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Knorr-Bremse in North America

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HVAC acquisition

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Technology is changing the world and the North American heavy haul railroad industry has watched this revolution in technological development, judging the usefulness of each new technology by tangible, bottom-line results, not by promises. What heavy haul railroads require from new technology is clear – increased productivity and safety, reduced operating costs and enhanced customer service.

One of the keys to success and growth at New York Air Brake, Knorr-Bremse’ center of competence for the AAR heavy haul market worldwide, is products that deliver proven productivity and reliability. Extensive field testing is done in partnership with the railroads to confirm that the benefits of new products are real and substantial.

Another key to growth is earning the continued trust of our railroad partners by working hand-in-hand with them as they deploy and operate new train control technology.

This edition of Informer contains a success story describing how New York Air Brake and one trusted railroad partner, Norfolk Southern Railway, are benefiting from new train control technologies that deliver tangible returns on investment. These products include – computer controlled brake CCB II, electro-pneumatic braking system EP-60, on-board driver-assist technology LEADER and Knorr-Bremse’s oil-free compressor.

This edition also looks behind the scenes in other markets. In Europe, for example, Knorr-Bremse secured a maintenance fleet concept with Bombardier in a highly competitive market segment. We also present our latest joint venture, Icer Rail, which is the next logical step in the ongoing development of the company’s brake pad strategy for the rail vehicle sector. Among other fascinating topics we finally take a closer look on Knorr-Bremse’s subsidiary Merak. The company has developed an air-conditioning system that operates with the new, ultra eco-friendly refrigerant HFO1234yf.

I am sure we all have succeeded in coping with the many challenges we faced in 2010. A new year lies ahead of us which will bring new tasks that are no less demanding than in the past. I wish you good luck and some relaxing days with your loved ones.

And, of course, I also hope you enjoy reading this issue Informer.

J. Paul Morgan
President New York Air Brake
Joint Venture Icer Rail

Friction materials cover both major rail standards

Knorr-Bremse Group is now able to supply brake blocks and brake pads for both the AAR and UIC markets.
A NEW PRODUCT FAMILY IN THE PORTFOLIO
In early summer of this year, Knorr-Bremse joined forces with Spanish manufacturer Icer Brakes to set up a new joint venture – Icer Rail. The creation of this company expanded Knorr-Bremse’s portfolio of friction materials – formerly limited to AAR brake shoes – to include organic brake pads and brake blocks designed for UIC standards (up to 200 km/h) for passenger cars, regional trains, locomotives, suburban and metro systems and freight trains.

OPTIMUM INTERPLAY OF COMPONENTS
The aim of the joint venture is to take a holistic approach for the development of friction materials for precisely these railway vehicles – thereby ensuring optimum interplay of the individual braking system components and extending their operating life cycle.

The joint venture between Knorr-Bremse and Icer Brakes brings together two partners who are a perfect match: As a recognised expert in the development and production of friction materials, Icer Brakes enjoys an outstanding reputation worldwide. Knorr-Bremse brings abilities to the joint venture that the highly specialized Spanish manufacturer was unable to access in the past: brake system expertise with over a century of experience in rail vehicle applications and a worldwide sales network. With locations in 25 countries, Knorr-Bremse ensures customers have competent local experts on hand all over the world.

ANSWERS TO TOMORROW’S QUESTIONS
Initial teams drawn from both companies are translating their experience into joint product developments. On the one hand they are focused on improving braking systems performance and reducing life cycle costs. On the other hand, environmental topics like emissions and noise reduction – especially for freight trains – are becoming an increasing priority.

These aspects and the growing demand for mass transit and mainline applications will be addressed by Icer Rail. By focusing on research and development of new and existing products, these growing challenges will be met.
HVAC acquisition

Strategy for strength

At the end of September, Knorr-Bremse further expanded its HVAC division with a strategic acquisition when Knorr-Bremse Asia Pacific (Holding) took over Australian HVAC specialist Sigma. This means Knorr-Bremse has joined the ranks of the world’s leading manufacturers of rail vehicle air-conditioning systems.

While its subsidiary Merak sells its HVAC systems mainly in China, Europe and the Americas, the company now has access to the growing markets of Southeast Asia, India and Australia. The acquisition considerably expands Knorr-Bremse’s market position. It will also generate many synergies for both companies, particularly in development, production and procurement. The key management posts at Sigma will remain, so the Knorr-Bremse Group will be able to utilize the company’s expertise over the years to come. Three decades of experience in the field will also guarantee the highest standards of quality and efficiency.

