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New metro systems under construction in major cities, high-speed train routes at the planning stage, and efficient heavy-duty locomotives and state-of-the-art freight cars being used to transport goods and raw materials between industrial centers: in this edition of the Rail Informer we take a look at the particular features of a number of so-called emerging markets such as China, India, Brazil, Turkey – and South Africa.

Developments in these regions are reflected in the strong sales performance recorded by Knorr-Bremse Rail Vehicle Systems. There is a good reason why our growth rates are so high – we offer our customers innovation, outstanding systems capabilities and excellent levels of service on a local scale.

In China, for example, we are currently expanding our engineering capabilities in order to ensure reliable delivery performance even at extremely short notice. In India and Brazil we recently opened new facilities. And Knorr-Bremse Turkey – the new company we recently set up in that country – fits into the Group’s long-term strategy and further enhances our ability to maintain a presence in all major rail vehicle markets. In recent years, growth in the Turkish market has been extremely rapid, thanks to investment in the high-speed sector, local public transport networks and freight transportation. In an interview, two of our Turkey experts explain why this growth is set to continue.

But as well as looking at developments in China, India, Brazil, Turkey and South Africa, this edition of the Informer also covers a host of other interesting topics. You can read, for example, about how Knorr-Bremse has developed its own separate engineering department to support modernization projects; or how our engineers can now replace time-consuming, costly prototype testing with computer simulations. There is also a very interesting article about a system developed by our North American colleagues at New York Air Brake (NYAB), who have added to the tried-and-tested EP-60 braking system an ingenious smart car application that controls the top hatch and bottom dump gate of bulk cargo carriers.

I hope you will once again enjoy reading this edition and find the topics it covers both interesting and stimulating.

Best wishes,

Dr. Ansgar Brockmeyer
Member of the Board Rail Asia Pacific
Knorr-Bremse Asia Pacific (Holding) Ltd.
NEW COMPANY: KNORR-BREMESE TURKEY

Knorr-Bremse’s latest company – Knorr-Bremse Turkey – has been fully operational since the end of April. The new company paves the way for further growth and fits into the Group’s long-term strategy of establishing a local presence in all major rail markets. The Turkish market has expanded rapidly in recent years, thanks in particular to investment in high-speed rail links, urban mass transit systems and freight transportation. And this growth is set to continue – the Turkish state railway company TCDD is planning to invest a further 24 billion US dollars by the year 2023, bringing the total planned investment to almost 45 billion dollars by 2035. The new company merges activities in the fields of braking, door and HVAC systems under one roof. The establishment of Knorr-Bremse Turkey will also facilitate rapid implementation of future localization projects and the effective deployment of local field service teams. By introducing a strategic procurement function the full potential of the Turkish supplier base can be used for the Knorr-Bremse Group. In addition to building up a comprehensive supplier base, the company also plans to offer Turkish operators a wide range of different service models under the RailServices brand.

MANAGEMENT CHANGE AT KNORR-BREMSE

With effect from June 1, Dr. Peter Radina is to join the Board of Management of Knorr-Bremse Rail Vehicle Systems, replacing Dr. Albrecht Köhler, who is leaving to devote himself to new professional challenges and tasks. Dr. Radina has been working for the Group since February 2000. He started by heading Sales & Systems for various vehicle categories, and in this function played an important role in the company’s successful launch in the Chinese market for locomotives and high-speed trains. Latterly he was Chair of the Board of Management of Knorr-Bremse GmbH in Austria, where he made an invaluable contribution towards putting the Knorr Rail Group’s door business on a profitable footing.

VV1000T FIELD TESTING SUCCESSFULLY COMPLETED

Knorr-Bremse subsidiary New York Air Brake (NYAB) has now successfully completed the first extensive field testing of the new VV1000T oil-free compressor. The tests had started in early 2010 at Norfolk Southern Railway with a view to assessing the compressor’s performance under real operating conditions as well as its impact on life cycle costs and the environment. For many years rail operators had had issues with the reliability of oil-lubricated compressors and their high overhaul costs. With the VV1000T Knorr-Bremse has developed the first high-performance compressor for heavy-duty freight trains that operates entirely without oil. NYAB has already received numerous orders for the new product.

▲ VV 1000T – the first high-performance compressor for heavy freight trains.

▲ Dr. Peter Radina
RUSSIAN EXPERTISE PAYS OFF

Knorr-Bremse is making a significant contribution to the new four-axle, dual-voltage double locomotives being built by Bombardier Transportation as part of its new “First Locomotive Company” joint venture with Russian metal construction company ZMK. Knorr-Bremse is responsible for supplying the entire GOST braking system for the TRAXX RUSSIA locomotives, incorporating tried-and-tested components specially developed for the Russian market such as the BP compact brake control system, the KAB60 control valve and the PEC7 block brake unit. All the components involved are designed to operate at temperatures down to -50 degrees Celsius.

IFE EQUIPS PESA DB-LINK WITH DOORS AND SLIDING STEPS

All the cars are air-conditioned and have multi-purpose compartments and space for wheelchairs. They also come with on-board power points for the use of passengers, and screens with real-time displays of information about the next stop and connection options. With up to 470 new Link vehicles ordered from Polish manufacturer PESA, Deutsche Bahn intends to set new standards for regional railroad links. For purposes of DB homologation, PESA is currently building two prototypes: a single-section and a three-section train on which testing will start during 2014. Knorr-Bremse subsidiary IFE is equipping these trains with door systems, driver’s cab doors and sliding steps. The order for the German market consists of an E3L-e2 sandwich door system equipped with light grids and a touch bar for blind people on the door leaf. The sliding steps have an electrical safety strip and weight detector. Deutsche Bahn has already ordered 36 of these trains from PESA for operation in the Sauerland region.
**NEWS**

**LEADER LONG-TERM TESTS POINT TO CONSIDERABLE POTENTIAL SAVINGS**

Knorr-Bremse is currently working with several European customers on long-term tests to identify the potential for energy savings offered by the LEADER driver assist system. One such customer is Austrian rail company WESTbahn, which operates on the line between Vienna and Salzburg. For passenger operations, LEADER uses a database containing information about the train, route, speed and timetable. A cab display provides the driver with recommendations about the most efficient driving style that is compatible with adherence to the timetable. Apart from achieving fuel savings and improving punctuality, this proactive driving style also reduces brake wear. In addition to LEADER for passenger trains, Knorr-Bremse is also currently testing a version specially designed for the European freight market.

