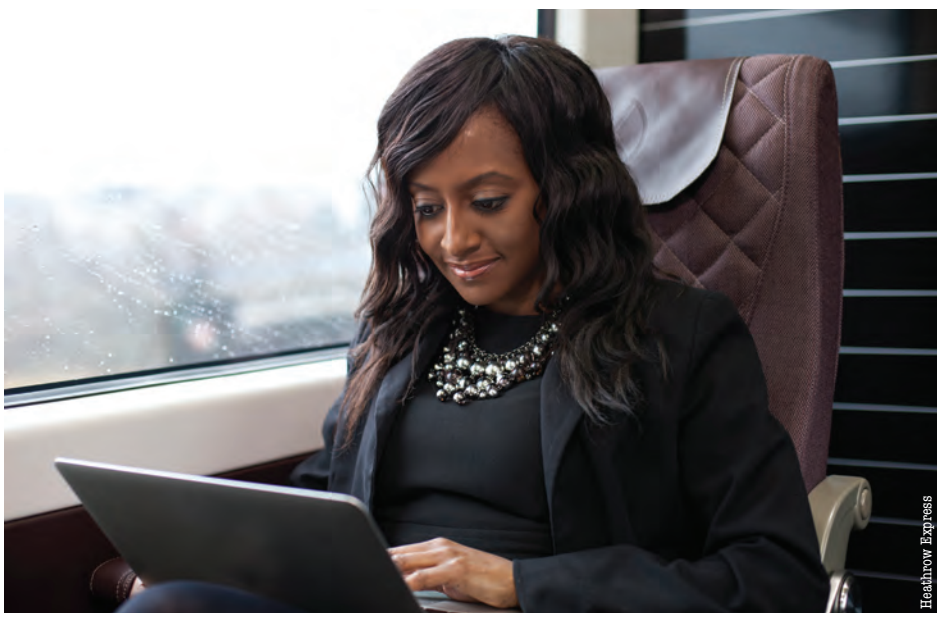
"These kinds of systems can advise people using wheelchairs where to board, guide them to universal access toilets, enable them to request help to leave the train, and indicate if platform elevators are available, for example," says Marc Schrader of Nomad.

But to be fully effective, these systems need to disseminate information in various ways. "For people who are blind or partially sighted there could be a special information channel, providing a text-to-speech service," says Schrader. "For deaf or partially deaf people, announcements can be linked directly to their hearing aid, using an app on their smartphone."

The implementation will be very complex. "There will be a lot of information channels, with different title screens for different carriages and even zones within carriages," says Schrader. "For example, we could display menu information in the bistro. The information will be pushed from shore-side to all trains on certain routes, specific trains, or even specific carriages."

The main challenge is that the system will serve a large number of operators, each of which has its own branding, rules and content. Some lines are used by multiple operators. Another complication is that different states might have different rules regarding what content can be shown, and they might not all own the rights to show it. "There are lots of things you have to consider, based on the position and other attributes of the train," says Schrader. "It requires very intelligent, modular and dynamic software on the shore-side, to make sure the right content is addressed to the right trains at the right times."

BELOW: Nomad implemented wi-fi portals for Heathrow Express


Heathrow Express

The small screen

In the sector as a whole, with non-basic information and entertainment, Schrader says there is a definite move away from implementation

LEFT: Nomad collaborates closely with each operator to implement a customized solution

on installed screens toward streaming content to passengers' PEDs. "Most passengers bring their own screens," he explains. "It's also a much lighter investment both in terms of maintenance and hardware – only a server is needed, which may already be on board anyway."

Schrader believes this trend will enable more personalized services in the future. "We're heading into the interactive age," he says. "Installed screens will remain useful for basic announcements and media, but a portal opens the door for personalization, especially when combined with open web-based APIs."

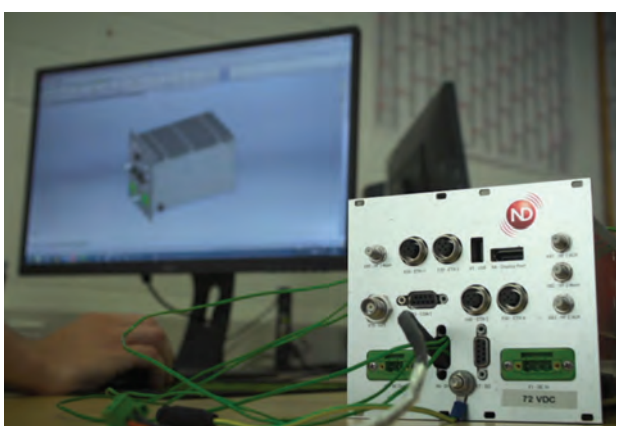
STREAMING DRM-PROTECTED CONTENT

Modern infotainment systems require a solution for streaming DRM-protected films to passengers' PEDs. "The content is uploaded to the train and stored in a secure area," says Marc Schrader of Nomad. "It is accessed with a temporary encryption key. The client applications that connect to these streams typically have to pass a certification process as the content providers. It is not possible for the passenger to store any of the encrypted frames in the RAM of their device."

If operators want to charge for this service, the system can be configured to refer to a list of customers before allowing access to the key. Customers have to enter their details when logging in to the portal.

Future visions

Open web-based APIs can enable third-party applications to communicate with the train, so they can make use of the information the train has stored about the journey, available services on board, and even passengers, if they have given permission for their information to be used in this way. "For example, if you linked a seat map of the train with the passenger's social media account, you could show them if any of their friends were on the train," says Schrader.



BELOW: With Nomad's IP solutions, all the peripheral equipment is controlled by the OBIS

He believes this technology could provide a seamless experience for passengers. "To begin with, they would buy their ticket via an app," says Schrader. "The server at the station could tell the passenger which platform their train is on and where their seat is, or, if they have no reservation, which carriages are the least crowded. The train server would take over after the passenger has boarded, exposing data about the train to relevant apps via its API, and then guiding the passenger to their seat and perhaps informing them about the services available on board that day. Passengers could also order food and drink from a truly up-to-date menu, and have it delivered to their seat; or receive a wake-up call when the train reaches their destination, based on information from the ticketing system and the real-time progress of the train. We're not that far away from this kind of digital journey. We have all the technologies; the challenge is just in combining the various systems with open web-based APIs. These services will enable operators to get closer to their passengers."

GOING GREEN

Environmental concerns are increasingly determining the product choices that specifiers are making, according to Forbo. "In Marmoleum we have a product where 97% of the raw material is natural – and 72% is rapidly renewable – and 43% of the finished floor covering is made from recycled material," says a spokesperson for the company. "It's arguably the most sustainable floor covering money can buy. Furthermore, we are continuing to innovate and improve the product's environmental credentials all the time, by adopting a lifetime assessment approach and striving to reduce our impact on the environment in every way we can."

