Informer

THE CUSTOMER MAGAZINE
OF KNORR-BREMSE RAIL VEHICLE SYSTEMS

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KNORR-BREMSE

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INFORMATION FOR
KNORR-BREMSE'S WORLDWIDE
CUSTOMERS AND BUSINESS PARTNERS

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DEAR READER,

It is difficult to avoid superlatives when it comes to describing the current situation in the Chinese rail sector. Business is booming! The Chinese high-speed rail network now amounts to over 16,000 kilometers and by the end of the year the country will have as many high-speed trains in operation as all the other countries of the world put together with the track length exceeding 18,000 kilometers. All this has been achieved within the space of about 12 years.

It is no coincidence that Knorr-Bremse has been extensively participating in this rapid expansion. In the early 1990s we had been one of the first companies to provide high-tech systems for Chinese metros, which meant that when the country began to invest in the high-speed sector, Knorr-Bremse was already well established in the market: Chinese manufacturers and operators had already discovered that the company's systems are not sold 'off-the-peg,' being developed instead in close collaboration with customers and designed to meet their specific requirements.

The growing importance of rail transportation in China is the reason why this edition of the Informer focuses on the Chinese market. And the articles are not just about high-speed projects: You can find out, for example, why more than 80 Chinese cities are planning to create LRV networks by the year 2020. You can also read about an innovative automated aluminum welding machine that recently went into operation at Knorr-Bremse in Qingdao. And you can find out about the expansion of the company's field service teams to enable it to offer improved service throughout a vehicle's life cycle.

Another important topic touched on in this edition is Knorr-Bremse's recent acquisition of Selectron Systems AG, a Swiss specialist in train control management. This has not only expanded Knorr-Bremse's product portfolio but has also underlined the company's across-the-board approach to its systems. We also report on the new 'LITE' decentralized power supply system and the decision made by Europe's biggest logistics specialist, DB Schenker, to equip its fleet locomotives with the LEADER driver assistance system.

All in all, I am sure you will find this Informer an interesting and enjoyable read.

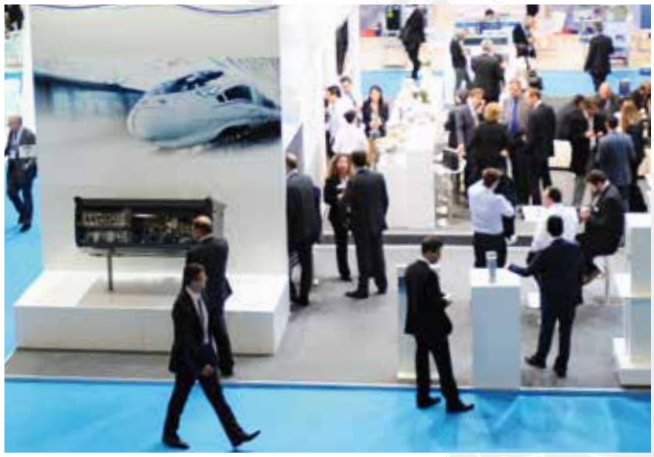
Best wishes

Domingo Mendieta

» NEWS

KNORR-BREMSE REMAINS ON THE ROAD TO SUCCESS

During the past financial year the Knorr-Bremse Group enjoyed significant growth, posting record sales revenues of €5.20 billion – an increase of 21% over 2013. All regions and divisions contributed to this growth, with the Rail Vehicle Systems division boosting revenues by 33% to €2.98 billion (2013: €2.25 billion), and the Commercial Vehicle Systems division posting figures that were 8% higher than the previous year at €2.23 billion (2013: €2.07 billion). In the rail sector the company benefited in particular from expansion of the Chinese high-speed network and the country's growing demand for mass transit systems. A report on the development of the business was provided during the press conference on the financial results held on March 24 at Knorr-Bremse's headquarters in Munich.



KNORR-BREMSE AT EURASIARAIL

A number of upcoming major projects in the Turkish high-speed, metro and freight car segments had a positive impact on the EurasiaRail exhibition, which took place in Istanbul in early March, with visitor numbers to the joint booth operated by Knorr-Bremse and Microelettrica considerably up on previous years. Apart from its importance for the Turkish rail market, the exhibition is also rapidly developing into a supra-regional event. This year, Knorr-Bremse experienced a significant increase in the number of visitors from neighboring countries and was able to showcase a broad range of products from its brakes, doors, HVAC and power electronics portfolios.

© Barbara Grossmann

SIFER 2015: ICOM THE MAIN FOCUS OF INTEREST

France's premier trade fair for rail industry suppliers takes place every two years in the northern French city of Lille. This year, Knorr-Bremse used the opportunity to showcase its latest technologies and solutions to top purchasing managers, planners and engineers. The Knorr-Bremse booth at SIFER 2015 included door and HVAC products as well as brake components which had been overhauled in France. The new iCOM system attracted particular interest: This extends existing system-specific diagnostics to cover the entire rail vehicle, paving the way for adoption of a proactive rather than a reactive approach to platforms.

KNORR-BREMSE FOUNDING MEMBER OF RAILSPONSIBLE INITIATIVE

Together with Alstom Transport, Bombardier Transportation, Deutsche Bahn, Nederlandse Spoorwegen and SNCF, Knorr-Bremse Rail Vehicles Systems is a founding member of the new Railsponsible initiative. The main aim is to establish sustainable procurement processes, thereby contributing towards sustainability across the entire supply chain. This will be achieved by sharing information on best practices and processes, promoting a common understanding of sustainability within the sector and improving efficiency through the use of common tools. Railsponsible's vision is to create a global rail industry in which all customers and suppliers are committed to ethical and social behavior and responsible environmental and business practices.

KNORR-BREMSE EQUIPS NEW KRAKOW TRAMWAYS

As part of a project to expand and modernize its fleet, the LRV operator in the city of Krakow has ordered 36 new low-floor vehicles from Polish manufacturer PESA. The "Krakowiak" vehicles are being specially developed for operator MPK Krakow and will be fitted with hydraulic braking systems from Knorr-Bremse. The new trams, which are due for delivery this year, will replace the old 105Na vehicles on the busiest lines in the city. One of the special features of the "Krakowiak" vehicles is that at 43 meters they are the longest low-floor trams in the country.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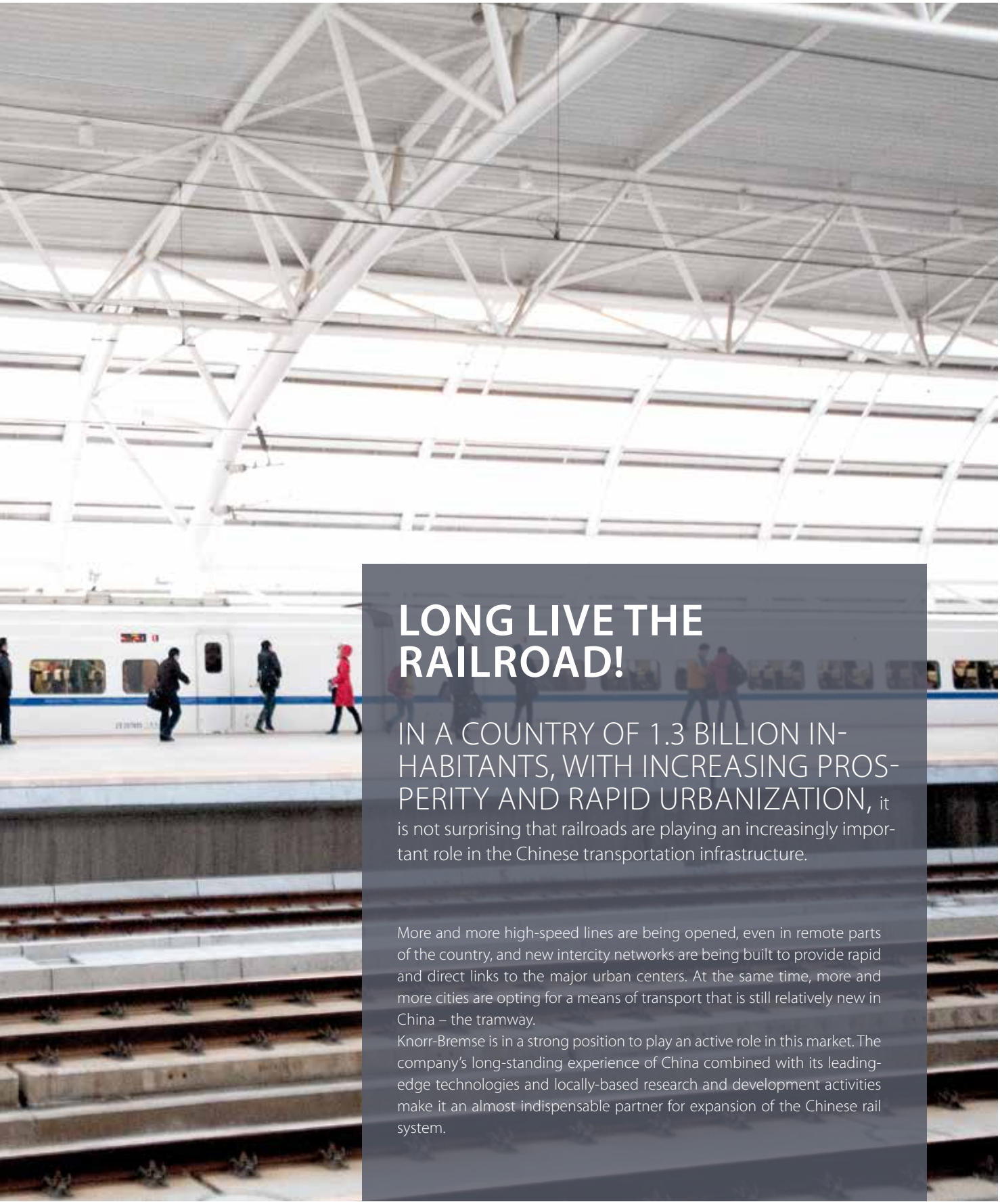