SIGMA – AN ESTABLISHED SYSTEMS DEVELOPER

With a workforce of some 200 employees and annual sales of EUR 50 million, Sigma is an established developer and manufacturer of HVAC systems. The company’s products are also used for mining applications, but the main focus is on rail systems.

As the market leader in Australia, Sigma supplies manufacturers such as Downer EDI, and elsewhere in the world the company’s products are installed in rail vehicles built by many major manufacturers. It is involved in supplying a large number of large-scale projects — for example, trains built by Kawasaki Heavy Industries for Taipei Metro are being equipped with Sigma HVAC systems; and the same goes for the new metro trains ordered from Hyundai Rotem by the operator of the public transport system in Boston.
Knorr-Bremse subsidiary Merak has developed an air-conditioning system that operates with the new, ultra eco-friendly refrigerant HFO1234yf.

The use of this refrigerant for air-conditioning in rail vehicles represents a major advance in the field. The Global Warming Potential (GWP) of the fluorinated solution is 4 in 100 years — significantly lower than the refrigerant currently used — R134a — which has a GWP of 1,300 in 100 years.

By using HFO1234yf the rail vehicle air-conditioning system also complies with the strict criteria of EU Directive 2006/40/EC relating to emissions from air-conditioning systems in motor vehicles. The directive requires the use of a refrigerant with a GWP lower than 150 in mobile air-conditioning systems using fluorinated greenhouse gases. In fact, the worldwide renowned organization SAE International also recommends HFO1234yf to fulfill EU-requirements as the refrigerant in car air-conditioning systems.

Merak has a long tradition of developing eco-friendly systems. For years the company has been developing solutions aimed at curbing global warming and preventing further depletion of the ozone layer. In 1981 it produced the first air-conditioning system for rail vehicles based on a heat pump — a technology that thanks to continuous development is now used in more than 1,000 Merak air-conditioning systems.

Even in the wake of its introduction of the new HFO1234yf refrigerant, Merak is continuing to drive forward research and development of more energy-efficient systems in response to a growing awareness of environmental issues and increasingly strict requirements in global markets.
Knorr-Bremse in North America  THE MOST EFFICIENT FREIGHT RAILROAD SYSTEM IN THE WORLD
North America's Class I freight railroads, in a network spanning 132,000 miles across the continent, form the most efficient and cost-effective freight rail system in the world, while also reducing pollution, energy consumption and highway congestion. Knorr-Bremse, through its subsidiary New York Air Brake, supports the Class I railroads with advanced brake systems and train control technologies.
FREIGHT RAILROADS - AN AMERICAN SUCCESS STORY

Together the Class I railroads move more than 40 percent of North America’s freight (measured in ton-miles), and they do so using just one fourth of the diesel fuel required to move an equivalent tonnage by truck. Since the passage of the Staggers Act by the United States Congress in 1980, which deregulated the Class I railroads, rail shipping rates have decreased by 55 percent and railroads’ share of the total freight market has increased by 50 percent. Over the same period, the Class I railroads have continuously improved their safety record with lower employee injury rates than all other modes of freight transportation.

North America’s freight railroads compete against each other, and other transportation modes, where the key to success is high-quality customer service. In 2009, the industry carried approximately 2.4 billion tons of freight over the network. Major commodities transported include coal, ore, automobiles, containers, chemicals, grain and other agricultural products. All the North American Railroads belong to the Association of American Railroads (AAR) which among other things sets standards for interoperability and other operational matters. They are all privately owned or publicly traded, and they receive very little government funding.

New York Air Brake, Knorr-Bremse’ subsidiary for AAR heavy haul train control worldwide, contributes significantly to Class I railroads’ efficiency, service and safety through investment in research and development of new AAR focused technologies. The successful deployment of new technologies into Class I railroads is premised on product performance, reliability and economics.

New York Air Brake customers include all of the Class I railroads. Among them, Norfolk Southern Railway has been a particular leader in the deployment of new heavy haul technologies, including those of New York Air Brake.

Norfolk Southern Railroad operates approximately 21,000 route miles in 22 states. The railroad operates the most extensive intermodal network in eastern North America and is a major transporter of coal and industrial products. Norfolk Southern Railway has won the “Harriman Safety Award” for each of the past twenty-one years with the best safety record in the industry.