**▲ Austrian rail operator WESTbahn is testing the LEADER driver assist system.**

**BPLE WINS CNA INNOVATION PRIZE**

Knorr-Bremse’s Brake Pipe Length Estimation (BPLE) system has won the 2014 CNA Innovation Prize “Intelligence for Transportation and Logistics”. The system offers technical support for brake testing and thus contributes towards avoiding accidents in rail transportation. BPLE for the first time creates a link between measured parameters of the braking system and its actual status, allowing for precise verification of the integrity of the brake pipe. Every year the Nuremberg Center für Transportation & Logistics Neuer Adler awards the prize to companies whose innovative services or products have made an outstanding contribution to sustainable growth, preservation of jobs and maintenance of competitiveness for Bavarian industry.
KNORR-BREMSE INVITED TO JOIN UNIVERSITY ADVISORY BOARD

The purpose of advisory boards for Master’s degree courses is to facilitate the transfer of knowledge between universities and companies, raise student awareness of the companies and provide technical advice to the course committee. These are some of the duties with which the advisory board for the Mechatronics/Precision Engineering Master’s program at Munich University of Applied Sciences is tasked. In return, the companies involved have an opportunity to recruit talented young graduates straight from university. Since the start of the year Knorr-Bremse has been contributing to the work of the advisory board for this Munich course. The person invited to represent the company on the board was Dr. Gert Fregien, who is head of “Innovation & Technology” and also responsible for “Rail Operator Support” at Knorr-Bremse Systeme für Schienenfahrzeuge GmbH.

KNORR-BREMSE SUPPORTS SHIFT2RAIL INITIATIVE

Shift2Rail is a joint technology initiative of the European Commission and the European rail industry that represents a first step towards using research and innovation to achieve Europe’s transport and environmental policy aims. The six-year program forms part of the “Horizon 2020” research program and has a budget of EUR 900 million provided in equal part by the rail industry and the EU. Knorr-Bremse will be closely involved in contributing its particular expertise to the initiative. Shift2Rail is expected to boost innovation in the rail industry, significantly reduce system costs for the rail sector and improve the capacity and attractiveness of the rail system. Other important criteria for measuring its success are based on social and environmental aspects such as noise and energy consumption.

TECHNICAL INNOVATION CIRCLE FOR RAIL FREIGHT TRANSPORTATION

Knorr-Bremse and eight other companies in the rail freight sector – rail car owners, rail transportation companies, the rail industry, forwarders and academic rail engineering departments at the technical universities in Dresden and Berlin – have joined forces to form the “Technical Innovation Circle for Rail Freight Transportation”. The aim is to examine in detail the growth opportunities for rail freight and for the rail freight car of tomorrow. All the players involved in the innovation circle will start by drawing up ground-breaking solutions to these challenges. One important aspect is the introduction of a telematics-based standard that could not only monitor the condition of the bogies in real time but also provide the operator with real-time information about maintenance requirements and intervals as well as the location of the nearest maintenance workshop. The advantages of such a universal technology for Europe would be lower operating costs and greater availability of freight cars. Optimization of logistics processes is also expected to reduce the number required by 20 percent.
GLOBAL GROWTH MARKETS

ALL OVER THE WORLD – BUT PARTICULARLY IN RAPIDLY GROWING MARKETS – THE RAIL VEHICLE INDUSTRY FACES CHALLENGES CAUSED BY MEGATRENDS SUCH AS ENERGY EFFICIENCY, SAFETY, URBANIZATION AND GLOBALIZATION. Knorr-Bremse has shown great strategic foresight in expanding its global presence in growth markets, opening new production facilities in Brazil and India, and forming a new company in Turkey – all of which meet the highest standards of modern logistics and environmental compatibility. And to make sure it can offer state-of-the-art solutions to its customers, Knorr-Bremse has also been strengthening its R&D activities at local level.
RAIL BOOM

HIGH-SPEED TRAIN LINES, METRO SYSTEMS AND THOUSANDS OF NEW LOCOMOTIVES. Anyone returning to China after twenty years’ absence is liable to discover an entirely new side to the country: It is currently one of the fastest-growing rail markets in the world – and Knorr-Bremse is a well-established player in the field.

The Chinese proudly remember Christmas 2012 as the date when their country officially opened the longest high-speed railway line in the world. Covering 2,298 kilometers between the capital, Beijing, and the southern city of Guangzhou, the high-speed link reduces a journey of over 20 hours to half that time – and as such represents a serious competitor for air travel. The same will soon apply to many other routes in China: The government is planning to increase the current high-speed network from some 10,000 to 19,000 kilometers over the next few years, and in the longer term this could even grow to a massive 50,000 kilometers! Knorr-Bremse was one of the first western companies to enter the Chinese rail market, having established the first contacts in the late 1970s. In 1985 the company set up its Asia headquarters in Hong Kong, and after receiving an initial contract in 1990 to equip Shanghai Metro with braking systems, it steadily consolidated its leading position in the Chinese market. Including joint ventures, Knorr-Bremse now has 13 production facilities in China, all of which meet strict local content requirements and at the same time ensure that the company’s customary high standards of quality are upheld.