Line of beauty

Dutch Railways modernized 250 double-deckers with linoleum from Forbo

Dutch Railways has undertaken a major fleet modernization project – replacing all furnishings, fixtures and fittings on 250 intercity double-deck trains. For the flooring, Forbo's Marmoleum Striato FR linoleum was chosen. This is a recent addition to the company's linoleum collection, designed to have a modern yet retro linear design and available in a palette of natural colors. "The flooring had to meet high legal safety requirements, be easy to clean and maintain, and be very durable," says Brigitte Matheussen, train formula manager at Dutch Railways. "On average the life of a train is approximately 30 years, and halfway through that period we will carry out this kind of full-scale refurbishment. We were therefore looking for flooring with a 15-year life."

Appearance was also very important. "The choice of floor coverings forms the basis for your entire design scheme," says Matheussen. "The new Marmoleum Striato FR collection arrived at just the right time for us. It's completely different from traditional linoleum and fits precisely into the new concept."

Environmental sustainability is another high priority for the operator. "Linoleum is very environmentally friendly, made almost entirely from natural raw materials, and we also know that Forbo is striving to make its manufacturing processes as sustainable as possible," says Matheussen.

Dutch Railways collaborated with Eindhoven-based industrial design agency Puur Ruimte on the project. Marion Rovers from Puur Ruimte has been working on train carriage designs for Dutch Railways for about 15 years. "Designing a train is an incredible job," she says. "It covers everything to the very last detail. Where the flooring is concerned, quality and long-lasting performance are critical. It's relatively easy to replace chair upholstery or a table, but if something turned out to be wrong with the floor we would have to redesign and refit the entire interior of the train – an enormously expensive undertaking."

"We're clearly innovating in aesthetic terms, and the subtle linear styling and natural colors of Marmoleum Striato FR are perfectly suited to the railway carriage environment," says a spokesperson for Forbo. "In terms of functionality and performance, we have completely reformulated the surface finish, Topshield 2, to meet the demands of constant heavy traffic. Topshield 2 has superior durability and improved resistance to scratches and stains, resulting in a floor that will deliver performance that lasts."

MAIN AND ABOVE: Marmoleum Striato FR linoleum on double-deck trains operated by Dutch Railways

Change of scenery

Established in the aviation sector, Chameleon Products is now bringing its decorative technology to the rail industry

Chameleon Products can make plastic, composite materials and most other substrates look like different materials. It can, for example, make plastic look like marble or wood. Components, which can be complex in shape or pattern, are decorated with the desired pattern using a number of technologies, including a water- and ink-based transfer printing system. The component is then finished with a hardened lacquer.

"We've been very successful in the aviation sector, where our technology meets the stringent certification requirements, and now we're offering the technology to the train sector," says Trevor Whetter, managing director at Chameleon Products.

Chameleon's technology features on 15 executive jets, and on the first-class seats and bar units of A380 and B787 Dreamliner aircraft. The same products have also been used to redecorate aircraft toilets.

The company is investing in further development, and has been testing a number of its technologies to BS 6853 and BS 476 standards, in order to offer them to the train sector. Chameleon's technology can be used on any existing furnishings in trains.

Whetter says there are many advantages to the process. "The finish is 300% lighter than a wood veneer, it does not crack and lift off like veneer does, and it is suitable for recycling and refurbishment," he says. "There are so many possibilities. We can apply the technology to train seat plastics – we can take a gray, dull piece of plastic and turn it into something spectacular."

LEFT, ABOVE: AND CENTER: Chameleon's products have been used to transform many aircraft lavatories

LEFT: Trevor Whetter, managing director at Chameleon Products

The company also offers several other, recently developed, products and technologies. "These include Visionairy, which enables train operators to create a 3D image for signage or advertising purposes, and Famotex, a foam replacement product designed to enhance comfort and safety in seating products," says Whetter. "It's a bit like being a magician – we change things into something else."

Pressed to impress

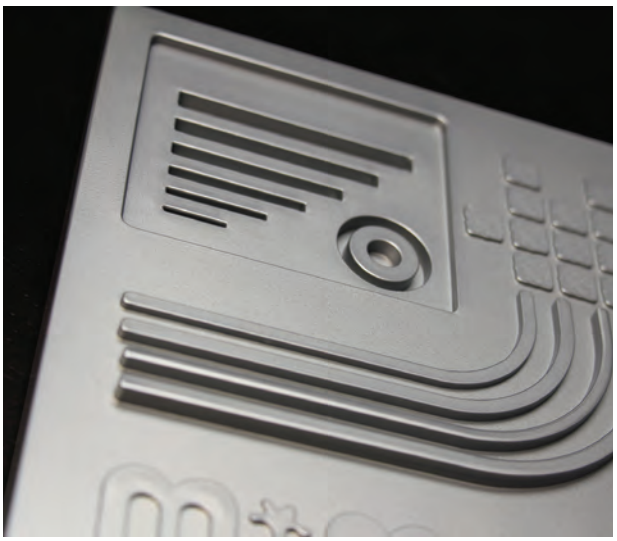
Sekisui Polymer Innovations discusses the design benefits of thermoplastics and pressure forming for the mass transit industry

Material and processing advances in the thermoplastic and thermoforming industries are creating new design possibilities for mass transit interiors. “Until recently, thermoplastics were considered late in the design process and only selected on the basis of price, quantity and compliance,” says Rich Cort, mass transit business manager at Sekisui Polymer Innovations (SPI), a thermoplastic manufacturer. “Designers are now considering thermoplastics at the beginning of the design process. This early collaboration between manufacturers and suppliers is yielding efficiencies in the process and improving overall interior design.”

So why does Cort believe designers are choosing thermoplastics? “The requirement to minimize weight has become more common in the mass transit industry, and toxicity and environmental regulations have become more stringent,” says Cort. “The indications are that regulations will rapidly become stricter. The desire to improve the passenger experience is also driving innovation. As these factors converge, project teams are turning more frequently to thermoplastics over fiberglass.”

Thermoplastics versus fiberglass

Thermoplastics are made of polymers that become pliable or moldable above a certain temperature and solidify upon cooling. “Designers, OEMs and transit authorities are realizing the advantages that thermoplastics have over fiberglass,” says Cort. “They are lighter in weight, enable a more detailed design and are cheaper to fabricate. Parts retain mechanical properties such as durability, which decreases replacement and out-of-service costs. Integral color thermoplastic parts don’t need secondary finishing and require little cosmetic maintenance because they are resistant to chipping, cracking and discoloration. As such, during



LEFT:
Pressure-formed thermoplastics offer intricate detail and tight tolerances

ABOVE:
Vacuum-formed (left) and pressure-formed (right) thermoplastic

RIGHT:
Sekisui says thermoplastic wall panels offer graffiti resistance, a tight fit and flowing aesthetics

refurbishment projects they are often selected by transit authorities to replace worn-out parts made of other materials. Furthermore, unlike fiberglass they are VOC-free, so when parts are eventually replaced they can be recycled directly into the production stream."