LONG LIVE THE RAILROAD!

IN A COUNTRY OF 1.3 BILLION INHABITANTS, WITH INCREASING PROSPERITY AND RAPID URBANIZATION, it is not surprising that railroads are playing an increasingly important role in the Chinese transportation infrastructure.

More and more high-speed lines are being opened, even in remote parts of the country, and new intercity networks are being built to provide rapid and direct links to the major urban centers. At the same time, more and more cities are opting for a means of transport that is still relatively new in China – the tramway.

Knorr-Bremse is in a strong position to play an active role in this market. The company's long-standing experience of China combined with its leading-edge technologies and locally-based research and development activities make it an almost indispensable partner for expansion of the Chinese rail system.

MADE FOR SPEED

THE CHINESE HIGH-SPEED RAIL NETWORK CONTINUES TO EXPAND: It has already reached some 16,000 kilometers in length, and more lines are being planned. As a systems supplier Knorr-Bremse is playing an important role in the process.

At the end of 2012, when the world's longest high-speed rail line went into operation between Beijing and Guangzhou, it was an extraordinary achievement even by Chinese standards. The trains cover the 2,298 kilometers in around eight hours – hardly longer than the journey would take by air if you include travel to and from airports.

Last year saw China celebrate another major event in the rail sector: In June 2014, following more than four years of construction work, the first train went into operation on the so-called Lanxin Line in the northwest of the country. The 1,776 km high-speed railroad between Lanzhou and Ürümqi crosses the Gobi Desert and reaches a height of 3,610 meters above sea level. Virtually all provincial capitals in China are now linked to the country's high-speed rail network. And the expansion continues apace. By the end of this year, China will have as many high-speed trains in operation as the rest of the world put together. And all this has happened within the space of a dozen years.

▲ The CHR380D at Changsha South station

LOCAL SYSTEMS ENGINEERING

Knorr-Bremse is an important partner in the expansion of the Chinese high-speed train network. Last year alone, the company and its Chinese partners received orders to develop and produce braking systems for 422 high-speed trains, 270 of which will also be equipped with door systems and 100 with HVAC systems from the Knorr-Bremse Group.

One of the reasons why Knorr-Bremse has been involved in these major projects is the company's strong local presence in China. By building up extensive production capacity, it has put itself in a position to deliver all these systems on time, despite often very tight delivery schedules. But there is another reason why operators choose Knorr-Bremse: Local development engineers and technical teams are at hand to design the systems to meet specific requirements.

HIGH-SPEC SYSTEMS

As the Chinese high-speed railroad network expands, operators are, for example, finding themselves working in some of the coldest regions of the country, and for trains to operate reliably throughout the year various adjustments have to be made. Amongst other things the braking modules have to be redesigned to cope with low temperatures. Drawing on their experience with the Russian market, the Knorr-Bremse engineers have been able to adapt the systems for temperatures down to -40 °C.

Or take the HVAC systems for the Lanxin Line: The demands made on these are extremely challenging. As the altitude increases, the air density changes, with the result that the performance of the electrical components is reduced by between 8 and 13 per cent for every 1,000 meters in height. Because the air is thinner, solar radiation is also higher, which means that even at relatively low external temperatures of 15 °C, the temperature inside the train can rise to 30 °C or more.

Together with CSR Sifang the Knorr-Bremse Merak-Jinxin joint venture was responsible for developing roof-mounted HVAC systems with sand filters for operating in desert conditions but also with low-temperature cooling. In a collaborative project that benefited both parties, the engineers made considerable modifications to ensure that the interior of the train is cooled even when external temperatures are normal.

▲ Passengers in Suzhou's new tram Line 1

FAST TRACK

THEY DON'T REQUIRE MUCH SPACE, ARE RELATIVELY EASY TO PLAN AND CAN BE QUICKLY INSTALLED: Tram networks are becoming increasingly important for local public transport in China. And Knorr-Bremse is playing a key role in the process.

Shortly before the new Line 1 in Suzhou went into operation last fall, members of the public had an opportunity to inspect the latest addition to their public transport network when operator SND Tram invited them to free trips on the new LRVs. The result was long queues at Suzhou Amusement Park, one of the central halts on the new line. By the end of the year this Chinese mega-city located about 100 km to the west of Shanghai also plans to open a second line, and eventually a total of six lines will ensure the smooth running of the public transport system.

AMBITIOUS PLANS: LRV SYSTEMS FOR 80 CHINESE CITIES

The example of the Suzhou LRV network demonstrates the speed with which such projects can be implemented in China: Work started on the 18 km of Line 1 in September 2012, and was completed within little more than two years. 18 low-floor vehicles based on the Flexity 2 platform were ordered from CSR Nanjing Puzhen Rail Transport Co., Ltd under a 10-year licensing Transfer of Technology agreement with Bombardier Transportation by the operator, Suzhou New District Tram (SND).

By the year 2020 the plan is to install an LRV network totaling over 4,000 km in length in more than 80 Chinese cities. Just how seriously China is taking this new transportation option can be seen from the setting up of the SND Tram Industry Association last year – the first all-embracing association for the LRV sector in China. Its declared aim is to jointly promote and develop the LRV industry in the country, and Knorr-Bremse is playing an important role as the first corporate member of the organization.

RAPID DELIVERY THANKS TO LOCAL DEVELOPMENT AND PRODUCTION STRUCTURES

Because pneumatic braking systems would be too big for the restricted installation envelope available in tramways, hydraulic systems are used. These have very high quality requirements – whereas a pneumatic braking system operates at a pressure of 10 bar, a hydraulic one usually

▲ Mockup of the new LRV line

3 QUESTIONS FOR …

SHEN MINGSHENG, GENERAL MANAGER, SND TRAM

Suzhou already has an ultra-modern metro system, so why does the city also need an LRV network?

It is true to say that the city's metro system is very modern. But Suzhou has around 12 million inhabitants, and to transport all of them we need a really efficient public transport system. Metro lines are not enough. Trams are a good option in districts not directly served by the metro and can also have an important feeder function, linking into the metro network.

What is so special about the LRV network in Suzhou?