2014 TO BE RECORD YEAR
In the local public transport sector, braking systems have been ordered or already supplied for more than 13,000 vehicles in 20 cities. Some 7,500 orders have been received for locomotives, and as many as 14,000 for the high-speed sector – 7,000 of them for door systems and 3,000 for HVAC systems. Last year alone, Chinese vehicle builders ordered braking systems for more than 480 high-speed trains from Knorr-Bremse. In the spring of 2013, the Chinese government’s reform plans triggered a new wave of investment in the country’s rail infrastructure, and 2014 is expected to be a bumper year for rail vehicle production.

DETECTION CAPACITY REQUIRED
The company’s ability to deliver the required quantities on schedule is one reason why Knorr-Bremse has been able to play a prominent part in many of these projects. The challenge is to supply extremely high product volumes within a very short period of time – a large proportion of the orders for the high-speed sector placed in fall 2013 stipulate delivery between November 2013 and the end of 2014. In some cases this calls for an increase in output of more than 150 percent within a few months, and close collaboration with numerous regional suppliers is essential. Knorr-Bremse was careful to reserve capacity with suppliers early on and incorporate them into the production ramp-up.

Knorr-Bremse currently employs 2,800 people in China, with current major orders increasing the company’s human resources requirements by some 30 percent. More than 400 employees are involved in engineering products to meet specific local requirements. And in order to ensure smooth running of the entire vehicle fleet, another 400 specialist technicians are on hand in field service teams and local service centers to supply 24/7 customer support.
SOUND PERFORMANCE BY THE SUBCONTINENT

MORE THAN A BILLION INHABITANTS, AROUND HALF OF WHOM HAVE AN AVERAGE AGE OF 25; strong economic growth and a steadily expanding middle class that is increasingly mobile and whose consumption patterns are further boosting the transportation of goods – India is one of the world’s fastest-growing rail markets.

The healthy order books at Knorr-Bremse India in recent years reflect the relatively steady economic growth of the subcontinent. Despite the impact of rising debt and devaluation of the national currency, there are many indications that growth is set to continue in the longer term.

One important factor is India’s plans for infrastructure expansion, with an important focus on creating an up-to-date rail network. Modernization of existing rolling stock is also involved, as is the ordering of new vehicles – two areas in which Knorr-Bremse has been highly successful in India for several years.

NEW SITE TO COVER GROWING DEMAND

In order to keep up with growing demand in recent years, Knorr-Bremse has increased its capacity by creating a state-of-the-art facility in Palwal, 30 kilometers from its existing site in Faridabad, Northern India.

The new facility offers around 26,000 square meters of production and office space, with some 500 employees manufacturing brake control systems, bogie equipment and air dryers for rail vehicles. In line with Knorr-Bremse’s international strategy they are destined primarily for the Indian market and are manufactured in close collaboration with certified regional suppliers.

Another product group is compressors. Knorr-Bremse recently launched volume production of an oil-free compressor for electric locomotives in response to an order from Chittaranjan Locomotive Works, a subsidiary of Indian Railways. The company is currently manufacturing an initial batch of 140 units for Indian Railways in addition to meeting global demand for the oil-free compressor.

KNORR-BREMSSE INVOLVED IN PRESTIGIOUS INDIAN PROJECTS

Knorr-Bremse’s recent expansion of capacity on the Indian subcontinent means it is now better placed to respond to customer requirements – and is doing so highly successfully. Indian Railways recently certified Knorr-Bremse as a preferred supplier of the latest generation of CCB computer-controlled brake systems for electric locomotives. And the company has also received two further prestigious orders for developing braking systems for the metros in Delhi and Hyderabad.

Knorr-Bremse is supplying braking systems for a total of 57 three-car trains ordered by vehicle builder Hyundai Rotem which will run on three metro lines in Hyderabad. Each line is designed to carry up to 50,000 passengers per hour. The city authorities and the train operator have designed the system to take into account the restricted
space available in Hyderabad, with all the lines running above ground on stilts. Phased opening is planned for the period from 2014 to 2017.

The Delhi Metro project underlines the market and growth potential offered by India – the operator has ordered no fewer than 636 cars. Knorr-Bremse’s new Palwal facility – which was planned according to Green Building Standards and is equipped with modern production technologies and optimized logistics – is well prepared to cope with an order of this volume.

JOINT TECHNOLOGY CENTER WITH KNORR-BREMSE COMMERCIAL VEHICLE SYSTEMS

The Knorr-Bremse Rail Vehicle Systems and Commercial Vehicle Systems divisions have concentrated their engineering and development services in a new Technology Center India (TCI) at the Pune site in response to the rapidly increasing importance of the Asia-Pacific region for both divisions and in order to enable ongoing development of the portfolio in line with specific customer requirements. One core activity here is software development for the Knorr-Bremse Group worldwide. By the end of 2014 the TCI will be providing work for a total of around 200 employees.
highest standards

With its construction of the modern facility in Itupeva Knorr-Bremse has set the highest standards in terms of process organization, labor efficiency, logistics and quality. In a so-called "lean conversion" project, for example, measures have been introduced to enhance the efficiency of production line workplaces. A modern logistics concept for materials supply, combined with optimization of production and assembly operations has resulted in considerably shorter manufacturing throughput times. And environmental considerations have also been taken into account in planning the new plant, with a view to cutting energy consumption and operating costs and reducing environmental impact.

▲ Bombardier Transportation is supplying modern monorail systems for the Brazilian city of São Paolo.
FOOTBALL, SAMBA AND BIG BUSINESS

THE POPULAR IMAGE OF BRAZIL IS ONE OF PALM TREES, BEACHES AND YEAR-ROUND SUN. But there is another side to the country: megacities where the traffic is close to gridlock. To tackle this problem, Brazil began investing increasing amounts in local public transport some ten years ago.

It was on a Tuesday in October 2007 that the entire country suddenly exploded with joy. The Executive Committee of FIFA had just announced its decision that Brazil would host the 2014 World Cup for the second time since 1950. People took to the streets and queues of cars drove around sounding their horns in celebration. From that point onwards the plan was clear: The Brazilian national team – or Seleção (the selection) as it is known – was expected to secure the trophy.