Cort also says the thermoforming process can yield savings. "The process typically generates more parts per hour per mold than fiberglass, often in ratio of 8:1," he says. "In addition, prototyping molds are cheaper, making more design iterations possible and delivering a quicker time-to-market. Production molds are also cheaper, given that they often produce more than 20,000 parts before they need to be replaced."

Vacuum versus pressure forming

There are two main ways to form parts from thermoplastic. "With traditional vacuum thermoforming, wall thinning can be a problem because variations in the sheet material occur as it is stretched over the tool," says Cort. "With pressure forming, a combination of air pressure and vacuum, plus more sophisticated process controls for monitoring tool and sheet temperature, result in more consistent parts and make it possible to create precise details and intricate undercuts. The air pressure forces the thermoplastic into the minute crevices of a mold so that tight corners, vents and ribs, logo silhouettes and assembly points can be formed accurately."

Cort reports that although temperature-controlled molds have been around for decades, in recent years they have been much more widely adopted. "Evenly cooling the formed part delivers a more stable part in the end, aiding consistency and enhancing quality," he says.

Pressure forming also enables designers to selectively texture parts of a surface on a single part by applying the texture directly to the mold, which transfers directly to the primary surface of the part. "In vacuum forming, this is accomplished by embossing a texture on the extruded sheet, which can introduce inconsistencies in parts as the material is stretched or distorted," says Cort.

COLOR AND BRAND

Rich Cort of Sekisui Polymer Innovations believes that color is one of the most powerful ways to enhance the passenger experience and reinforce a brand.

"Choosing an interior color scheme requires careful consideration," he says. "Color can influence how passengers perceive a space by making it seem larger or more intimate. It can be calming, highlight a design feature, or establish a sense of place. It also means different things in different cultures."

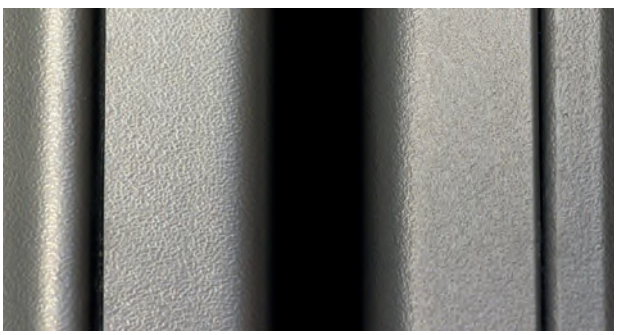
The thermoplastic industry offers a wider array of materials with integral color. "A big decrease in the minimum required volume for pigments is resulting in lower costs for custom colors and new color engineering, allowing designers to experiment more freely with color," says Cort. "The thermoplastic industry continues to develop new palettes and capabilities."

"Pressure forming produces low-cost, aesthetically refined parts that rival those made using other types of forming," says Cort. "As designers and manufacturers discover what they can accomplish with pressure forming, we are bound to see it used more for the mass transit interior industry."

Early intervention

Cort is a strong believer in the power of early collaboration. "Designers are collaborating with thermoformers and manufacturers earlier, and so we're seeing an increase in awareness of these new capabilities and technologies," he says. "That improvement in the collaboration process has had a big impact on the passenger experience. The worlds of design and manufacturing are intersecting more powerfully than ever before because there is much to be gained by it. Consider the many suppliers that contribute to a mass-transit interior. If each of those contributors works in isolation, the overall design quickly degrades. If colors and materials are chosen as part of a cohesive design, then components are able to interplay, complement and make sense with each other. Carpet, seat coverings and lighting all contribute to the passenger experience, enhancing the brand and the overall enjoyment of travel."

MAIN: An Amtrak interior featuring SPI material for interior components



ABOVE RIGHT: A comparison of the gloss created by vacuum-forming (left) and pressure-forming (right)

Cort also contends that there are financial benefits to the collaborative approach. "It can lower costs," he says. "Collaborating on a mass transit interior design earlier in the project development process translates to better results, often in a shorter time. As material suppliers, we all have the privilege and responsibility to continue the journey of developing mass transit products that exceed and anticipate increasingly stringent regulations while improving the passenger experience with refined design. Pressure forming is a game changer when combined with thermoplastic's light weight and recyclability."

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Wash and go

Omnova Solutions contends that the ease with which vinyl-coated fabrics can be cleaned makes them ideal for mass-transit applications

Vinyl upholstery, such as Omnova Solutions' PreVaill Transit, can be manufactured in almost any color and texture to simulate fabric. "It provides a pleasing riding environment, while meeting the transit industry's stringent standards," says Lisa Jones, global transportation market manager for Omnova Solutions.

PreVaill Transit is available in three varieties: PreVaill XMT, which is engineered for softness; PreVaill XMT Plus, which is designed to offer the same softness but with added durability; and PreVaill MT, which is designed to withstand the harshest transit applications. Customers can choose from standard patterns and colors or specify custom ones.

Omnova Solutions believes the biggest benefits of vinyl solutions are how easy they are to clean and their durability. With PreVaill upholsteries, these qualities are boosted through the application of PreFixx protective finish. PreFixx is designed to ensure that most staining agents can be wiped off and that more challenging ones can be addressed with common cleaning products. It is also designed to cope with the use of disinfectants.

"Cloth-covered transit seats accumulate stains and odors," says Jones. "Hard-to-clean cloth fabrics, such as wool, can be a breeding ground for germs and bacteria. Ramping up cleaning measures to address contamination can increase costs for transit organizations, and the costs of replacement are high, too. Transit organizations looking for cost savings are adopting more durable, easy-to-clean vinyl-coated fabrics."

Jones cites several metro systems in the USA – in San Francisco, California; Charlotte, North Carolina; Boston, Massachusetts; New York City; and Washington, DC – as having implemented vinyl-coated fabric upholstery for seating.

"A shift to vinyl-coated upholstery is giving many transit organizations the ability to clean and disinfect transit seating more easily, helping create a cleaner and more pleasant environment," says Jones. "One transit system estimated it would save more than US$500,000 a year in cleaning costs by making this change, and that the seats would last at least twice as long. Furthermore, the cost of replacing the seats with vinyl-covered ones would be approximately 40% less than with fabric-covered ones. Most importantly for passengers, vinyl upholstery was found to be much easier to clean and disinfect thoroughly than existing wool-based or newer synthetic fabrics."