NEW TECHNOLOGY DEPLOYMENT

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INTEGRATED TRAIN CONTROL

New York Air Brake has developed products and systems to fulfill its vision for a fully integrated, electronically controlled freight train. The key technology building blocks include EP-60, CCB II, and LEADER. All of these
technology products have been deployed at Norfolk Southern Railroad and are in the process of being integrated, enabling heavy haul trains to operate more efficiently, benefiting from fuel savings, reduced in-train forces and life-cycle costs in an environment of rising fuel costs and increased traffic.

BEST-IN-CLASS LOCOMOTIVE BRAKE CONTROL

New York Air Brake delivered its first production contract of 150 CCB II systems to Norfolk Southern Railway in 1998 and has been awarded by additional orders of 970 systems over the past 11 years.

With a 0.01 Mission FLY (failures per locomotive per year), designed-in redundancy and diagnostics, and a mean time to repair of just 20 minutes, CCB II is recognized as the most reliable locomotive air brake system on the market and the data proves it.

CCB II has been installed on all Class I railways and is the preferred locomotive computer controlled brake system worldwide – 12,000 CCB II systems have been installed.
OPTIMIZED TRAIN HANDLING AND ENERGY SAVINGS

New York Air Brake's Train Dynamic Systems division develops advanced on-board, real-time train handling products and training simulators. Norfolk Southern Railway has equipped its training centers with New York Air Brake training simulators and is in the process of deploying on-board LEADER systems following pilot testing on 15 locomotives in coal service.

The pilot program demonstrated that LEADER reduced fuel consumption on distributed power coal trains by 17.5 percent, while managing schedules as well as in-train forces in a very demanding service. LEADER provides locomotive engineers with real-time information about a train’s operating conditions – topography, track curvature, train length and weight, etc. – and gives locomotive engineer operating prompts to assure optimized train handling and energy savings.

Since the initial pilot, more than 300 additional Norfolk Southern Railway locomotives have been equipped with LEADER, with more installations scheduled for 2011. Fuel savings on traditional head-end only powered trains is averaging 9%, with distributed power trains reporting higher savings. LEADER is being deployed across the Norfolk Southern Railway network as an integral part of Norfolk Southern Railway’s Optimized Train Control system. Their drive to improve locomotive engineer performance is being further supported by the installation of 20 additional New York Air Brake training simulators.

NEW BRAKING TECHNOLOGY APPLIED IN COAL SERVICE

New York Air Brake has developed EP-60, an electronically controlled pneumatic (ECP) air brake system, which provides instantaneous brake applications throughout the train and a dramatic improvement in heavy haul train handling. Finer control results from EP-60’s ability to graduate the application and release of air brakes.

In 2007, Norfolk Southern Railway installed EP-60 on 30 locomotives and 727 coal cars which make up six operational unit coal trains operating in two different coal operations. These contracts represent the largest commitment to ECP technology by any North American railroad. New York Air Brake will supply CCB II, EP-60 and LEADER on another 94 Norfolk Southern Railway locomotives in 2011.

Railroads around the world – in South Africa and Australia as well as in North America – are deploying EP-60 as the technology’s economic benefits become clear.

OIL-FREE COMPRESSOR TECHNOLOGY

The reliability and maintenance issues of traditional oil-lubricated air compressors have been a long-term problem for railroads, resulting in excess down time which affects cost and locomotive availability. Knorr-Bremse recently developed the first high-capacity, oil-free air compressor design capable of operating in heavy haul service, the VV1000T.

In early 2010, Norfolk Southern Railway began field trials of two VV1000T units installed in DASH 9 locomotives to evaluate performance and to demonstrate the oil-free technology’s ability to lower life cycle costs, protect the environment and survive in a harsh operating environment.

Norfolk Southern Railway’s interest in field testing the advanced-concept VV1000T is an example of why successful development of new technology depends on a proven track record and a strategic partnership between innovative companies. Both New York Air Brake and Norfolk Southern Railways demonstrate their commitment to investing in the future of the freight railroad industry – operating greener, cleaner and smarter.
Railroads around the world – in South Africa and Australia as well as in North America – are deploying EP-60 as the technology’s economic benefits become clear
Mr. Bowie, markets almost all over the world are recovering from the economical crisis – is the North American market doing so, too?