The decision to hold the competition in Brazil not only triggered a planning process for the new football stadiums that would be required. “Already by the mid-2000s, when the traffic situation in our major cities started to become increasingly intolerable, politicians had started to earmark funding for public local transport systems,” explains Everton Pereira, Sales Director at Knorr-Bremse Sistemas para Veículos Ferroviários in Brazil. In addition to the World Cup, Rio de Janeiro has also been selected to host the summer Olympics in 2016, so there has been investment in the rail transportation structure in the cities chosen to host both events.

NEW METRO LINES IN TOWNS, NEW EMU AND LRV PROJECTS IN MAJOR CITIES

The new transport systems have proved popular with the Brazilian public. For example the suburban rail network operated by Companhia Paulista de Trens Metropolitano, (CPTM) in São Paulo is now one of the busiest in the world, carrying well over two million passengers every single day. More than half the cars – 672 in all – are equipped with braking and door systems from Knorr-Bremse and 384 also have HVAC systems from the company. Knorr-Bremse is also currently tendering for a further 520 cars for an expansion of the CPTM network, with a new Line 13 linking the city center to São Paulo’s international airport in Guarulhos.

Metro systems, especially those in Rio de Janeiro and São Paulo, were also rapidly expanded and new lines introduced. In São Paulo, Knorr-Bremse was commissioned to supply braking and door systems for the new trains on Line 4 and braking and HVAC systems for the new Line 5 trains. And an order for the modern EP2002 braking system for the new monorail was a first for South America. Knorr-Bremse is also supplying braking systems for Line 15 of a new monorail network. “And the company is involved in numerous EMU and LRV projects in various other cities,” reports sales director Pereira.

NEW SITE SETS NEW STANDARDS

Knorr-Bremse started up operations in Brazil in 1977 and since then has steadily expanded its braking system and component business. Recent years have seen growth in demand for rail vehicle products and systems, especially in connection with infrastructure projects. The result of this development was that the Knorr-Bremse plant in São Paulo began to reach the limits of its capacity. As there was no space to expand, the company decided to build a new, state-of-the-art development, production and sales facility covering an area of 31,500 square meters in Itupeva, 85 kilometers from the old site. This has been operating at full stretch since early February 2013.

Itupeva is the largest production facility for both divisions of the Knorr-Bremse Group. For the rail vehicle division it produces and sells braking systems for passenger and freight trains, bogie equipment and on-board systems.
Informer: With a land area of more than 800,000 square kilometers, Turkey is more than twice the size of Germany and has a population of around 77 million. But even so, the country is not regarded as a core market for the rail industry. Why is that?

Karius: In the past, other major European markets were a greater focus of attention, not least because of their high-speed networks. The Turkish market, by contrast, was dominated by traditional rail vehicles for decades. About ten years ago, though, things began to change rapidly, with public investment programs increasingly focusing on urban local transport projects and new regional links. And at the same time, planning began for high-speed routes.

Informer: What features characterize the Turkish rail market?

Karius: The average age of the population is relatively young, and mobility is beginning to play an increasingly important role in society. The sheer size of the country also means that demand for rail transportation has grown enormously.

Informer: What has been the impact on operators’ investment in vehicles?

Gavarini: Growing demand for rail transportation is reflected in an increase in orders. Operators set great store by having state-of-the-art vehicles – and this attitude applies to subsystems as well. For example they put great emphasis on the braking and air conditioning systems to be installed in their new trains.

Informer: Is that a reason why Knorr-
Bremse is currently expanding its Turkish operations?

Karius: What we want to do is to benefit from increasing demand in Turkey by offering a locally-based response. Turkey is by no means new territory for us – Knorr-Bremse has successfully established itself as a systems partner for various applications in the past. So given current growth forecasts, it makes sense to strengthen our local presence with a subsidiary in Ankara.

Informer: In recent years Turkey has had a high balance of trade deficit. Does that make it more difficult for foreign companies to gain a foothold in the market?

Gavarini: The situation is more complex than that. Turkey is very interested in acquiring expertise in the rail sector – and that expertise often comes from abroad. In return, the country offers companies like Knorr-Bremse good business prospects. Localization requirements are shaped in such a way that both parties benefit from collaboration.

The new company is going to do more than just sell braking systems. In addition to growing localization requirements for OE deliveries, the highly complex systems involved will require servicing in the medium and long term. With our RailServices division we are in a position to offer operators a wide range of different service models.

Informer: What major projects are on the horizon in Turkey?

Karius: Knorr-Bremse has already equipped the first two Turkish high-speed trains with braking systems. And recently we received an order from Siemens for systems for six Velaro high-speed trains ordered by Turkish State Railways. Over the next few years we are expecting many more calls for tender, and we estimate that between now and 2023 there will be a need for more than 100 additional high-speed trains. Parallel to this, the metros in Istanbul and Ankara will continue to grow. And streetcars are playing an increasingly prominent role in the Turkish transportation market, with many medium-sized towns like Kayseri, Izmir or Bursa expanding their local public transport systems or planning entirely new networks.
LOOKING SOUTH

ALTHOUGH MANY COUNTRIES IN AFRICA HAVE NO RAIL NETWORK AT ALL and their existing roads are often in poor condition and largely confined to coastal regions, South Africa is an exception. The rail system, in particular, is of huge importance for the country’s development, and Knorr-Bremse has a strong presence there.