ABOVE: San Francisco's Bay Area Rapid Transit refurbished existing seats with PreVaill Transit vinyl

Jones also argues that greater durability translates into environmental benefits. "One transit system estimated that switching from wool-based seating upholstery would have a positive sustainable impact, eliminating 750 tons of waste sent to landfill every three years," she says.

Living space

A lot of thought has gone into the details of Hitachi's AT100 metro and AT200 commuter EMU mock-ups

Hitachi Rail Europe commissioned Schoenemann Design to develop its vision for a future platform, the AT100 metro and AT200 commuter trains, in 2013. Central to the brief was to create a design that focuses on the Central European market, but still reflects Hitachi's Japanese roots.

This design was to be showcased in two mock-ups, introducing a modular interior system. This system means multiple components can be shared across 20m and 23m vehicle types. The aim is to reduce the manufacturing costs that are associated with offering flexibility to operators.

The interior components are designed to eliminate intrusion into the flooring and body panels, enabling an interior to be reconfigured without engineering changes. This was made possible by integrating a cantilevered system that interfaces with linear rails in the vehicle structure. "The benefits of using this system include ease of cleaning, maintenance and refurbishment, as new components can be inserted without difficulty," says Lee Kavanagh, industrial designer at Schoenemann Design.

Particular attention was paid to the structural interface between the draught screens and the seat, to optimize the body-side mounting system, reducing structural complication. "This, together with a regime of weight and cost control, has achieved the flexible and innovative interior desired," says Kavanagh.

Schoenemann Design says one of the major challenges always faced by designers on this sort of project is how to develop space-efficient seats that get as many people into a carriage as possible. A pitch of 730mm with a knee clearance of 40mm (for a 95th percentile male) was achieved for the AT100 platform. "To enable such a small pitch without compromising comfort, we crafted a seat shell that maximizes knee room," says Kavanagh.

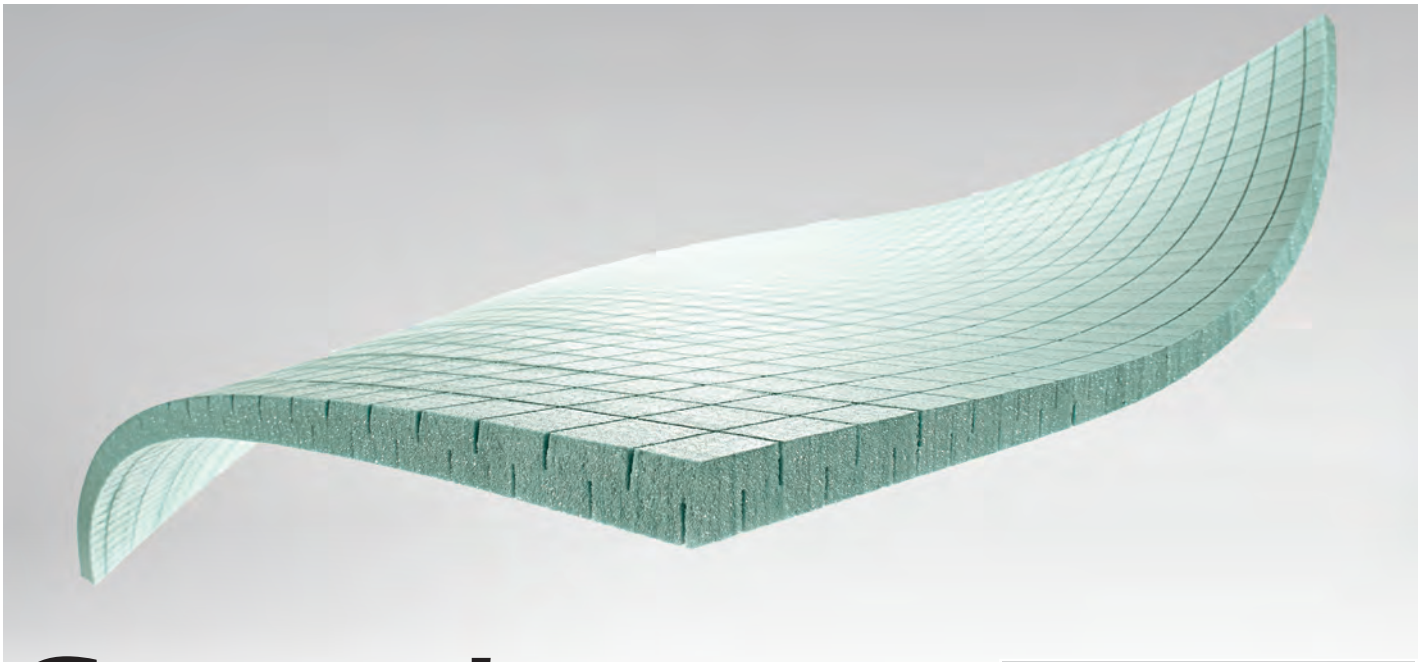
ABOVE: Components on the AT100 metro are attached to the sides of the train, for greater modularity

A particular challenge was to develop a headrest for first class that would integrate multiple electrical units, while still providing a comfortable cushion. A TFT display unit was installed, to inform passengers whether or not the seat has been reserved. This is linked to a small LED that also indicates the availability of the seat. A small reading light was also integrated into the headrest, and can be controlled via a switch on the valance.

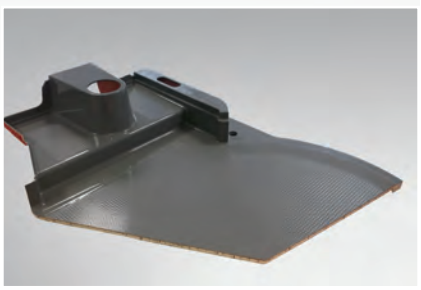
QR codes are also integrated into the headrests. These enable passengers to check in to their reserved seat by scanning the code through the Hitachi train app on their smartphones. When a passenger checks in, the TFT screen displays a welcome message and the LED light turns red, signaling to the onboard train manager that the seat is occupied by the correct passenger, removing the need to check their ticket.

"With such a great focus on the development of the seats and other components, the mock-ups became much more than concept vehicles," says Kavanagh. "The seats and tables were crash tested and the other interior components were all designed in accordance with GM/RT2100 and TSI-PRM requirements. All of this combined to create a realistic and truly immersive experience as to what future rail travel could look like."