Firstly we have created countless new hubs and transfer points. During the planning process we carried out an in-depth analysis of passenger flows and were able to design a system that brings travelers to their destinations much faster. In addition, Line 1 is intended to serve as a model for future LRV projects in China. The highest standards were consistently applied during construction of the line and infrastructure and the building of the vehicles. These standards have also been maintained in operating the system.

What were SND Tram's priorities in planning and implementing the network?

We had – and still have – a clear set of priorities: Needless to say, safety came first, followed by reliability and a determination only to use state-of-the-art technologies.

requires between 100 and 150 bar.

Knorr-Bremse first started marketing hydraulic braking systems in China back in 2012, and before the year was out the first orders started rolling in. Chinese operators like the combination of local engineering capacity, competent support provided in their language, as well as the company's capacity for rapid delivery of products.

The tramways operating on Suzhou Line 1 will never be far from home – wherever they operate, the birthplace of their braking system will always be close at hand. "Most of the braking system was developed and produced here in Suzhou," explains Cao Gouji, responsible for sales and projects for mass transit at Knorr-Bremse Suzhou. Knorr-Bremse company IFE is supplying the vehicle door systems, and the simulators for driver training come from Group subsidiary Sydac.

MORE LOCOMOTIVES

LAST YEAR KNORR-BREMSE SUPPLIED BRAKING SYSTEMS FOR 1,277 NEW LOCOMOTIVES IN CHINA. The further increase is due above all to Knorr-Bremse's competence in supplying individual solutions.

▲ High-grade locomotive HXD3D, reaching up to 160 km per hour

The state railroad operator China Railways has significantly expanded its passenger and freight transportation capacity in recent years, and this has been reflected in orders received by Knorr-Bremse for braking equipment for new Chinese locomotives. Last year the company supplied 1,277 braking systems in this segment – most of them for new locomotive types for which individual solutions had been developed in collaboration with local partners.

The new orders boosted the number of CCBII braking systems being used in China to more than 8,200 units by the end of last year in the case of the advanced HX series locomotives. In 2014 the company received firm orders for almost 1,300 more braking systems.

For the Chinese market, top-quality, reliable braking systems are paramount, but customers are also looking for rapid delivery and comprehensive technical support. All of this Knorr-Bremse can deliver – from initial receipt of orders right down to aftermarket service – thanks to the competence of its local engineers and its extensive investment in the field.

STATE-OF-THE-ART AUTOMATED WELDING

IN THE CHINESE CITY OF QINGDAO, KNORR-BREMSE DOOR SYSTEM MANUFACTURER IFE-VICTALL has introduced a pioneering robotic system for aluminum welding – a new departure for MIG welding methods.

▲ Robotic welding system – Serial production has started on door frames for the CRH380.

Robots are very popular in the railway industry for welding, spray painting and material handling, as they work with a high degree of precision. However, there have always been limits to their use because the aluminum MIG process is not as forgiving as steel. Hitherto nobody had succeeded in using the advantages of robots for MIG (Metal Inert Gas) welding of aluminum in door production.

Together with one of its suppliers, Knorr-Bremse door manufacturer IFE-VICTALL has now developed a control system that makes it possible to use the advantages of production robots even for MIG welding of doors.

The system consists of two 6-axis robots and two MIG welding machines (ESAB). Four pneumatic clamped welding jigs are used to hold the workpieces accurately in position, taking into account heat deformation. Other elements in the system are robot motion devices, sensors, two smoke-cleaning units and various safety devices.

SYSTEM FOR COMPLEX WELDING PROCESSES

To get started, the portal frame and door-frame for the CRH380 high-speed project were selected, as this project has the highest volume and involves the most difficult welding structure. The two welding robots work as a group on a right-hand portal frame and a right door frame while the system is loading the left-hand parts, and vice versa. Automated loading and unloading, combined with other safety measures, not only make for optimum working conditions but also improve productivity.

The two MIG welding machines have different functions and use different welding wires: One is for welding the joint of the die-cast corner and the aluminum profile, and the other is for welding the aluminum-to-aluminum joint. The size of the workpieces varies from 1,500 mm (L) X 500 mm (W) X 30 mm (T) to 2,750 mm (L) X 1,500 mm (W) X 400 mm (T). With this range, all IFE-VICTALL doors can be welded using the system.

An analysis of test runs revealed that this advanced robot technology coupled with arc welding processes helps to make manufacturing operations more competitive in terms of safety, efficiency and quality. The new technology has therefore been in use in series production since February 2015.

LITE: SMALLER, LIGHTER, STRONGER

KNORR-BREMSE POWERTECH AND HVAC MANUFACTURER MERAK ARE CURRENTLY DEVELOPING A NEW POWER SUPPLY SYSTEM FOR RAIL VEHICLES – the Light Integrated Train Energy System. Unlike conventional products this system, initially intended for the Chinese market, is decentralized in design and therefore considerably more effective.

Modular standalone inverter for Metro ▶

Air conditioning, on-board bistros, safety systems – as demand increases for a comfortable and safe passenger experience in rail vehicles, the number of consumers of electrical power is on the rise. "But the approach to designing power supply systems has changed, with the focus now on smart distribution of energy from the overhead line according to actual need," says Martin Kutschker, development engineer for power supply systems at Knorr-Bremse PowerTech. "This should make for significant energy savings."

This is the idea underlying the latest generation of auxiliary power supply systems currently under development at PowerTech and Merak. The system is called LITE, which stands for Light Integrated Train Energy System. Trains usually have a single large auxiliary power converter to supply the HVAC system and air compres-

◀ Compact roof-mounted HVAC unit for Metro application

Product advantages

- Power saving due to optimized operation conditions based on real needs
- Weight reduction of the auxiliary power supply
- Efficiency increase due to reduced power loss
- Life time increase and maintenance optimization of heating, ventilation, air conditioning (HVAC) unit & air supply unit
- Stress reduction on electrical and mechanical components
- Noise reduction due to variable speed
- Passenger comfort improvement due to stable temperature & air conditioning
- Environment benefits due to less energy waste

sors with the necessary energy, but LITE takes a new approach, with distributed systems linked to a single, integrated control system.

INCREASE IN EFFECTIVENESS

The new design not only saves some of the components required for the auxiliary power converter – it also offers further advantages. "The individual energy users can be supplied according to their real needs," explains Kutschker. The positive impact: In the case of a centralized system, efficiency is 89%, whereas with LITE, levels of 95% can be achieved – the equivalent of a 40% reduction in power loss. Other advantages of a decentralized system are improvements in weight distribution, elimination of critical inrush current at motor start-up and a related increase in the service life of the systems and compressors.

The LITE architecture is as follows: Two scaled-down auxiliary power converters supply the HVAC systems and compressors with a constant DC input and are themselves supplied as required on a VVVF basis from a DC/AC converter integrated into the HVAC/compressor units. The remaining 50 Hz consumers are supplied directly from the auxiliary power converter.

LITE has been initially designed for applications in the Chinese metro segment, "but it can easily be adapted for other applications," explains development engineer Kutschker.

ALWAYS AT THE READY

KNORR-BREMSE NOW HAS MORE THAN 300 ENGINEERS WORKING IN ITS CHINESE FIELD SERVICE TEAMS, offering a comprehensive 24/7 service for braking, door and HVAC systems in virtually all parts of the country.