Rich Bowie: While slower than hoped, we are seeing incremental improvements in the key indicators in the US. The economic crisis in North America and the world has had a significant impact on the transit market. The commercial vehicle and freight divisions were hit especially hard, requiring that Knorr-Bremse adjusts capacities to the new market conditions. The impact to the transit division was initially in the aftermarket, but significant delays in nearly all planned major projects have been experienced.

Public transit riders across the country are paying higher fares and face reduced service due to revenue shortfalls experienced by most public transit systems. Most public transit systems have seen flat or decreased funding from local, regional, state, and federal funding and nearly all were forced to raise fares or cut service.

How does the price of gasoline affect the popularity of North America's railway services?

Rich Bowie: When gas prices hit record highs in the US, nearly every Transit Agency reported dramatic ridership increases. Freight traffic increased, too. Unfortunately, as prices fell back, so did the increased usage. Transit authorities took a double hit: besides having significantly reduced federal and state funding, they have further reduced funding from gasoline taxes.

In which segments can trains really compete against planes?

Rich Bowie: Of course there is no competition in heavy haul and in intercity transit. But trains have demonstrated a competitive advantage in a number of the commuter markets, such as the Northeast Corridor. For example, with Amtrak Acela you can get from downtown Washington D.C., to Downtown New York City in less time door-to-door — with much less hassle — at a competitive price and much more flexibility. The challenge is to be able to construct these lines in other corridors.

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How does High Speed Rail play into the future in North America?

Rich Bowie: Clearly, North America can benefit from High Speed Rail. However, the obstacles are significant. To start, the existing infrastructure cannot support High Speed Rail. Besides the major issue of funding, there always seems to be issues with the routes such as land acquisition, environmental impact issues, and special interest groups trying to influence the decision process.

How are the Knorr-Bremse products positioned in the growth in North America’s ambitious railway plans?

Rich Bowie: One of the most significant developments in air brakes has been the Knorr-Bremse oil-free compressors. These compressors were designed specifically for the rail environments, not commercial products being adapted to trains. The success in the US is tremendous. Besides advantages in maintenance costs (no oil to change) there is no oil passed into the air that needs to be separated out and discarded. Our oil-free compressors are one of the many ways Knorr-Bremse demonstrates our commitment to going Green.

Rich Bowie, President Knorr Brake Corporation, Westminster, USA, speaks about High Speed Rail traffic

“There has been a significant push for High Speed Rail with our current administration”
Richard Bowie, President, Knorr Brake Corporation is responsible for the transit business in North America for brakes, entrance systems (IFE), and HVAC (Merak). He earned his “Bachelor of Science” in Mechanical Engineering from Rutgers College of Engineering. After working for a railcar builder, he joined Knorr Brake Corporation in 1995 and was responsible for the Engineering Department until he took over as President in 2007.

How do you see the future of the rail market in North American Rail in five years from now?

Rich Bowie: There has been a significant push for High Speed Rail with our current administration. High Speed Rail is the hot topic in North American Transit. Our government describes a new era of trains, linking major regional corridors via fast trains that rival door-to-door times for air travel and put highways to shame. The Administration has placed a new emphasis on building high-speed and intercity passenger rail to connect communities and economic centers across the country. A fully developed passenger rail system will complement highway, aviation and public transit systems.
Knorr-Bremse and Bombardier have been doing business with one another for many years. Now, the first pan-European maintenance contract between the two companies was signed.

The main focus of the agreement signed at Innotrans 2010 is a strategic partnership designed initially to run for five years. Knorr-Bremse will undertake the task of overhauling all braking systems on the European TRAXX locomotives for which Bombardier has signed full service agreements with the owners.

Within eighteen months a rough idea has developed into an agreement that will provide excellent support for the TRAXX locomotives and further deepen cooperation between Bombardier as a vehicle builder and Knorr-Bremse as a systems manufacturer.

TRAXX: A JOINT SUCCESS STORY
It is no coincidence that Bombardier is now doing business with Knorr-Bremse in the maintenance field – the success of the TRAXX fleet has been closely linked to Knorr-Bremse from the very outset. Intensive collaboration with Bombardier at the development stage resulted in Knorr-Bremse designing a customized braking system for the individually modifiable TRAXX platform. Based on the modular braking system (MBS), it is a good example of how Knorr-Bremse comes up with convincing solutions that are compact, lightweight and economical.