RIGHT: The AT200 commuter train interior is based on the same modular system as the AT100 metro



Green dream



Armacell is introducing a foam core made of recycled PET bottles and designed to meet EN 45545-2 FST

Polyethylene terephthalate (PET)-based structural foam cores from Armacell have already found many uses in the railway industry. The company's ArmaForm PET AC (the standard offering) and ArmaForm PET FR (a fire retardant, self-extinguishing version) have been used in sandwich applications for floors, doors, toilet cabins and nose cones.

"The success of PET foam cores is due to a combination of excellent fatigue and FST properties, very good temperature stability and excellent compatibility with all resins and manufacturing methods," says Stefan Reuterlov, global general manager of technical service for technical foam at Armacell.

PET, a thermoplastic polymer, can be recycled. "Today, PET scraps can be mixed back into production, leading to the reputation of PET foam cores as an environmentally friendly solution," explains Reuterlov. "Now we are going a step further, with the introduction of ArmaForm PET GR to the railway industry."

ArmaForm PET GR is based on 100% recycled PET. Waste PET, from drinking bottles for example, is collected and sorted. The material is cut into flakes, thoroughly cleaned and shipped in big bags to Armacell's plant in Belgium. At this facility there is a dedicated granulation line, an investment that Armacell says ensures the PET flakes are converted into granules that have all of the stable material attributes needed to achieve the end product's desired mechanical properties.

By April 1, 2016, all materials used in the railway industry in Europe will have to pass the new EN 45545-2 FST norm instead of older national standards. Armacell says fire-retardant core materials are not necessarily needed to meet the new standard. Therefore, the company tested the standard grade PET AC against EN 45545-2. "With the core material, it is mostly the smoke and toxicity levels, and to a lesser extent heat release, that are important, rather than the flame spread," says Reuterlov.

Two sandwich samples were tested – aramid paper honeycomb with a density of approximately 60kg/m^3, and ArmaForm PET AC with a density of 80kg/m^3 – both with the same phenolic skins.

"Both panels passed EN 45545-2 tests for material requirement set R10 (horizontal surfaces) and with excellent results," says Reuterlov. "Both panels were classified as HL3, which is the highest class you can reach, meaning the materials can be used on all types of trains, including metros and sleeping coaches. The panel with the PET foam core also showed great smoke and toxicity results and good heat release results."

Armacell then proceeded to test the recycled GR grade against EN 45545-2 FST, but for the R1 (vertical surfaces) material requirement set. "Again, the PET foam core passed with very low smoke and toxicity levels, proving that ArmaForm PET GR should be of great interest for railway applications with an environmental focus," says Reuterlov.

MAIN: ArmaForm PET GR is made purely from recycled PET

ABOVE RIGHT: A train floor part made from ArmaForm PET

Fresh thinking

Three sanitary cabins were developed to blend harmoniously within the holistic design of Eurostar's new e320

At the end of 2015, Eurostar's new high-speed e320 trains – based on Siemen's Velaro platform – are due to enter service. They will complement Eurostar's existing fleet, operating through Belgium, France, the Netherlands and the UK.

For the e320's interior design, Eurostar brought in Pininfarina. The agency has worked to create a consistent design, which runs through the whole train and applies to all its fittings, including the sanitary cabins. These sanitary cabins are not finished in the usual gray and white. For the e320, Pininfarina created an elegant color scheme, which is applied to all parts of the train. For example, the handrails in the toilets are green and a similar color is used for stitching on some leather seats, and for grab handles in the entrance areas.

Satek is the exclusive sanitary cabin supplier for the e320. It worked collaboratively with Siemens on the development. In addition to the construction, Satek was responsible for the technical realization and modifications.

The basis of the sanitary cabins is a 3D-formed GRP (fiberglass) body, which is fitted with all the technical equipment. The visible front is made from a specially treated high-pressure laminate (HPL) and the ceiling and floor elements are made of aluminum. "HPL was used because it is resistant to scratches, abrasions and impacts, is certified in line with EN 45545 HL2 and is easy to clean," says Jürgen Kaiser, general manager at Satek. "But HPL incorporates wood, so we had to make sure the material would not bend or warp. To do this, we controlled humidity and temperature at every stage of the chain."

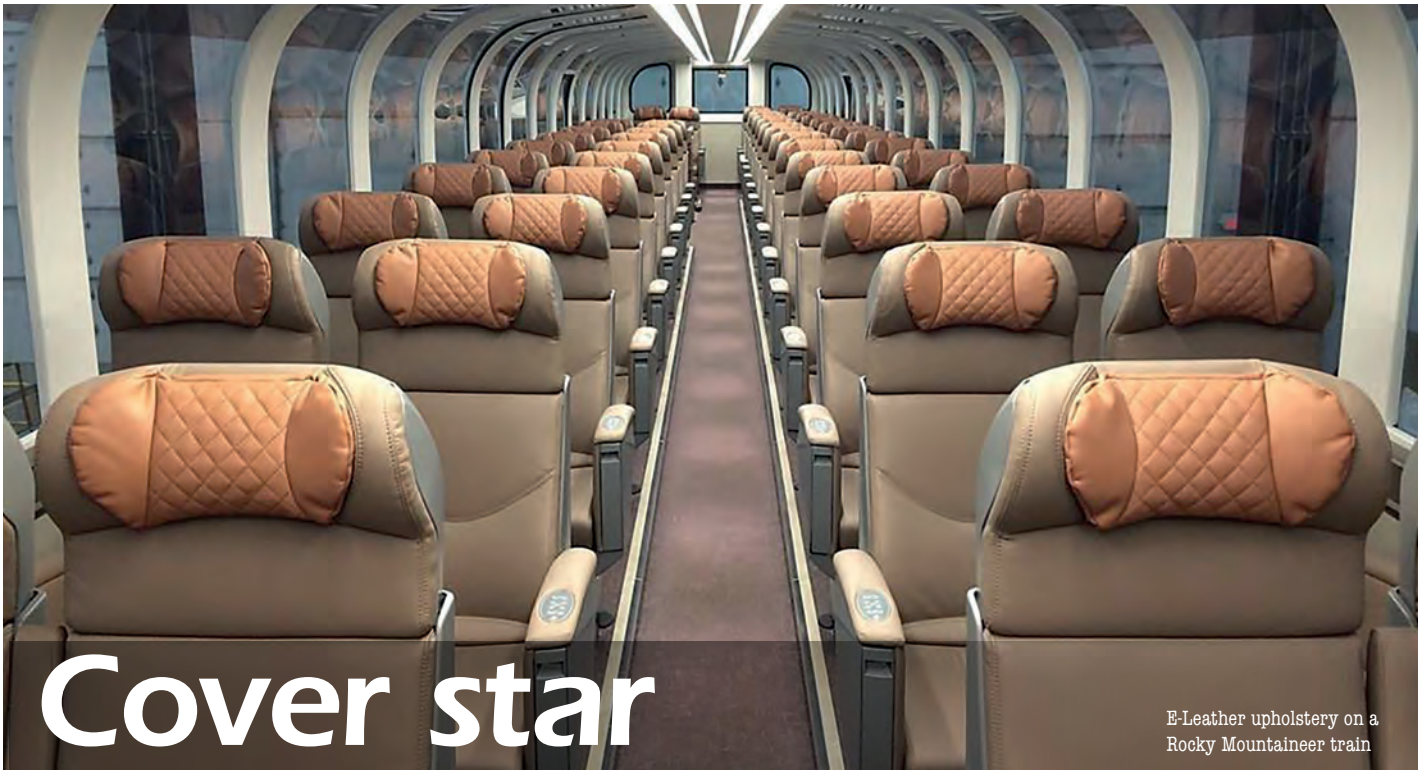
ABOVE: Toilets on Eurostar's new e320 train were designed to harmonize with the overall interior design