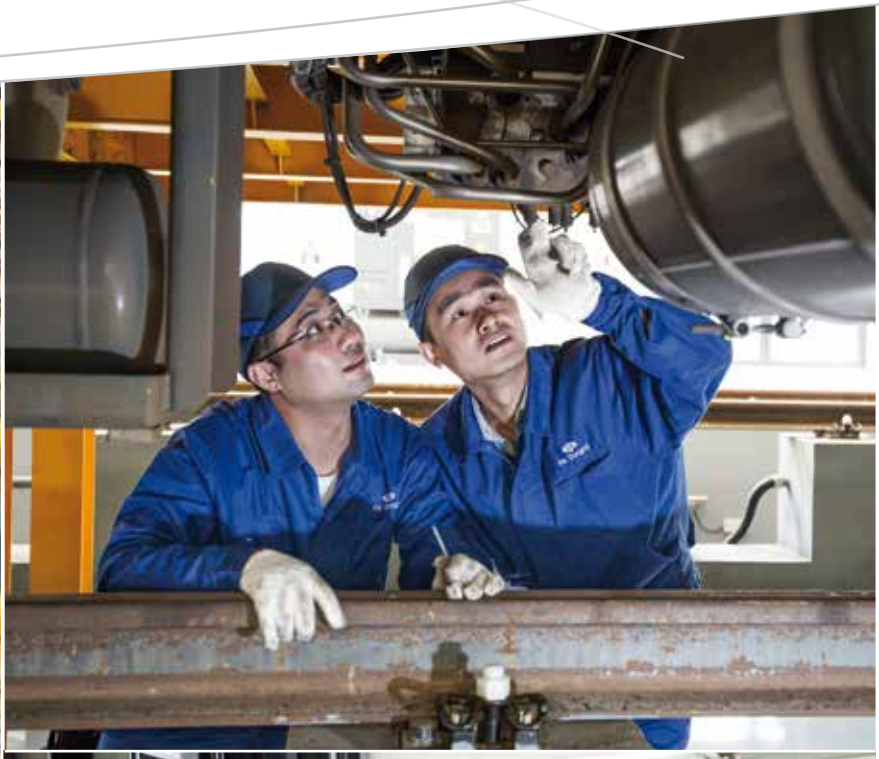
As technologies evolve, so too do the demands made on rail vehicle products and systems. It is no longer just a question of their being fit for purpose – customers increasingly also expect backup in the form of expert aftermarket field service. "Operators are increasingly looking beyond individual products and expecting us to deliver across-the-board solutions," explains Wu Jingbo, Vice Director RailServices at Knorr-Bremse Suzhou and responsible for Chinese field service teams. "Our teams are crucial to our commitment to offering customers the full range of company expertise – from initial design right down to aftermarket service."

FOCUS ON SYNERGIES

When it comes to service this is only possible if colleagues are either directly available in local depots or can travel out to customers at short notice. "We have both these options in mind when we create our teams," says Wu Jingbo. The specialist engineers come from the Knorr-Bremse site in Suzhou as well as the Chinese joint ventures for door and HVAC systems – IFE-VICTALL in Qingdao and Merak-Jinxin in Wuxi. The 150-odd colleagues in the braking system field service teams are divided into three groups: high-speed, mass transit and locomotives. The various applications for the braking systems are supported by teams responsible for the different geographical areas. The field service teams for doors and HVAC systems are coordinated at regional level, with Knorr-Bremse making extensive use of skills synergies where appropriate. "In some depots we have people from two or even all three specialist areas," explains Wu Jingbo.

SKILLS MATRIX FOR TOP LEVELS OF TRAINING

The engineers are available round the clock, 365 days in the year to support commissioning of products and enjoy direct access to the field service database (FSDB). With its information on all products and systems currently in operation, this provides the basis for delivering a rapid, precise and punctual service. If further information is needed about a product, the relevant colleagues are of course also always available.

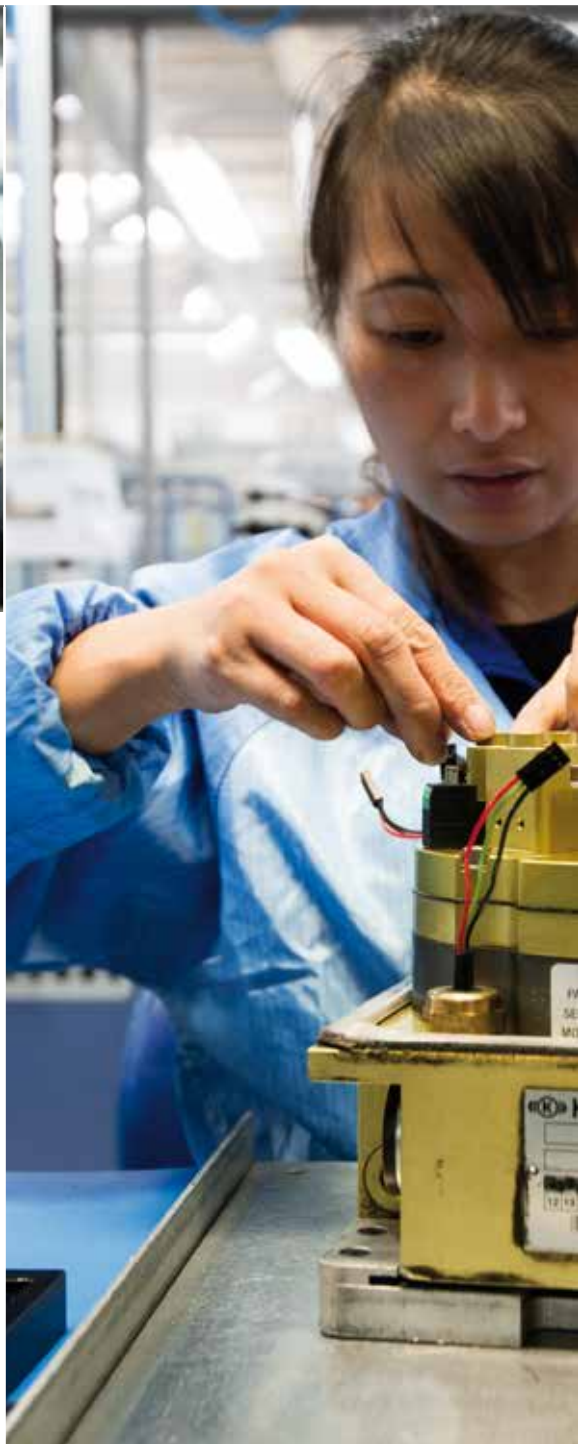


Knorr-Bremse is keenly aware of the value of these teams. "The field service teams have a crucial influence on the way operators perceive the company," says Wu Jingbo. "Skills matrix training ensures that their knowledge and skills are kept up-to-date." And ultimately Knorr-Bremse itself benefits from the activities of the field service teams. "Our design engineers receive important feedback from our colleagues on the ground as to how products and systems are performing in day-to-day operation."

RAPID THROUGHPUT

WORKERS ON THE EP2002 OVERHAUL LINE AT KNORR-BREMSE'S SUZHOU SITE CAN PROCESS UP TO 14 UNITS PER SHIFT. The new line has drastically cut throughput times for the brake control systems used on countless Asian metro systems.