Whereas the first two TRAXX locomotive series still used screw compressors, from 2004 onwards the innovative oil-free compressor VV270-T, with its low maintenance costs, was installed in TRAXX 2e. And for more than ten years, Knorr-Bremse’s modular bogie braking equipment is engineered for a range of different locomotive weights, speeds and track gauges has also been contributing to the success of TRAXX vehicles throughout Europe.

ONGOING IMPROVEMENT
The new agreement covers more than just maintenance of the systems supplied by Knorr-Bremse – it also includes the delivery of replacement components to Bombardier. This is initially designed for some 330 TRAXX locomotives, and Knorr-Bremse is using its field experience to ensure that Bombardier meets the high expectations of its customers regarding vehicle availability.

Parallel to the overhaul work, specialists from both companies will also meet regularly to discuss further improvement of the maintenance services in terms of cost and availability. Both partners will benefit – as a systems specialist, for example, Knorr-Bremse can support Bombardier’s “total cost of ownership” approach by carrying out test dismantling in its own service centers to examine the actual condition of components and developing appropriate maintenance measures. And in return, Knorr-Bremse will receive feedback on the behavior of its braking systems under operating conditions.
Successful audit

IRIS Revision 02 sets stricter requirements

Back in 2006, Knorr-Bremse Rail was the first German manufacturer to achieve the sought-after certificate of compliance with the International Railway Industry Standard IRIS. Now, in 2010, all Knorr-Bremse sites have been undergoing scrutiny according to the stricter IRIS Revision 02 standard – once again confirming the company’s status as a pioneer in the field.

IRIS certification involves responding to several hundreds of questions that enable the auditors to evaluate business processes and transparency levels in rail vehicle sector companies. Knorr-Bremse could have undergone the process for the IRIS 01 standard once again, but opted instead for the IRIS 02 audit, which involves considerably stricter criteria for assessing quality standards and for the first time includes key figures from a wider range of areas within the company, such as tender, cost, and project management.

There are several reasons for this decision. The most important is a question of customer confidence. Knorr-Bremse wants to demonstrate that the strictest and most up-to-date standards are applied wherever possible, ensuring that Knorr-Bremse products continue to meet customers’ expectations.

CUSTOMERS AND COMPANY BENEFIT

The extra effort to make this stricter audit also pays off for Knorr-Bremse itself. Virtually all the company’s sites worldwide have been involved in the review, this ensures the same standard now applies throughout the Group. Building on and expanding the earlier ISO 9001 standard, IRIS also enhances the effectiveness of the supply chain.

Consistent application of the standard results in systematic, ongoing improvement of processes by identifying existing weak points, pre-empting potential problems and permanently eradicating them. Ultimately this benefits everyone concerned – vehicle manufacturers, operators and even passengers.
Disc brakes

Successful development

Knorr-Bremse and its partner CARS (China Academy of Railway Sciences) have successfully developed the “Knorr-Bremse CARS” joint venture for brake disc manufacturing in Daxing, China.

The joint venture is part of Knorr-Bremse’s strategy to localize its products as required by the Chinese Ministry of Railways and to secure a high market share in the long-distance business.

The joint venture was first set up in 2006. Now, after a mere four months’ construction time, the original small factory has become a large-scale facility that went into operation in April 2010. The new plant enables Knorr-Bremse to respond to growing demand for multiple units and locomotives in China within the shortest lead times.

Based on standardized production runs and high batch volumes, the new factory’s production strategy uses five takted manufacturing lines, each capable of completing one friction rig every fifteen minutes. The machinery used is especially robust and reliable. The joint venture has already achieved a delivery performance of nearly 95 percent. And the latest ramp-up boosted output levels to approximately 9,000 rigs per month.

For this volume of output it is essential to have a system of just-in-time delivery of raw materials that avoids unnecessary inventories or shortages despite the length of the supply chain. Kanban and line feeder principles support highly efficient production processes that have already made possible throughput times of a mere two days.

NEXT STEP: LOCALIZING BRAKE CALIPER PRODUCTION

In addition to manufacturing of brake discs, the Daxing plant has also been selected to assemble CRH-2 brake caliper units, with the start of serial production scheduled for April 2011. Prior to SOP, an existing building has to be refurbished, the assembly line has to be built-up, staff has to be recruited and trained. However, the most challenging task will be to organize an efficient logistic process for more than 10,000 sub-assemblies and more than 1,000 finished caliper units to be handled per month.
Knorr-Bremse has added two more products to its highly successful EP Compact product range: Now it is not only possible to control the direct brake cylinder pressure but also the pressure in the brake pipe – which means the system can be used in locomotives as well as multiple units.