During the design and development, special attention was paid to ensuring that technicians have simple access to all the functional elements when it comes to maintenance and refurbishment. Satek also integrated drip trays and sensors so that if there is a leak, the train manager will be alerted automatically.

For the e320, three types of toilets were developed. One is a universal toilet, which is larger and manufactured to the standards of TSI PRM, to accommodate persons of reduced mobility. The other two types are standard toilets, one for first class and the other for second. These two standard toilets are basically the same but they have different color schemes. They are designed to be space and weight efficient.

The parts used for these cabins come from all over Europe. The GRP parts come from Poland; the sinks come from France; and some of the valves, the pipes and the floor come from Italy.

Satek has been manufacturing complete sanitary systems for more than 10 years. "In this field we have built up unique and specialized competences and production capacities," says Kaiser. "These include a lean production system that enables us to produce more than 1,000 cabins a year, using a single-shift production system with around 100 employees."



Cover star

E-Leather upholstery on a Rocky Mountaineer train

As part of its commitment to the rail industry, E-Leather is introducing a purpose-designed composition leather

The latest composition leather product from E-Leather, SL7, is engineered to meet EN 45545-2:2013 HL3 for seat upholstery. “Customers using SL7 have passed the new standard, which asks for reduced smoke density, minimal toxic smoke and heat release at three hazard levels,” says Alexandra Bennett, global business manager at E-Leather. “SL7 meets these stringent requirements at HL3 – both on its own and in combination with presently used industry solutions. Now customers can have increased confidence when specifying E-Leather, knowing they will achieve positive test results.”

But the need to meet these new fire standards is not the only trend the company has noticed. “It’s important that SL7 provides a cost-effective platform that enables designers to challenge the status quo in railway interior design,” says Bennett. “The rail and bus industries are being influenced by the aviation and adjacent industries. Operators are being challenged to make the bus or train commute a more pleasurable experience. Customers using public transport want to feel valued.”

E-Leather says the modernization of bus interiors is driven largely by the need to persuade drivers away from their cars. “These upgrades do not go unnoticed by passengers, and social media provides instant feedback,” says Bennett.

The company believes that the bus and train industries also want a product that is hygienic, easy to clean and requires minimal maintenance. “We are delivering sustainable benefits, including improved durability,” says Bennett. E-Leather says its composition leathers have displayed all these properties in the aviation sector, where they are fitted on more than 750,000 seats.

Although still considered a relatively new entrant into the rail market, E-Leather is already used for rail applications around the world, including on the metro in Seoul, South Korea, and by Rocky Mountaineer in Canada and Deutsche Bahn in Germany.

Each operator has its own defined criteria. E-Leather works together with the operator, its designers and seat manufacturers, to deliver on those criteria.

The investment in new products specifically for its rail portfolio demonstrates E-Leather’s commitment to mass transportation. It also enables intermodal operators to brand their various methods of transport in a similar fashion, so they can enhance customer experience and brand awareness.

RIGHT: Headrests upholstered in E-Leather, on a Deutsche Bahn train

EPOXY COMPOSITES

Hexion also offers epoxy matrix technologies, honed in the automotive industry. "You can reduce composite costs by shortening production cycle times," says Sigrid ter Heide of Hexion. "Over the past five years, Hexion has made big investments to serve the automotive industry, developing mass-production systems with structural part cycle times as low as one minute."

The company expects to apply this manufacturing expertise in the rail market soon.

Fire guard

Resin-based composites from Hexion are being used to make train interior parts that comply with EN 45545-2

At Railway Interiors Expo 2015 (to be held on November 4-5 in Prague, Czech Republic), Hexion is showcasing its Cellobond resin systems. They are designed to comply with the 2013 EN 45545-2 fire safety standard, which will become mandatory in all European countries from 2016, replacing national fire standards.

Recently Cellobond resin-based composite materials have been used in the UK for Heathrow Express, Gatwick Express, London Underground, Virgin West and East Coast Main Line, Crossrail and Thameslink trains. All these projects had to comply with British Standard 6853 class 1A and 1B, comparable to EN 45545-2's HL3 and HL2 categories. The Cellobond resins were used to make window surrounds, side panels, standbacks, flooring, ceiling panels, luggage racks, bike storage units and toilet modules.

"Mtag Composites has produced window and ceiling panels for Alstom's Virgin West Coast Main Line coaches, and Datum Composites is manufacturing cab ends for Bombardier's Crossrail trains," says Pat Colclough, business manager for phenolic specialty resins at Hexion. "Meanwhile, Brecknell Willis Composites is producing phenolic cab ends and light surrounds for the refurbishment of the Docklands Light Railway." Hexion is partnering with Caleb Technical Products to service the UK market.

Hexion says the chemical structure of phenolic composites makes them highly fire resistant. "Cellobond resin-based composites easily meet HL3 fire protection for R1 interior applications," says Colclough. "In fact, these composites perform well enough to meet hazardous classification HL3 or HL2, even with less-compliant coating systems. Furthermore, the use of these composites in place of aluminum or steel can save weight, translating into better fuel efficiency, faster acceleration and lower maintenance costs."

ABOVE: Cellobond resin-based composite cab ends and standbacks, produced by Brecknell Willis Composites for Bombardier, for operation by Gautrain of South Africa

Phenolic composite parts are made by hand lay-up, vacuum infusion or a vacuum-assisted RTM process. "The advantages of automated, closed-mold processes such as infusion and RTM are many – good part quality and consistency, higher productivity and better health, safety and environmental conditions," says Colclough. "Cellobond resins are relatively easy to use in these processes. The absence of flame-retardant additives averts filler-related problems including sedimentation, uneven distribution and voids."