South Africa covers an area of more than 1.2 million square kilometers, making the country bigger than Germany, France, the Benelux countries, Denmark and Austria. The main economic centers are long distances apart, with most of them concentrated in the deep-water ports around the coast. Johannesburg in the northeast (home to Africa’s biggest freight terminal, the City Deep Container Terminal), is about 600 km from Durban on the northeast coast, about 1,000 km from Port Elizabeth on the east coast and about 1,200 km from Cape Town on the southwest coast. The country’s geography means that most freight that does not require rapid transportation by air is carried by road or rail. Currently the relative proportion of road to rail freight is approximately 2:1 and part of Transnet’s market demand strategy is to turn this figure around. For this reason, a contract for 1,064 locomotives has been put out to tender in South Africa. The preferred bidders were recently announced as follows: CSR Zelc with 359 electric locomotives and BT with 240 electric locomotives; GE with 233 diesel-electric locomotives and CNR D Loco with 232 diesel-electric locomotives.

The South African railway network currently measures more than 20,000 kilometers and operates according to the AAR standard on a narrow 1,067 mm gauge. More than half the network is not yet electrified and can only be used by diesel locomotives. Some 74,000 freight cars are currently in operation on the system, and this year alone, a further 4,000 are to be added to the fleet.

▲ The Service Centers can return all critical components within a mere three days.
RAPID OVERHAUL OF DB60 CONTROL VALVES

Knorr-Bremse has been operating in the South African market since 1969, and today employs a workforce of close to 200 in Johannesburg, Durban, Richards Bay, Ermelo, Cape Town and Saldanha. For many years now the company has acted as a technological pioneer in the South African rail market. fitted with Knorr-Bremse systems; and the next product launch is just round the corner. The VV180T has now been running for almost three years without maintenance. The majority of freight routes in South Africa run through extremely dusty and sandy conditions. The large number of rail vehicles in operation means it is important to have effective servicing structures, and since the 2010 World Cup, when SA’s first medium-speed rail link between Johannesburg International Airport in the east, Johannesburg in the south and Pretoria in the north was opened. Numerous Park & Ride facilities were set up, including a regional network of buses and service stations. The Gautrain, as it is called, has multiple units that operate at speeds of up to 160 km/h, making them the fastest Electrostar trains of their kind. Knorr-Bremse supplied the train’s electro-pneumatic braking system, including the oil-free compressor, as well as the sanding system. Knorr-Bremse subsidiary ifE supplied the doors for the passenger cars and driver’s cabs. The successful deployment of Gautrain has seen Prasa awarding a R51 billion contract for 600 new EMUs over the next ten years to Alstom, with the possibility to extend this to another 600 over a further ten-year period. This is the first time in approximately 40 years that SA is investing into its rail infrastructure and is an exciting and challeng-

Together with General Electric (GE) Knorr-Bremse introduced “GE locotrol”, a system designed to run long and heavy freight trains through remote locomotive control to maximize the efficiency of Transnet’s iron-ore transportation. The company also launched the S4200-ECP braking system in the market and operates on the coal export line between Ermelo and Richards Bay in the east. Some years ago Knorr-Bremse introduced its CCBII micro-processor-controlled locomotive brake control system to South Africa. Approximately 80 percent of South African rail vehicles are now Knorr-Bremse has therefore set up Electronic and Mechanical Service Centers at transport hubs to offer a full range of services for all their braking systems in operation in South Africa. Knorr-Bremse’s mechanical and electronic service centers provide a turnaround service of three days on critical components.

PASSenger Train Services

Passenger train services in SA traditionally played a less dominant role than freight transportation. This has started to changeing development, due to the considerable localization requirements. KBSA is well positioned to meet these requirements and will hopefully be able to secure a large part of the available business.

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EXTENDED DEVELOPMENT COMPETENCE

HIGH-SPEED TRAINS, METROS, TRAMS AND LOCOMOTIVES – THE CHINESE RAIL TRANSPORT MARKET IS RAPIDLY GROWING. Companies wishing to secure tenders for projects must be able to deliver rapidly. Knorr-Bremse is taking up the challenge by enlarging and extending its local development team.

Dr. Yangpei Xie, Design and Quality Director at the Suzhou site of Knorr-Bremse Systems for Rail Vehicles, knows the Chinese market very well. “The challenge lies in its great volatility.” Decisions regarding new rail transport projects, for example, are often made at very short notice. “When this happens, it is extremely important to be able to give immediate, binding confirmation of tight time schedules for subsystem delivery.” In the past, orders awarded to Knorr-Bremse by Chinese manufacturers relied above all on development capacities in Germany. For complex development projects such as that of a braking system, a rapid and intensive coordination process was crucial. Any delay in the response on technical issues could seriously jeopardize projects in the People’s Republic.

AUTONOMOUS DEVELOPMENT

Knorr-Bremse has had close contacts with China since the late 1970s and has been steadily extending its leading position with a large number of successful projects. However, since local manufacturers of braking systems are now also gaining a stronghold, particularly in the fields of metros, trams and locomotives, short response and delivery times based on strong local engineering competence are becoming an increasingly significant factor in the tendering process. Knorr-Bremse recognized this development in good time and reacted appropriately. Whereas 35 systems developers and two design developers were employed at the Suzhou site in 2008, these figures had increased to 86 systems and 46 design developers by 2013. And by 2017 – apart from a few highly complex projects – the site should also be in a position to conduct all the development activities required for local projects using its own facilities. To ensure this, test rigs covering functional, endurance and low-temperature testing for design validation and type testing have been put into operation in parallel to a reinforcement of the workforce. In addition, a state-of-the-art dynamometer test bench to meet the high requirements of Chinese customers will be installed at the Suzhou site in 2015.

PROJECT TERMS CONSIDERABLY SHORTENED

Much has already been achieved. “By extending our capacities, we have been able to reduce the time required to conclude

▲ Knorr-Bremse braking systems are being installed in the new vehicles for Ankara Metro.
metropolitan and locomotive projects by 60 percent within the space of two years,“ Xie explains. Whereas the duration of a project averaged around twelve months in 2011, the figure was only five months in 2013. The first development project carried out entirely by Knorr-Bremse Suzhou, from the first technical negotiations to the start of series production, demonstrates the potential offered by the reorganization: The initial coordination processes for the brake systems installed in new railcars for the Ankara metro system by the Chinese manufacturer ZELC were conducted in September 2012; Knorr-Bremse then delivered the first unit on February 26, 2013.