EP Compact was first launched in 2004 as a compact modular braking system for central and distributed brake cylinder pressure control. It is designed to be configurable for a wide range of different functions, so that it can be tailored to the needs of individual customers as far as possible.

The modular unit can be used for both brake cylinder and brake pipe pressure control on various different platforms. Sales of some 2,000 units per year are ample proof of this product family’s success.
EP COMPACT: C-pressure control with integrated continuous pneumatic load correction for multiple units and high-speed trains; example with integrated CU01 underfloor electronic unit for decentralized control (3-channel slide protection), without cover

BP COMPACT: Brake pipe pressure control with assimilation function for locomotives, multiple units and high-speed trains; example with shut-off module and GCU02 underfloor gateway electronics for central and decentralized control, without cover

The individual modules of BP Compact and BC Compact can either be integrated into locomotive control panels or integrated as a complete system into the train in the design of the well-known EP Compact family.

For additional flexibility, all four units can have modules with further control functions added, for example for parking brake, air suspension or sanding. Customers are able to cover their precise requirements with the help of various combinations of standardized control functions.

COMMON BASIC MODULE
The basic modules for this product family are EP Compact, EP Compact lite, BC Compact and BP Compact.

**EP Compact** offers brake cylinder pressure control with integrated continuous pneumatic load correction for multiple units and high-speed trains.

**EP Compact lite** provides brake cylinder pressure control with electronic load correction and pneumatic load limitation for metros and multiple units.

The newly launched **BP Compact** regulates the brake pipe pressure and has an assimilation function for locomotives, multiple units and high-speed trains.

And **BC Compact** controls the brake cylinder pressure for locomotives.

For additional electronics, the entire product family can be extended by adding integrated electronic units designed for underfloor installation – the electronic control unit (CU) for the braking system and the gateway control unit (GCU) as the interface between the braking and train control systems. The control unit controls the anti-skid function and regulates the pressure on each car or bogie; and the gateway control unit looks after central functions such as brake management and diagnostics.

The advantage for the customer is obvious: this is a familiar system designed for a wide variety of functions. It also combines all the pneumatic and electronic functions into a single unit with pre-defined interfaces. It includes pneumatic pressure control modules that can have various additional modules and electronic variants added according to customer requirements.

**ADDITIONAL ELECTRONIC OPTIONS**
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Overview 2011

Systems expertise at trade fairs

The exhibits and applications showcased at this year’s InnoTrans exhibition will be on display at trade fairs 2011 all over the world. Experts will be available to explain systems such as the LEADER train driver information system, various highly effective brake control systems, the oil-free compressor, and even a complete bogie that demonstrates the perfect interplay of a whole range of Knorr-Bremse systems.
FAIRS 2011

5 - 7 April  SIFER  Railways & Harbours Conference and Exhibition  Lille, France
6 - 8 April  59th UITP WORLD CONGRESS AND EXHIBITION  Expo Centre, Johannesburg, South Africa
10 - 14 April  Railtex  Dubai, United Arab Emirates
14 - 16 June  Korea Railways & Logistics Fair  Earls Court, London, United Kingdom
15 - 18 June  Suissetraffic  Busan, Korea
6 - 9 September  Railway Interchange  Bern, Switzerland
18 - 21 September  APTA'S EXPO  Minneapolis Convention Center, Minneapolis, USA
3 - 5 October  Nordic Rail  New Orleans, USA
4 - 6 October  9. International Railway Fair TRAKO  Jönköping, Sweden
11 - 14 October  AusRail  Gdansk, Poland
22 - 24 November  Brisbane, Australia

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We think mainly in commercial terms – which is good for the environment.

At Knorr-Bremse, everything we do is driven by a desire for maximum efficiency at reasonable cost. For years we have been marketing products and systems that successfully combine economic and ecological aspects. For example our oil-free compressor won a Bavarian Environment Award as far back as 2003; and LEADER - the world’s foremost driver information system – helps passenger and freight trains reduce energy consumption. Now, with ECCO₂ we have launched a group-wide campaign to increase energy efficiency by 20% and cut CO₂ emissions by a similar amount – to the benefit of company and environment alike. | www.knorr-bremse.com |