"Glass-reinforced phenolics can be molded into interior parts at a competitive price and low weight while meeting fire specifications," says Sigrid ter Heide, market development manager for transportation at Hexion. "The cost of a typical phenolic interior part is attractive because labor costs are lower in an automated, closed-mold process than for the more labor-intensive hand lay-up process that must be used to make flame-retardant-filled resin systems. Other factors contributing to cost efficiencies are relatively low post-curing time and material expenditures."

Softronic Group

Andrei Irimescu

LEFT AND ABOVE: Softronic chose Jets toilets for its Hyperion train

BELOW: Jets' toilet mechanism installed on a stainless-steel inner bowl

Jets Vacuum

Vacuum power

Romanian train manufacturer and operator Softronic Group has chosen vacuum toilets from Jets Vacuum for its trains

Established in Craiova, Romania, in 1998, the Softronic Group today works on two sides of the rail industry. Softronic manufactures trains and locomotives, while its sister company Softrans operates cargo and passenger trains.

Being both a manufacturer and an operator in the rail industry has its advantages and some potential drawbacks. "We are on both sides of the fence, for better or worse," says Cristian Prundeanu, head of quality at Softronic. "If anything goes wrong on a train, some operators have the luxury of simply letting the manufacturer deal with the problem. On the bright side, this double role means we select only the most reliable technology for our trains, to avoid any issues in the first place. This provides peace of mind."

The latest addition to Softronic's product range is the Hyperion train. For the Hyperion's toilets, Softronic chose Jets Vacuum. "The latest vacuum toilet technology from Jets offers complete independence from compressed air, a feature we greatly appreciate," says Prundeanu. "This unique feature has enabled us to finally say goodbye to older designs. We needed a better toilet solution and are very pleased to have found Jets. The Jets toilet mechanism has fewer and stronger parts than other toilet systems, so there is considerably less risk of failure. Other benefits of these vacuum toilet systems include low service and lifetime costs, long-term durability and a powerful vacuum pump that can be installed away from the toilets."

"The Hyperion is a great example of innovation," says Paul-Sindre Tarberg, railway market manager at Jets Vacuum. "To innovate, older technologies must sometimes be left behind, and that is exactly what Softronic has done by choosing Jets toilets for its trains. We offer the newest solution available for railway toilets, with our well-proven method of vacuum generation."

The third-generation vacuum technology used in Jets Vacuum's systems was developed in Norway, where all the company's vacuum generators are still built. These vacuum generators are also used for military applications around the world.

"The robustness that the Norwegian industry is known for all over the world is incorporated into each and every one of our products," says Tarberg. "We know this is of great importance to Softronic, as well as to our other customers."

The customer is king

The industry's demands for high-class aesthetics, performance and customization inform Boxmark's leather offering

Marjan Trobis, managing director of Boxmark Slovenia, believes only leather can enable rail operators to match the ambience of high-class automobiles and aircraft. "Operators competing with other forms of transport need to offer potential customers a real alternative," he says. "They can capture this exclusive ambience in the compartments of their trains through the use of high-quality leather."

Boxmark invested many years of research and development in creating Xtreme, a leather designed to offer an elegant and natural appearance and yet meet the industry's need for an extremely hard-wearing solution.

"This exclusive natural product combines the high technical qualities of synthetic leather with the captivating and enduring sensations of real leather," says Trobis. "It is antibacterial, antimicrobial and resistant to mildew, suntan oil, mosquito repellent, water (including salt water), UV, alcohol, soil, sweat and disinfectants. It is also lightfast and easy to clean, with high resistance to abrasions, stretching, tearing, flames and breaking, even at freezing temperatures."

Another key offering from the company is Xlight. As well as being designed for durability and ease of maintenance, Xlight leather was developed to offer rail operators a weight-saving solution. The product weighs ±600g/m² when laminated.

"Xlight's excellent technical values and easy cleaning guarantee longevity," comments Trobis. "Xlight and Xtreme also fulfill all international standards for the rail industry – including the European EN 45545-2 standard."

ABOVE: Boxmark's leathers can be customized in terms of color, texture and technical properties

Additional tests can be performed if required, and a test schedule for US railways is currently under development. Boxmark says the leathers are applicable to all interior components.

Boxmark can customize its leather to meet customers' specifications for grain pattern, color and technical properties. Xlight and Xtreme are also available in a combined leather product.

This development work is carried out at Boxmark's manufacturing facility in Slovenia. The company started out in the automotive industry and is also active in the airline, shipping and furniture industries. In 2012 it expanded the facility's production areas, modernized machinery and added new equipment.

The additions include 3D scanners and computing systems that enable the development of virtual prototypes, as well as CNC-controlled machines, band saws and milling machines. Boxmark is also able to create foam models, perform foam reconstructions and add upholstery to existing seat systems and add-on components.

It says all this means it is prepared to fulfill any customer requirement. "These leathers can be tailor-made to operators' design and project specifications," says Trobis. "The development is carried out in cooperation with our leather technicians and supported by our laboratory. The customer's designers can be creative, its engineers can find a trouble-free solution, and its passengers will enjoy the comfort."

LEFT: TM8 flooring is suitable for use on light rail and trams

Basis for success

Operators including London Underground have chosen Treadmaster's rubber-based safety floors

Rubber is the main ingredient in Treadmaster's safety floors for the rail market, which include TM7 and TM8. In both products, the rubber is included in a colored compound, which is mixed with speckles of the same material in many colors. Treadmaster says the floors are anti-slip, firesafe, easy to maintain, durable, hygienic and non-porous.

In terms of the UK's BS 6853 standard, TM8 is classified as a Class 1b product and TM7 as Class 1a, meaning both are suitable for trams and light rail, but TM7 can also be used on underground trains. "TM8 is also accredited against EN 455545 as an HL3 product, and although not tested, TM7 would also achieve an HL3 result," says Barry Curtis, flooring sales manager at Treadmaster.

Several projects using these flooring products are nearing completion. Treadmaster's TM7 is being used for two projects for London Underground, for trains running on the Piccadilly and Northern lines. As well as its Class 1a classification, TM7 also complies with London Underground's stringent engineering standards. "To reduce the number of joins in the vestibule areas, two colors were co-vulcanized to give a dual color sheet," reveals Curtis. "One of these colors was then machined to give a slatted profile."

LEFT: Two colors of TM7 were co-vulcanized for a seam-free finish on London Underground's Northern line

The Northern Line project began in January 2013 and involves 106 six-car sets. Treadmaster began deliveries for the Piccadilly Line in March 2013. The project involves 86 six-car sets.