▲ Jack Wei, Director After Market & Services, Knorr-Bremse Suzhou



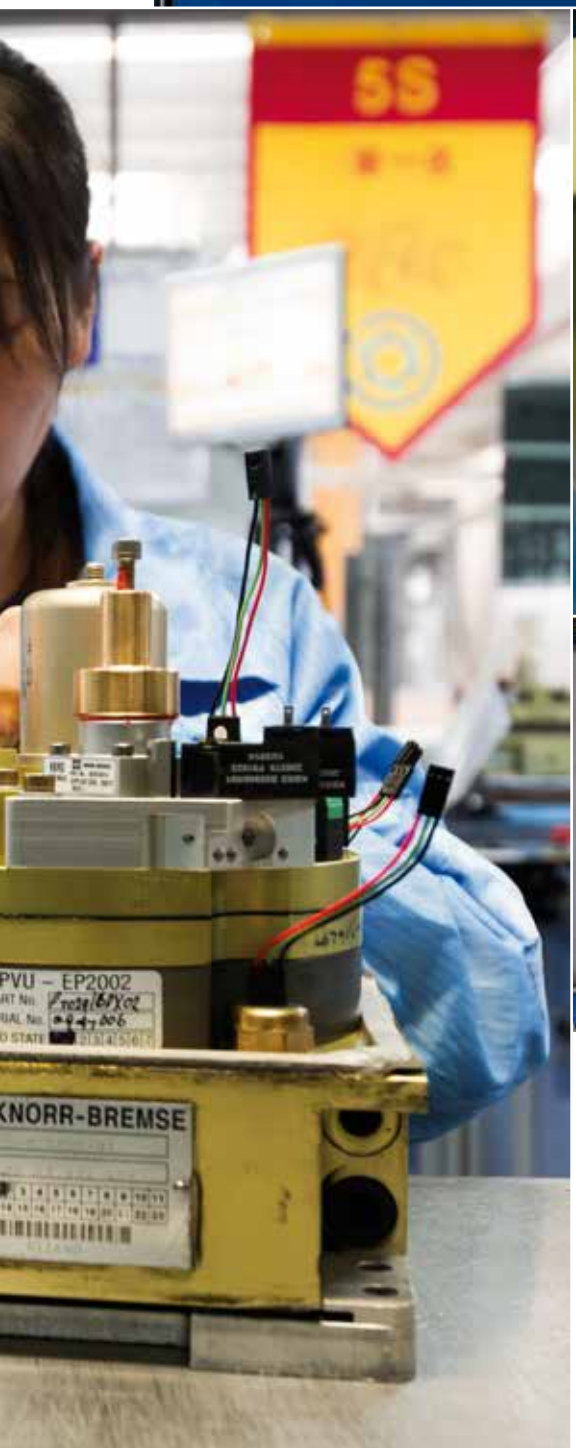
It looks rather like a high-security scientific laboratory. Anyone wanting to enter is subjected to a lengthy procedure that involves standing on a slightly sticky rubber mat and then attaching a discharger to one arm. These are not random rituals – the electronics in control systems can be extremely sensitive. And the systems being overhauled behind the glass door play a central role in the Asian market: Almost 22,000 units of the EP2002 metro brake control are currently in operation in China alone, and the number is on the increase – after all, the very first orders for the system were received from Guangzhou already in 2004.

The secret of the system is its decentralized design. Weighing in at some 20 kg, the smart valve installed for each bogie controls all the functions for the load-dependent emergency and service brakes, the wheel slide protection system and the full range of self-tests. The modules installed in the train are connected via a data bus, enabling the EP2002 to distribute the braking force as effectively as possible to the individual bogies, taking into account a wide range of variables including the weight distribution of the passengers. This improves the braking performance of the entire train, increases reliability and reduces life cycle costs.

DAYS RATHER THAN WEEKS

The individual workplaces on the EP2002 line are configured in a U-shape. First comes the dismantling process, then the checking of the software and finally the detailed examination. "Systems and individual components are subjected to different degrees of stress," explains Jack Wei, in charge of service at the Knorr-Bremse Suzhou site. "This calls for experience in deciding which components need to be replaced and which can be put through the next operational cycle without any

◀ High-tech from the inside: an EP2002 control unit on display



problems in order to cut overhaul costs." This is why it is not just local workers who operate on the overhaul line but also colleagues from the UK, where all the systems were overhauled prior to the opening of the line in Suzhou. "We are utilizing the UK's experience over here in Suzhou," explains Wei. This is underlined by a prominent sign on the wall with the letters KPS – indicating that all the work is carried out according to the globally standardized Knorr-Bremse Production System.

Component by component, step by step, the EP2002 units are put back together. At the end of the process comes the "Top Level Test": Technicians link the overhauled system up to a computer to check whether the electronic connections are correct and the latest software has been installed, before carrying out operational testing.

Employees usually manage to overhaul 14 EP2002 units per shift, but much more important than this figure is another factor: "The Suzhou line enables us to return overhauled systems to our Chinese customers within just a few days," explains Wei. In the past, when the systems were overhauled in the UK, the process took weeks, not because colleagues worked more slowly over there but "because of the distance the units had to be shipped and the time-consuming procedures required for re-importing them."

ALL-ROUND EXCELLENCE

KNORR-BREMSE HAD TO PULL OUT ALL THE STOPS TO SECURE A HIGHLY COMPLEX INTERNATIONAL ORDER TO SUPPLY BRAKING SYSTEMS FOR 1,064 LOCOMOTIVES being built by four different manufacturers for the South African market.

"It's fantastic what our teams achieved over a period of more than two-and-a-half years," says Dr. Ralf Voß, member of the Executive Board of Knorr-Bremse Systeme für Schienenfahrzeuge GmbH. "The fact that Knorr-Bremse managed to clinch this strategically important order was thanks to the way everybody rose to the occasion and was determined to meet all the challenges."

MAJOR RAIL ORDER

In a bid to boost the country's economy, create new jobs and combat poverty, South Africa's government has launched a series of major infrastructure projects to run until 2019. Two-thirds of the budget of some EUR 30 billion will be invested in the rail freight sector – specifically in the state logistics company Transnet Freight Rail. The idea is that by expanding capacity for container transportation, more freight can be transferred from road to rail. South Africa also has considerable raw material reserves and is keen to increase exports and transport large volumes of coal, manganese, iron ore and chrome rapidly and safely to the country's main ports.

The most important project involves a massive expansion and modernization of the locomotive fleet, and in August 2012,

Transnet launched an international tendering process for the biggest single infrastructure measure in South Africa's history – the building of 1,064 locomotives.

A PARTICULAR CHALLENGE

"It started with twelve international locomotive manufacturers being invited to submit tenders," says Dr. Jonathan Paddison, Senior Vice President Sales & Systems Locomotive Hauled Trains. Dr. Paddison, together with Dr. Voß, is responsible for the project at the company's Munich headquarters. "At this stage we worked with all the manufacturers as though they had already been granted the contract."

As project leader for Europe, Michael Urbatzka knows best what this meant, having been closely involved in the overall organization and all the negotiations. "Twelve companies from the USA, Europe and Asia were involved in the tendering process, each with different requirements and wishes. It was a real challenge."

▲ GE Class 43 locomotive

KNORR-BREMSE'S ADVANTAGE: ITS INTERNATIONAL STRUCTURE

It took only a short time to put together project teams around the world – it was a huge advantage that Knorr-Bremse is such a global company and so many team members already had extensive intercultural experience. Knorr-Bremse South Africa played a central role in the process, maintaining contact with Transnet, and carried out the negotiations on the ground.

"I'm sure that our intensive exchange of ideas across time zones made an important contribution to the success of the project," says Dr. Paddison. There were daily progress reviews and at least once a week a large-scale telephone conference involving all project leaders and top management.

Following every meeting with the manufacturers the other teams were provided with a detailed report on the status of the negotiations. This meant that in some cases it was even possible to suggest solutions to potential customers before the particular problem had even emerged. What helped the communication was also the fact that Knorr-Bremse had already carried out successful projects with many of the locomotive manufacturers.

HIGH LOCAL CONTENT

Another feature of the call for tender was a stipulation that the lion's share of locomotive production and component manufacture should take place in South Africa. The law on 'Broad-Based Black Economic Empowerment' is intended to mitigate the impact of the apartheid regime and ensure that disadvantaged citizens of South Africa are offered economic equality of opportunity.

This means that companies taking part in public tendering processes not only have to create jobs for South African citizens but also to look after training and skills development or help build up supplier companies belonging to Black Africans, Coloureds or African Indians.

1,064 locomotives – who is building what?

- 359 electric locomotives: CSR ZELC, China
- 240 electric locomotives: Bombardier Transportation, Europe
- 233 diesel locomotives: GE Transportation, USA
- 232 diesel locomotives: CNR DLoco, China

LONG-STANDING INVOLVEMENT IN SOUTH AFRICA

Since it was first established in 1969, Knorr-Bremse's Kempton Park site near Johannesburg has evolved into a modern

factory that produces a range of components for braking systems. "This is a long-established and well-functioning company," says Alois Adlkofer, Managing Director of Knorr-Bremse South Africa," and it is well integrated into the country' structures."
Knorr-Bremse's support for the country's development aims at long-term commitment rather than short-term success. Thus, for example, Knorr-Bremse Global Care provided EUR 425,000 of funding for the construction of an operating theater at a children's clinic in Cape Town between 2007 and 2009. "This undoubtedly did a lot to boost our reputation in the country," says Dr. Paddison.