**A PROMising Future for “Simultaneous Engineering”**

At the same time as that first development project, the design engineers adapted the drawings and the supplier development engineers clarified technical specifications with a local foundry. The key to this success was “simultaneous engineering”: early, close cooperation between systems development, design, purchasing and production in processes with overlapping time schedules. “This can only be achieved when all the project members and departments involved are at the same place, with rapid and uncomplicated teamwork,“ Xie explains. Combining these activities at one location has an additional advantage: Since there is no language barrier involved, the Chinese Knorr-Bremse developers and representatives of local car builders and operators can directly communicate and cooperate. Previously, most of this coordination work required the services of an interpreter.
EFFECTIVE SUPPORT FOR DEVELOPMENT ENGINEERS

IN THE PAST, SAFETY-CRITICAL PRODUCTS AND SYSTEMS HAD TO BE EXHAUSTIVELY TESTED ON PROTOTYPES; nowadays, engineers can carry out a wide range of tests using computer simulations – to the benefit of customers.

According to their length and intensity the green, red and orange arrows flowing past the compressor represent particular pressures and temperatures. A brake caliper changes color to indicate the degree of braking force being applied and the extent to which the material’s resistance is being utilized. Both these displays are only possible because the functioning of the compressor and the application of the brakes are not taking place on a test rig but rather as part of a computer simulation. “It enables us, for instance, to see early on whether any part of the compressor needs additional air cooling,” explains Dr. Frank Günther, Head of Technical Analysis/Simulation at Knorr-Bremse Rail Vehicle Systems.

On the computer the engineer could, for example, add a small deflector plate to the air intake. “By running the simulation again we would be able to see whether this has improved things – or whether the new deflector actually has an undesirable knock-on effect elsewhere.” In the past, the development engineers would have had to undertake elaborate modification of the test rig, now, thanks to computer simulation, the actual rig testing can be much more effective.

SIMULATIONS ENSURE QUALITY, PERFORMANCE AND SAFETY

The flow of cooling air and its impact on the individual components of the compressor is a good example of what computer simulation is capable of nowadays. Of course, test rigs still continue to be used – but mainly when it comes to specifically ensuring the quality, performance and safety of a particular product.

Because of the growing need for computer simulations and their increasing complexity, Knorr-Bremse is steadily expanding its use of this testing technique all over the world. “Knorr-Bremse SFS has a long tradition of using computer simulation,” says Günther, “but over the last ten years we have virtually trebled its use.” As part of their mission to ensure the rapid development of mature products, the Knorr-Bremse teams in Munich, Budapest and Faridabad, India, can now offer simulations covering a considerable proportion of the global market. It is above all the customer who benefits from this development: Computerized testing procedures ensure greater safety in increasingly complex and technically sophisticated systems. They also enable Knorr-Bremse to react much more rapidly to specific customer requirements.

THE NEXT DIMENSION: SIMULATING AN ENTIRE BRAKING SYSTEM

The increasing use of simulation has been made possible by the exponential growth
in computing power. In the not-too-distant past, computers would have required weeks if not months for the type of complex calculations for which nowadays Günther and his colleagues reckon with hours or, at the most, days. Such technological progress has enormously boosted the speed with which development projects can be completed and has enabled extremely complex calculations to be carried out at increasing speeds.

Simulations played a crucial role in ensuring the timely completion of a recent major Knorr-Bremse project – development of the KAB60 control valve for Russian freight cars. The company used simulations not just for validating the individual components but also for examining the interplay of the individual valves along the entire length of the train. The technique, which Knorr-Bremse has been steadily developing over the years, saves time, reduces costs and enables functionality to be tested at an early stage in the development process.

**VISUALIZED DATA CREATE IMAGE SEQUENCES**

“Our task was to simulate the valves on a 100-car freight train, creating a detailed picture of each individual valve and simulating its effect on the braking of the entire train,” explains Günther. “The information we received about the interplay of the valves enabled us to considerably improve the overall system – and that is immensely important for us as a systems supplier.” It goes without saying that this work is carried out in close collaboration with the development and testing departments.

However varied the specific questions related to development of safety-critical systems may be, the basic principle involved in simulation is always the same: “We use the computer to break down a complex system into countless small, manageable and calculable units,” explains Günther. “On the basis of pre-defined criteria the computer then carries out the calculations for each unit and generates an overall picture from the results.” This delivers the huge amounts of data that the engineers need for any development project. Individual images of the flow of air involved in a compressor can even be combined to form a film sequence.
OPERATING SYSTEMS FOR SMART FREIGHT CARS

KNORR-BREMSE’S NORTH AMERICAN SUBSIDIARY, NEW YORK AIR BRAKE (NYAB), has added an ingenious Smart Car application to its EP-60 Braking System. The system opens and closes the loading hatches and monitors the position of the bottom dump gate. It also provides status information for wheel temperature and excessive vibration.

The system which went into revenue service with the United Arab Emirates’ state railroad company, Etihad Rail, in early 2014, represents the next step towards automated freight train operations. Whereas in the past, the bottom doors and top hatches of covered bulk freight cars had to be opened and closed manually, the locomotive operator now has the ability to efficiently open and close the hatches from the comfort of his cab.

The system is based on the EP-60 electro-pneumatic braking system installed on a total of 240 sulfur hopper freight wagons built by Chinese manufacturer CSR Yangtze Rolling Stock and seven locomotives built by EMD. EP-60 transmits the electrical braking command from the locomotive to the freight cars via the Intra-Train Communications Network, applying the brakes simultaneously.

The EP-60 electro-pneumatic braking system provides instantaneous braking, lowering in-train forces during brake applications. The longer and heavier a train, the greater the advantages of EP-60 in terms of avoidance of wear and optimization of life cycle cost for the operator.