Another current project is the Queensland New Generation Rollingstock Project in Australia, for which Treadmaster is supplying TM8 in both flat and profiled types, including a luminous version. It made the first delivery to Bombardier India in August 2015. The contract was signed in January 2015 and involves 75 six-car sets.

Treadmaster offers full support to its customers throughout each project. "We offer a design service, producing colors as requested, and offering the best size options to keep material costs to a minimum," says Curtis. "We also offer on-site supervision when the floor is being fitted."

TM7 and TM8 are available as tiles and rolls. Three sizes of tiles can be supplied – 50 x 50cm, 60 x 60cm and 100 x 100cm. The rolls are 1.83m wide and 11m long. The material is available in thicknesses ranging from 2.5mm to 5.5mm. The material texture can be ribbed, slatted, or round- or square-studded. Unlimited colors are available to operators ordering at least 80m^2.

A tale of two cities

To make it suitable for airport service as well as commuters, Siemens' Desiro City Class 700 Thameslink EMU needed a modern, multipurpose interior

When Siemens embarked on the design of a new Desiro City train platform for the UK's Thameslink, Schoenemann Design was commissioned to aid the development of the passenger spaces, color and trim, the interior of the driver's cab, exterior styling and livery.

Thameslink runs from Bedford, Bedfordshire, through London to Brighton, East Sussex, and also offers other suburban services. It stops at London Luton Airport and London Gatwick Airport. Therefore, the Class 700 EMU had to be designed for both high-density metro service and inter-airport travel. This posed a challenge, as the design had to optimize passenger ingress and egress (particularly at London Bridge Station), while providing plenty of storage facilities for those travelling to and from airports north and south of the capital.

The initial tasks were to create an effective and consistent seating layout and position the doors carefully. "Getting this right was crucial to achieving the optimum levels of ingress and egress," says Graham Scott, interiors engineer at Schoenemann Design. "Demanding passenger standing space targets led to the introduction of wide gangways and stand-backs that provide passengers with a reasonable level of standing comfort."

The designers also had to consider passenger psychology to achieve the optimal flow pattern. "For example, the grab poles in the train's vestibule are designed to lead passengers further into the vestibule and prevent congestion in the area surrounding the doors," says Scott.

An overarching design aim was to maximize space and reduce structural complexity. This resulted in various decisions, including the introduction of cantilever seats and the integration of a luggage stack with the draft screen. The interior also had to be a calming environment for passengers and provide a flexible layout that operators can tailor to meet their needs.

Meanwhile, the exterior had to have a unique quality. "The exterior had to have its own individual style and character, drawing inspiration from modern architecture in London, while reflecting Siemens' reputation for delivering cost-effective and durable products," says Scott. "This can be seen in the design around the over-riders. Instead of trying to hide the units, they became an integral design feature. The rest of the cab is set back from the units, which results in long sweeping panels. In contrast to existing very masculine cab designs, the Thameslink Class 700 has a much more refined and feminine form that has longevity and character."

The contemporary design of both the passenger areas and the cab exterior influenced the livery, which was kept to a minimalist style. "Operators can apply their own branding, but in a controlled manner that will not disrupt the styling of the vehicle," says Scott.

Crashworthiness requirements dictated various elements of the interior cab design, including the position of the desk. Human factors also played a major role in determining the position of the zoned controls on the desk, to optimize performance and comfort. "The result is a design with its own unique styling that can meet the high demands of the Thameslink service," says Scott.

ABOVE: Thameslink's new train design, built on the Desiro City platform

HOT TOPIC

The introduction of the EN 45545 fire safety standard has huge implications for the European rail industry

It used to be that each European Union (EU) member state had its own specifications, test methods and safety criteria to assess materials for fire safety in rolling stock. The UK, for example, used BS 6853 while France operated under NF F 16-101. But in 2013, these national standards were replaced with EN 45545, a harmonized standard for Europe. EN 45545 was based on a reworking of CEN/TS 45545:2009, which was published in 2009.

The EN 45545 standard has seven parts: requirements for fire behavior of materials and composites; fire resistance requirements for fire barriers and partitions; fire safety requirements for railway rolling stock design; fire safety requirements for electrical equipment; fire control and management systems; and fire safety requirements for flammable liquid and flammable gas installations.

Almost all new products weighing more than 100g made or sold in Europe now have to undergo EN 45545 fire testing before installation. The standard will also be applied as existing stock is replaced under maintenance schedules.

WHAT TESTS ARE USED?

Standard fire safety tests for materials include the cone calorimeter (ASTM E1354) test and the room corner (ISO/DIS 9705-1) test. The former involves applying a heat source to a sample and measuring time to ignition. Smoke, toxicity, gases and heat released during the combustion process are also measured.

The room corner test is used to measure how quickly flame spreads. It is intended for the evaluation of the flammability characteristics of wall and ceiling interior finishes, other than textile wall coverings, where such materials make up the exposed interior surfaces of buildings.

What are the benefits?

Dr George Kotsikos, principal research fellow and project manager at NewRail, Newcastle University's center for railway research, and an accident investigator for the European Railways Agency, says the introduction of the new standard was smooth. He believes it has succeeded in its aim of making cross-border trade and cooperation in the industry easier throughout the EU.

This view is shared by Guillaume Craveur, fire safety engineer at SNCF. "With EN 45545 certification you can use your product in all European countries, whereas with a national certificate you can only use your product in that country," says Craveur. "When everybody speaks the same language, with the same criteria, it is easier to agree on various subjects concerning fire safety."

Continuous improvement

Since the publication of EN 45545, four task forces have been established to work on new standards for toxicity, fire tests for seats, fire control and command systems, and a wider revision of all seven parts of EN 45545. The European Commission is also providing funding of €13-14m (US$14.5-15.7m) for research on materials.

Kotsikos hopes that the new standard does not risk inhibiting the development of better materials. "It depends on how some operating companies interpret the standard," he says. "Some might use it as a prescription for the application of certain materials and that, in some senses, may stifle innovation. There are examples in the aeronautics industry where a company comes up with a better material than was traditionally used to comply with the standard, but the company operating the aircraft doesn't implement it because it's not what was specified." Overall though, Kotsikos sees EN45545 as a positive step, and even anticipates some non-EU customers will request compliance with it.

CONFERENCE SPEAKER

Guillaume Craveur of SNCF is one of 60 speakers lined up for Railway Interiors Expo 2015's free-to-attend Conference. The event will be held in Prague, Czech Republic, on November 4-6, 2015. At 12:35pm on day one of the Conference, as part of a breakout session on security, safety and connectivity, Craveur will discuss how SNCF is using evacuation modeling technology to improve safety. Visit www.railwayinteriors-expo.com to register for your free pass.

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