BATTLE TO WIN FOUR ORDERS

After a tendering process lasting a good 12 months, the field of a dozen bidders began to thin out. "The first order went in November 2013 to GE in the USA, and then three further companies were added," says Dr. Paddison. "But that didn't make our task any easier. We now had to win not one or two, but four orders."
Motivation was high amongst the members of the project teams. On the basis of the manufacturers' specifications the engineers of the R/LSS department came up with suggested solutions and the offers were drafted. "We had countless personal discussions with the manufacturers," says Urbatzka. "At all levels: technicians, planners, sales and management."

NEGOTIATIONS ON FOUR CONTINENTS

Negotiations with the four locomotive manufacturers were held partly at their headquarters – for GE in Erie, Pennsylvania, USA, for Bombardier in Kassel and Zürich, Europe, for ZELC in Zhuzhou, China, and for CNR DLoco in Dalian, China – using teams drawn from various sites in each region. Partly, though, the negotiations took place directly in South Africa, as the manufacturers had undertaken to carry out much of the production locally.

DIFFERENT TECHNICAL STANDARDS ADD TO THE PROBLEMS

The complexity of the project was increased by the different standards for braking systems that exist. In South Africa, the American AAR standard applies in principle, but the various locomotive manufacturers all have their own particular special solutions and deviations from the norm.
"We try to apply our standard products and tried-and-tested solutions," says Dr. Voß. "But in practice there can be too little room for a component in a particular model of locomotive and we have to modify our design. The art is to solve the problem as economically as possible."

MODERNIZATION AND EXPANSION OF PRODUCTION CAPACITY

The Kempton Park site in South Africa is not only being expanded but is also undergoing an extensive technological upgrade. The new facility has more space and has been designed according to Green Building principles in order to maximize sustainability and resource efficiency. New assembly lines with state-of-the-art testing facilities have been installed for the bogie equipment, brake control and air supply systems contained in the supply agreement, local employees are undergoing specific training to prepare them for this major project, and additional staff is being taken on. This doubling of production capacity has been carried out according to the principles of the Knorr-Bremse KPS production system. At the same time the company's entire IT operations in South Africa are being migrated to SAP. Delivery of the locomotives is scheduled to be completed by the end of 2018.

▲ CSR ZELC22E E locomotive

LEADER ROLLOUT BEGINS

KNORR-BREMSE'S LEADER DRIVER ASSISTANCE SYSTEM IS READY TO BE LAUNCHED FOR UIC FREIGHT OPERATIONS. Logistics specialist DB Schenker Rail has already begun to install the first systems in its fleet of 300 locomotives.

With decades of experience under his belt, the locomotive engineer is initially skeptical. His train still has several kilometers to climb before it reaches the top of the grade, but the driver assistance system installed in his cab for testing purposes is already telling him to reduce traction completely. He shakes his head doubtfully, but follows the instructions. And lo and behold: The train's momentum enables it to glide over the top without using unnecessary energy and – of course – without dropping behind schedule.

This is nothing new to Dirk Seckler, the man at Knorr-Bremse Systeme für Schienenfahrzeuge GmbH responsible for the LEADER driver assistance system. "Even engineers with many years' service are amazed at how precise LEADER's recommendations are." But this is not just a fluke: "LEADER uses route, train and timetable data to calculate the optimum way to save energy, and passes its recommendations to the driver." As the system merely uses the locomotive's electrical supply but does not intervene in the controls, it does not require licensing.

For many locomotive engineers working at DB Schenker Rail AG, the system will soon become part of their daily routine. As a first step, Europe's leading rail freight operator has started installing 300 LEADER systems in its locomotive fleet. But before this could happen, several months of pilot testing were required. "A direct comparison between operating with and without LEADER has shown that energy consumption can be cut by up to 10%," reports Angeline Charré, who was closely involved in developing the driver assistance system at Knorr-Bremse. And this has been achieved in a field in which savings of just a few per cent are usually regarded as a major triumph. "It just goes to show that even with experienced drivers, energy consumption can be further improved," comments Charré.

LEADER RECEIVES INNOVATION AWARD FROM PRIVATBAHN MAGAZINE

LEADER has won a 2014 innovation award from Privatbahn Magazine, an industry journal published by Bahn-Media Verlag. The Privatbahn awards go to technical developments that make an important contribution to boosting performance and innovation in the German rail sector. The jury put LEADER in first place in the category "Energy and Environment."

FOCUS ON THE MAN-MACHINE INTERFACE

Even though it is now in regular use, LEADER is still to some extent experimental. "We now have to optimize the man-machine interface," explains Seckler. Customers are also increasingly confronted with trends such as digitalization and networking. "We want to live up to our claim to be a technology leader and help customers generate genuine added value with customized solutions," says Seckler. One example of this is a tablet-based version of the system, which is currently under development in collaboration with selected customers.

© Deutsche Bahn AG/Jochen Schmidt

Although assistance systems such as LEADER are already significantly reducing CO_2 emissions from passenger transportation and are in regular operation on scheduled services, their use in European freight operations is still in its infancy. But here, too, the system can make an important contribution to reducing the environmental footprint of the rail industry and boosting the competitiveness of rail freight transportation.

3 QUESTIONS FOR …

Steffen Bobsien, Senior Vice President European Assetmanagement & Technology, DB Schenker Rail AG

The first LEADER systems are already being installed on locomotives in the DB Schenker Rail fleet. What is the company hoping to achieve by this?

We have been field-testing LEADER for several months and have so far achieved impressive fuel savings of up to 10%. The feedback from our locomotive engineers has also been overwhelmingly positive, and they have suggested additional information that could be used when LEADER draws up its recommendations so as to ensure that these savings continue. Using and developing the system should help us achieve our environmental protection and resource conservation goals.

What role does LEADER play for DB Schenker in maximizing emission reductions?

LEADER is one of a whole range of innovative projects that will help us improve the efficiency of our vehicle deployments and offer customers even higher quality transportation services. Most of our modern locomotives will benefit, particularly in terms of condition-related maintenance, intelligent vehicle deployment and resource-saving driving.

DB Schenker Rail has turned to Knorr-Bremse for implementation of the project. What was it that tipped the scales in favor of the company?

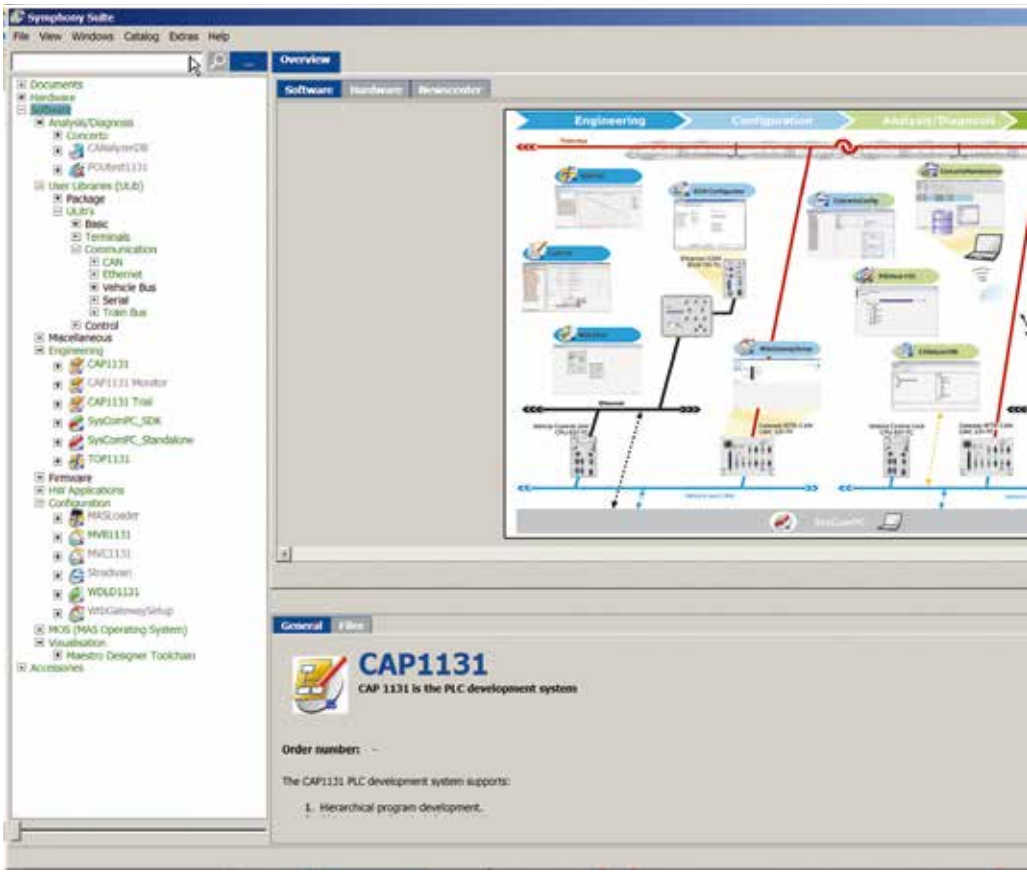
We realized early on during field testing that the optimization algorithms currently available in the market can't be transferred directly to rail freight transportation in Europe. Knorr-Bremse was quick to respond and proved an invaluable partner in testing and further developing the system.