Technological development of the Smart Car application was not the only challenge for NYAB; the timeline was also extremely tight. The company received the order for further development of EP-60 in December 2011, with commissioning of the entire train occurring in November 2013.

NEW FUNCTION USES EXISTING EP-60 COMMUNICATION NETWORK

The new function for the Etihad Rail project, which goes by the name of Wagon Diagnostic & Hatch Operating Feature (WHDO), uses the existing EP-60 communication network as a backbone to display the bearing, door and hatch status of the entire train as well as control the opening and closing of the hatches. Each car is equipped with 13 wireless sensors that continuously monitor the state of the wagon.

“NYAB is the first company to apply this to a freight car,” explains Dr. Gert Fregien, responsible for Innovation and Technology at Knorr-Bremse Rail Vehicle Systems. As well as controlling functions, the Smart Car application also has a diagnostic role. Hot wheel sensors inform the driver if there is a potentially dangerous temperature increase in axle bearings on individual cars, and there is also a derailment detector. All the systems components have been adapted for operation in the desert conditions that prevail in much of the United Arab Emirates, but the Smart Car application is also suitable for other countries and markets. “It is of interest to all operators who want to reliably and efficiently load and unload large volumes of bulk cargo,” explains Dr. Fregien.
A CHALLENGING DIVERSITY

HYDRAULIC BRAKING SYSTEMS STILL ONLY ACCOUNT FOR A SMALL PROPORTION OF KNORR-BREMSE’S SALES, but with the growing popularity of streetcars in China, this is beginning to change. The company recently started to manufacture hydraulic control units and actuators in Suzhou.
Many people understandably have the impression that the Chinese passenger rail market consists mainly of high-speed train and metro projects. After all, the longest high-speed line in the world runs between Beijing and Guangzhou, and China’s big cities are opening one metro line after another. But these spectacular projects have overshadowed another significant development in China: light rail vehicles or streetcars.

In 43 Chinese cities, 131 streetcar projects totaling some 3,000 kilometers of track are currently out to tender or already being built. And that is only the beginning: 33 further cities are planning new lines. Pingdingshan, Tangshan, Taizhou or Foshan – any self-respecting Chinese city of a million or more inhabitants wants its own light rail vehicle network.

**Lrvs cheaper than metros**

“Streetcar networks are relatively cheap and can be built quite quickly,” explains Andreas Heitland, responsible for LRV segment sales at Knorr-Bremse Rail Vehicle Systems. “For a city that doesn’t yet have an extensive mass transit network or wants to add to an existing metro system, streetcars are an attractive option.” Because low-floor streetcars have a limited installation envelope for the braking system, they have to use hydraulic systems – pneumatic ones would be too bulky.

This means there is another important factor that vehicle builders have to take into account: “The quality requirements for hydraulic braking systems are very demanding.” Whereas a pneumatic system operates at pressures up to 10 bar, in the case of a hydraulic system the figure is between 100 and 150 bar. Knorr-Bremse’s proven, globally standardized KPS production system ensures that the required quality is achieved.

Knorr-Bremse started to sell hydraulic braking systems in China in 2012, and last year the company received its first orders from this segment in the form of a contract to supply LRV braking systems for lines in Liupanshui, Suzhou, Nanjing and Zhuhai. “Vehicle builders appreciate the fact that we have managed to build up local engineering competence and capacity at our existing Suzhou plant within a very short period of time. We are also able to provide competent advice in Chinese and to manufacture reliable hydraulic systems locally,” comments Heitland.

**Local authority guidelines increase vehicle diversity**

But meeting all the requirements is still quite a challenge. “When it comes to logistics we have to prepare the supply chain in Europe to cope with higher volumes of products,” explains Dr. Paul Ross, head of hydraulic braking system production at Knorr-Bremse. “On the other hand we also aim to localize components – the increase in demand couldn’t be met at reasonable cost in Europe alone.”

At the same time the local engineering teams face huge challenges: 17 vehicle manufacturers who hitherto have been producing high-speed trains, locomotives or freight cars are now crowding into the Chinese LRV sector with their various requirements and platforms. In the case of streetcars, local authority design requirements are also often imposed in a bid to preserve the city’s visual impact, which not only boosts the sheer diversity of vehicle types involved but also means the number of different braking systems increases. Despite attempts at standardization, it is not possible to have a single ‘off the peg’ LRV braking system that can be rapidly produced for all the cities involved. “In each case we effectively have to produce a tailor-made system,” explains Heitland.
IMPROVING ROAD SAFETY

FOR MORE THAN 50 YEARS, KNORR-BREMSE GESELLSCHAFT DR. TECHN. JOSEF ZELISKO GMBH HAS BEEN SUPPLYING SAFETY EQUIPMENT FOR RAILROAD CROSSINGS. Now the company’s latest red light monitoring system promises to further improve road safety. Field testing was successfully completed early in 2014.

Serious accidents at level crossings with half-barriers or lights are still quite common. Since 2008 the annual number of incidents involving personal injury at light-controlled crossings in Austria has more than doubled to 34. According to road safety studies, one reason is increasing inattention on the part of drivers – which is why the authorities are increasingly focusing on stricter monitoring of red lights. A new system from Zelisko is supporting their efforts.

The use of twin infra-red cameras enables surveillance to take place even at night or in poor weather conditions. One camera focuses on the red light and the other records the vehicle number plate. If a driver crosses the stop line at red, both cameras are triggered, recording the entire road section including the light and the vehicle.

The patented system operates without any link to the safety barriers themselves – it automatically senses whether the red light has come on. The image data is then sent via a LAN network to a central computer for storage.

After more than two years of successful piloting at a location near Allensteig, Lower Austria, the system is now to be installed at several Austrian railroad crossings during the course of 2014.

▲ The new red light monitoring system provides essential support.