CENTRAL CONTROL OF VEHICLE SYSTEMS

AT THE END OF 2014 KNORR-BREMSE ACQUIRED TRAIN MANAGEMENT CONTROL SPECIALIST SELECTRON SYSTEMS AG. The acquisition has enabled the company to expand its portfolio to include components and solutions for rail vehicle management control.

It is a process that takes place millions of times every day: A train stops in a station and passengers press the button to open the door. The control system 'understands' the command and passes it on to the units that operate the doors. Seconds later, they open and the passengers are able to embark and disembark freely. But it is also important for the driver and the electronic train control system to know that the doors have just been operated: For example the train must not be set in motion until they have closed again. So the control system sends the status information 'door open' across the network and, amongst other things, activates a message on the cab display. Now before the train can move off again the driver has to send a command 'close all doors' to the control units, and it is only then that the message displayed on his console changes and the software allows him to drive off.

Functions such as these, controlled and monitored by the Train Control Management System (TCMS), are used for other on-board systems as well. They exist in a similar form for all the networked subsystems in a train – the brakes, air conditioning, drive system, fire protection system, lighting and sanitary facilities. The task of the TCMS is to link up all of them into a single, intelligent system.



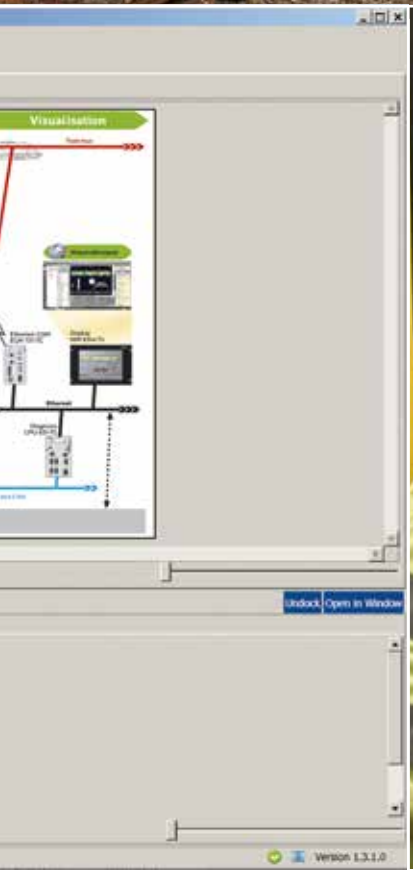
INTEGRATING ADVANCED CONTROL TECHNOLOGY

With the advance of technology, the quantity of data flowing between individual on-board systems and the TCMS is growing steadily, and broader bandwidths are becoming necessary. At the same time, increased safety standards have to

Image: Stadler Rail

ABOUT SELECTRON SYSTEMS AG

- More than 50 years' experience in industrial electronics and programming
- Focus on the rail vehicle market since 2001
- More than 100 employees, of whom 80% are engineers and technicians
- Solutions meet latest international standards
- Optimized systems for easier vehicle approval and maintenance
- Processes IRIS- and SIL-certified
- 100% of products undergo burn-in prior to delivery
- 20% of sales revenues invested in research and development
- Efficient customer support system
- Independent of machine manufacturers and system integrators
- International workforce enables worldwide communication



▲ Top: Stadler Rail's KISS is equipped with state-of-the-art Selectron TCMS products
Center: Symphony® Suite Software: an interface offering easy access to all components, documentation such as flyers and manuals, and software tools

◀ MAS 83x and 73x modules: a secure control system for rail vehicle applications

be met. Selectron, with its headquarters in Lyss, Switzerland, is a recognized specialist and market leader with an extensive control technology and automation portfolio and years of experience in this field. The company's versatile and flexible solutions are produced by a workforce of around 100 and supplied to a growing customer base that includes Stadler Rail, Pesa and Plasser & Theurer. More than 5,000 rail vehicles using the TCMS system are already in operation.

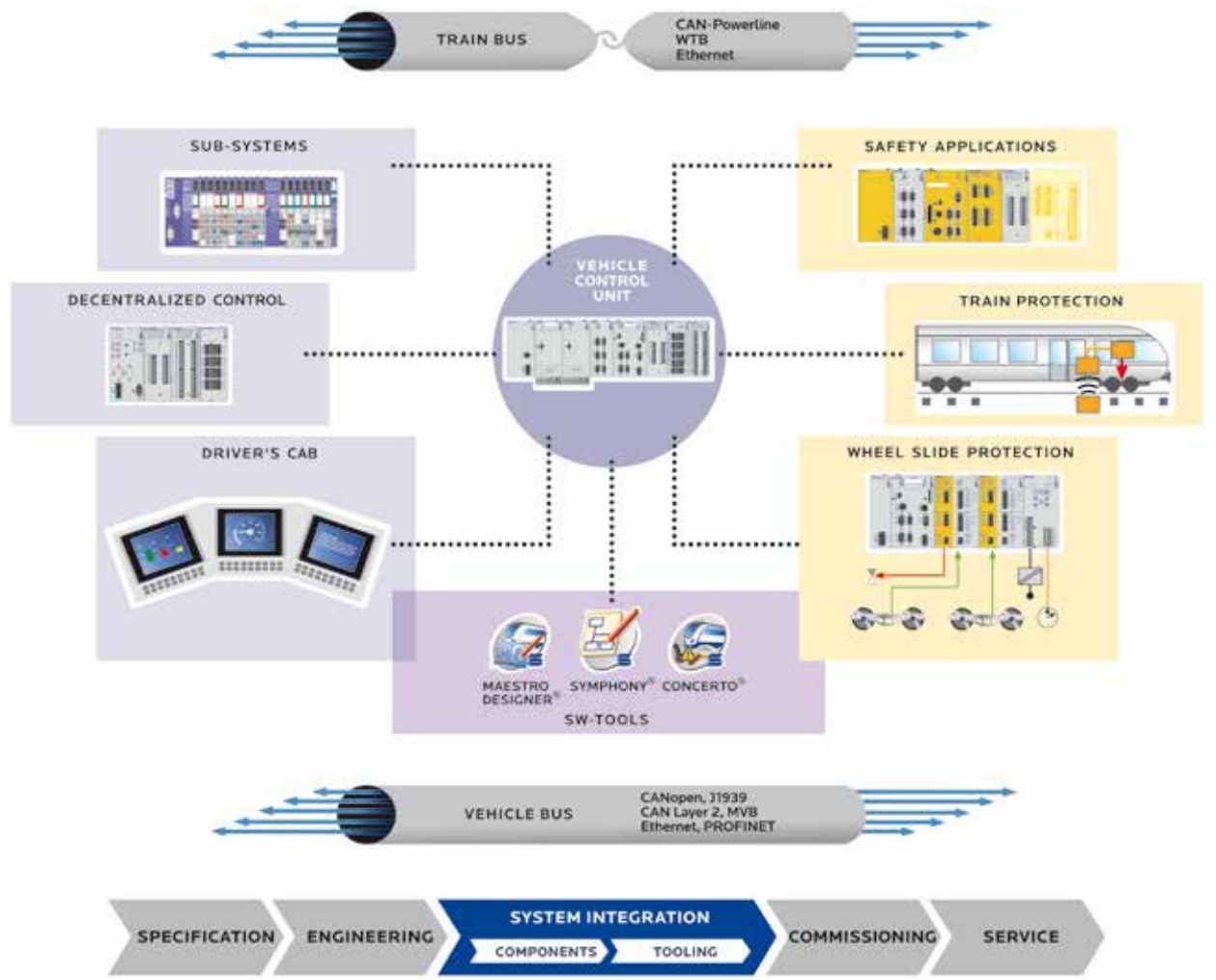
EXPANDING THE SYSTEMS APPROACH

Acquisition of Selectron has enabled Knorr-Bremse to further expand its systems approach and add innovative train control technologies to its product portfolio. The relevant anti-trust authorities have already approved the takeover.