▲ The use of infrared cameras means the system can function at night.
STREETCAR OR BUS?

STREETCARS IN THE FRENCH CITY OF NANCY LEAD A DOUBLE LIFE AS GUIDED BUSES. A RailServices team is currently supporting Knorr-Bremse subsidiary Freinrail in a project to modernize the vehicles’ entry systems and extend their working life by up to ten years.

With their metallic silver and gray livery, generous front windscreens and modern design, the streetcars operated by Service de transport de l’agglomération nancéienne (STAN) in Nancy have a futuristic air about them. And these vehicles built by Bombardier are, indeed, something special: For more than half the 11.1 kilometers of Line 1 they run on rails, but the rest of the time they operate as guided buses. This double life enables the light transit system to also make use of some sections of Lines 3 and 4. With its rubber tires the vehicle is used for one steep 13 percent gradient; and the system also avoids the need for further track to be laid in two of the city’s suburbs.

FREINRAIL SETS UP RAILSERVICES TEAM FOR ENTRY SYSTEMS

The first of these dual-mode vehicles went into service in 2000, and various measures are now being taken to modernize them and extend their working life. Responsibility for upgrading the entrance systems is in the hands of Knorr-Bremse’s French subsidiary Freinrail, backed up by IFE Kematen. The entire main drive components including the motor, brake and spindles have been renewed; and at the same time new sensors have been installed to ensure compliance with the PRM (Persons with Reduced Mobility) guidelines.

The project started in November 2013 and is scheduled to finish in May 2015. Freinrail’s introduction of its own special RailServices team for entry systems means the company is well prepared to cope with growing demand for such upgrades in France.
REPLACED AS NEW

THE Z80 MICROPROCESSOR WAS LAUNCHED IN THE SUMMER OF 1976 AND QUICKLY PROVED A HIT. During the 1980s and 1990s it was incorporated into hundreds of thousands of industrial applications – including brake control systems – and quickly became one of the most successful 8-bit CPUs of all time. But now, after four decades of reliable service, the reign of the Z80 is coming to an end. In anticipation of this development Knorr-Bremse is offering operators and vehicle owners a range of alternatives, thanks to RailServices’ in-depth engineering skills and years of experience with responding to customers’ individual needs.

The pace of development of electronic components is particularly rapid. “At component level we are now finding development cycles in electronics taking a mere three to five years,” says Werner Holzgethan, who for years was responsible for obsolescence management at Knorr-Bremse Rail Vehicle Systems. If it no longer makes economic sense for a manufacturer to produce an electronic component, the part concerned is discontinued – and this triggers the obsolescence process at Knorr-Bremse: Can a replacement product, or, where possible, a successor with comparable functionality be found? Once a potential replacement has been identified, a lengthy process of testing the functionality of the entire system including the new component begins.

▲ The HOCHBAHN in Hamburg is one of the most modern mass transit systems in Europe.
MODERNIZATION PROJECTS ARE NOT JUST ABOUT DESIGN

“We have to think about how we can make sure that systems function properly, even if certain components are no longer being manufactured,” is how Holzgethan describes the challenge. Using an obsolescence analysis tool, Knorr-Bremse carries out an ‘end of life’ analysis of critical components, especially electronic ones. In some cases it is possible to keep selected critical products in inventory under special storage conditions for a predetermined length of time – but such a process cannot be continued indefinitely.

“At some stage the point is reached where operators have to think about the future of their ageing vehicles.” If they don’t, there is a danger that the vehicle gradually becomes unusable because of a lack of available spare parts and eventually has to be taken out of operation.” The point at which this happens cannot be precisely predicted. Knorr-Bremse components and entire systems are, for example, put through extreme vibration and temperature tests, but in the long term, real operating conditions have a significant impact on the ageing and failure rates of components. “The wide variety of products and the differing operating conditions involved make it more difficult to make accurate predictions,” says Holzgethan.

That is why Knorr-Bremse RailServices is increasingly focusing on preemption and raising awareness of the issue amongst vehicle owners and operators. “The strategy shouldn’t be one of just thinking about the issue when a manufacturer has already announced discontinuation of a component,” explains Reinhard Rauscher, one of whose responsibilities at Knorr-Bremse is the marketing of modernization projects. “With a bit of foresight you can easily extend the life of the system by a couple of decades.” What is important is that modernization projects shouldn’t just consist of upgrading the interior design of a vehicle. “It makes a lot of sense to also look at vehicle components, in particular the electronic control systems – even if the passenger is not aware that these components have been renewed.”

MODERN ESRA SYSTEMS REPLACE ‘OLD’ Z80 BRAKE CONTROL SYSTEMS

What Rauscher means can be demonstrated with the example of the Z80 microprocessor, which is widely used in brake control systems. “The processor provided excellent service for many years, but anyone currently modernizing a vehicle would be well advised to keep in mind that the task of keeping the Z80 operating reliably for the next twenty years will become increasingly difficult and unpredictable,” says Rauscher. That is why, as part of a project for mass transit operator Hamburger Hochbahn AG, Knorr-Bremse is currently replacing existing Z80 brake control systems with modern ESRA ones (Electronic System for Railway Application). This futuristic brake control concept has a modular construction and is designed to ensure that functionally compatible spare parts are available in the long term. Knorr-Bremse currently has more than 500,000 ESRA components in operation, and a systematic support system for the entire ESRA product family offers synergies and other advantages for all Knorr-Bremse customers. “When it comes to modernization projects you have to sit down with the customer and look in detail at the issues, as the interfaces – in contrast to new-build projects – usually cannot be modified,” says Rauscher. That is one of the main reasons why within the RailServices team Knorr-Bremse has set up a separate engineering department tasked with providing competent and effective support to modernization projects.

More than 100 years’ experience in developing, manufacturing and maintaining innovative braking systems means that for modernization projects, too, Knorr-Bremse is the service partner of choice.
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