FOCUS ON SYSTEMS APPROACH

At the heart of the Selectron range is an EN 50155-compliant controller family – the MAS 83x. This flexibly extendable vehicle control unit has the computing power required to control the full range of functions on a rail vehicle. Central extension modules enable signal conditioning to be adapted to the sensors and actuators that are to be connected. A SIL 2 version of the control unit is also available for safety-critical applications. The relevant network systems can be connected via gateways or a second extension bus.

At train bus level these are Ethernet, WTB (Wired Train Bus) and CANpowerline. The train bus is used for train setup. For high bandwidths and extensive data transmission, IEC 61375 Ethernet switches and routers are available. At vehicle bus level the portfolio includes CANopen, MVB, Ehternet and RS 485 systems. Decentralized input and output modules are available for capturing sensor and actuator signals directly at a subsystem. These can be flexibly extended and adapted on a "just enough" basis to the number of sensors/actuators involved. The new Smartio® product family significantly reduces wiring costs for the control cabinet. The portfolio has a broad range of different driver displays for displaying speed, brake pressure, traction force or system failure. The most technically sophisticated have touch displays, but they are also available as classic displays with push-buttons according to the UIC 612 standard. There are also safety-oriented versions (SIL 2) and, in the near future, ETCS displays. The entire system is programmed, configured and parameterized with standardized, easy-to-use software tools.



▲ Selectron system architecture – the right component for each project phase

SERVICES

Selectron's product portfolio is complemented by an extensive range of services covering the entire spectrum from specification, engineering and commissioning to aftermarket service.

SPECIFICATIONS

Optimized system architecture is crucial for maintaining high vehicle availability. Whether for new vehicles, modernizations or subsystems – skilled engineers provide valuable support for technical design, train bus, vehicle bus, or connection to third-party systems.

ENGINEERING

Control and management modules, project management for subsystems or the engineering of turnkey solutions – the company's organizational flexibility and the open structure of its train control and management system offer users a solution which is precisely tailored to customers' requirements.

COMMISSIONING

Selectron provides full support to ensure the successful launch of a vehicle, with highly qualified specialists available around the globe to assist with commissioning, testing and calibration of the train control and management system or specific subsystems.

SERVICE

The support and service department with its highly trained engineers offers the very best after-sales support in all respects. Free telephone and e-mail hotlines, on-site support, training and hardware repairs are all offered as a matter of course.

THREE QUESTIONS FOR …

BERND RIEDEL, STRATEGICAL MARKETING MANAGER, SELECTRON SYSTEMS AG

What is actually going to change for customers?

Up till now, technical solutions from Knorr-Bremse were mainly related to individual subsystems. By joining forces, Knorr-Bremse and Selectron are now able to offer vehicle manufacturers and operators an across-the-board approach to train automation. This opens up entirely new possibilities for the customer, as Knorr-Bremse is now able to offer a portfolio ranging from individual safety-critical and ecologically efficient systems right down to balanced packages of complete solutions for vehicle automation. The company will continue to offer customers its established portfolio of systems, products and services and at the same time expand this by the addition of innovations.

In what way will customers benefit from the takeover?

If subsystems and control technology are derived from the same source, the engineering costs for the manufacturer and service organization are lower. But the biggest advantage concerns the interfaces – having an over-arching application makes programming, configuring and parameterization much simpler. The whole process of systems diagnostics is more straightforward, as the entire train network is designed to enable diagnostic and maintenance processes. System risks are reduced, and at the same time the cost of the approval procedure in terms of life cycle costs is reduced. And you shouldn't forget that the control technology is designed as an open system – at any time systems from other suppliers can be added.

What form does cooperation between Knorr-Bremse and the control technology developers actually take?

Knorr-Bremse's global sales and service network means that Selectron is in a better position to support its customers. Vehicle manufacturers and operators benefit in equal measure – in both the OEM and service segments. Selectron has a team of specialists who are experts in the entire field of vehicle automation, which enables us to tender for refit contracts. Application engineering of this kind is a basic element of any successful service operation, particularly when it comes to modernization projects – a market that is just beginning to take off.

▲ Russia – care home for elderly people

10 YEARS OF HELPING OTHERS

500,000 PEOPLE HAVE BEEN HELPED BY THE CHARITY KNORR-BREMSE GLOBAL CARE SINCE IT WAS FIRST SET UP IN 2005 –
with 270 projects in 50 different countries and funding of EUR 12.5 million.

▲ Mexico – refurbishment of elementary schools

▲ Tanzania – education center for AIDS orphans

▲ India – construction of student accommodation for vocational training centers

"Behind these figures are the personal stories of countless individuals whose lives have been changed for the better by our work and can now live in greater dignity and independence," says Julia Thiele-Schürhoff, chair of the executive board of Global Care.

In Mbeya, Tanzania, for example, Global Care has built an education center for 150 AIDS orphans who would otherwise have few prospects for the future. In India, Global Care has been supporting several projects that offer vocational training to young people who have dropped out of school, giving them a chance to find permanent employment. Global Care's involvement has consisted of building student hostels and constructing modern water storage systems for existing accommodation. In Acuña, Mexico, financial support from Global Care has gone hand-in-hand with the involvement of local Knorr-Bremse employees: colleagues at the Bendix site in Acuña have been helping renew sanitary facilities and water and electricity supplies and refurbishing playgrounds in two elementary schools. Every year, some 400 schoolkids benefit from this involvement. In Naberezhnye Chelny, Russia, near the Knorr-Bremse KAMA site, Global Care has helped modernize a care home for elderly disabled people.

A WAKE-UP CALL FOR EVERYONE

All this started with the devastating tsunami of December 26, 2004. In order to provide rapid, targeted help for the victims of the disaster, the Knorr-Bremse Group set up a charitable organization called Knorr-Bremse Global Care on January 18, 2005 and immediately made funding of EUR 2 million available.

The money was used for reconstruction measures in the immediate aftermath of the disaster in Thailand, Indonesia and Sri Lanka, for replacing medical equipment in Indonesia and to help revive the fishing industry in Sri Lanka.

Following the success of these and other tsunami aid projects, Knorr-Bremse Global Care decided to continue its activities on a global basis, broadening its focus to cover the fields of education and training as well as social infrastructure. The kind of emergency aid provided immediately after the tsunami now only accounts for a very small part of the organization's expenditure. The aim is always to support long-term projects that help people achieve more independent lives.

WHEN DOES LONG-TERM SUPPORT MAKE SENSE?

Since 2013, Knorr-Bremse Global Care has put a special focus on vocational training and WASH (water, sanitation and hygiene). This not only helps reduce infant mortality and improve maternal health but also strengthens gender equality. Global Care is funded mainly by the company's two divisions – Commercial Vehicle Systems and Rail Vehicle Systems – to the tune of EUR 1.5 million per year. What distinguishes the organization from many other aid organizations is its professional approach to project management and the intensive long-term personal supervision of projects by members of the organization. Individual Knorr-Bremse employees can also propose projects themselves, which they can then personally supervise. This helps establish a culture of social commitment throughout the entire Group. At the same time, young members of the management team are able to gain experience in international project management.

...IN **TECHNOLOGY AND QUALITY.**

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