

O' mag

[O] THE NTN-SNR GROUP PARTNERS' MAGAZINE

N°7

PARTNERSHIP

to linear growth



NTN  *With you*

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SMARTER



editorial

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02 MARKET UNDER ANALYSIS AUTOMOTIVE



NTN-SNR

Last September, NTN-SNR was named as a Key Supplier by the PSA Peugeot Citroën Group. The event was the culmination of more than 30 years of collaboration between the two Groups.

September 7, Anancy (Haute-Savoie), France. Cameras were flashing in the main reception area of the NTN-SNR plant : Jérôme Quilhot, Director of Mechanical Components Purchasing at PSA Peugeot Citroën, officially awarded the charter of Key Supplier to Didier Sépulchre de Condé, Managing Director of NTN-SNR, in the presence of local political figures and representatives of the management of the two companies. The ceremony establishes NTN-SNR as the first supplier of bearings to the automobile group. "Here is an example of a company which has known how to simultaneously develop its technical savoir-faire in this field, build an international presence, preserve its capacity for innovation and meet the needs of PSA", Mr Quilhot declared in his speech.

NTN-SNR and PSA Peugeot Citroën go back a long way: SNR bearings were first fitted to 2CV's in 1957! The relationship between the former Renault subsidiary and the vehicle manufacturer has strengthened over the last 30 years. NTN-SNR is now the number 1 supplier of wheel, gearbox and strut bearings. For its part, the PSA Group is one of the top three automotive customers for NTN-SNR.

3,6 MILLION VEHICLES A YEAR

Born out of the merger of Peugeot and Citroën in 1976, PSA Group is the second largest automobile manufacturer in Europe after Volkswagen of Germany. It employs 200,000 staff, of which 85,000 work in its 16 vehicle production centres and 15 component and casting plants (engines, gearboxes, drive chain, etc.). In 2010, PSA produced more than 3.6 million vehicles and had a turnover in excess of 56 billion euros.

Performance Plan 2013: with the emphasis on ambition

In Europe, our capacity for innovation places us in an ideal position to benefit from the technological breakthroughs linked to sustainable development: hybrid vehicles in the automotive sector, wind power in industry and the new generation of commercial aircraft engines in aerospace.....

In emerging markets the automotive sector is booming. We are strengthening our presence, notably in Eastern Europe, Latin America and Asia.

Given these opportunities for expansion, audacious is the keyword for our Performance Plan 2013. Boosted by the trust our clients and partners place in us, we have set an ambitious target: to maintain annual growth above 10% in order to achieve a turnover of a billion euros by the beginning of 2014. Speed will be controlled but the rate will be sustained.

Being part of the NTN Group gives us the strengths we need to rise to these challenges. Synergies already play a major part in our automotive sector and will be rolled-out across all our activities.

This new edition of O'mag bears witness, in it you will discover how NTN-SNR is innovating in mechatronics and benefiting from the connection with NTN to develop its Linear Motion range in Europe.

Happy reading!

Didier Sépulchre de Condé
CEO NTN-SNR ROULEMENTS
MANAGING DIRECTOR EUROPE & AFRICA REGIONS

With You



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One hundred Key Suppliers by the end of 2015

awarded Key Supplier status by PSA Peugeot Citroën

"This distinction reaffirms PSA Group's goal of recognising the privileged relationship with this supplier"



Identifying NTN-SNR as a Key Supplier to PSA Peugeot Citroën falls within the company's "Supplier Relationship Excellence Initiative" which follows French Government initiatives stemming from the Automobile Summit held in January 2009.

The process began in 2009 with the PSA Group designating 13 Strategic Suppliers representing the first circle of sub-contractors – Bosch, Valeo, Faurecia, Saint-Gobain, Michelin and others. Since last spring it has continued with the identification of a second circle of Key Suppliers. These are mid-size companies with international operations that set the standard in their respective fields. Around 100 key suppliers will be identified by the end of 2015. NTN-SNR is the tenth company awarded.

The award is made on several corporate and industrial criteria. Key Suppliers must have reached a critical size, be financially sound and their management show good strategic vision. They must display a high level of industrial excellence, especially in terms of quality and logistics. Finally, they must be capable of supporting PSA in new international projects.

"The label conveys commitments that are reciprocal not only in terms of purchasing and technical policy, corporate performance and industrial excellence, but also a commitment to, and support for the automobile industry. The PSA Group is keen to participate in the construction of a strong network through the entire automotive value supply chain beginning in our country of origin, France, and then extending to all the different zones in which we operate," explained Jérôme Quilhot, Director of Mechanical Components Purchasing at PSA.

AN ENGINE PROJECT

NTN-SNR is associated with many of PSA Peugeot Citroën's strategic projects. *"Bearings intended for the automobile industry are always the subject of specific developments : we take into consideration the function, the bearing and its environment"*, explains Jacques Lefèvre, NTN-SNR's sales manager.

This is how the Group came to develop the wheel and strut bearings for a future platform which, from 2013, will serve as the basis for the production of vehicles such as the replacement C4 PICASSO and 308. It will also produce the bearings for a new, innovative gearbox which will be fitted to numerous models from late 2014 onwards. Finally, it will make the balance shaft bearings for a three-cylinder petrol engine to be used from 2012 on vehicles intended for urban areas. This project is particularly important. *"Up until now, we weren't involved in PSA engines"*, Mr Lefèvre underlined.

IN THE WORLD TOP THREE

It is common knowledge that the French automobile champion plans to strengthen its presence in Latin America, Russia and China. In order to do so, it needs to work with component manufacturers that also have an International standing. *"The automobile industry is a local industry: the cars we sell in China are made in China. So we expect our suppliers to be present in the countries where we are present"*, explained Fabio Cury, Chassis Components Purchasing Manager at PSA Peugeot Citroën.

PSA PEUGEOT CITROËN

Through its integration into the NTN Corporation in 2008, the NTN-SNR Group is now present on every continent. It has factories in Brazil, Romania, China and India – including one in Chennai (formerly Madras). The PSA Group has also just announced the creation of a new manufacturing plant in India. *"We have an international strategy that corresponds well to that of PSA"*, explains Mr Lefèvre, underlining the fact that NTN-SNR is among the top three suppliers of bearings to the automobile industry.

The Group remains firmly planted in Europe, particularly in France where it has a research centre and no fewer than seven factories – five of which are in its home region, Haute-Savoie. This presence is also taken into account by PSA Peugeot Citroën in its policy of identifying Key Suppliers. The aim of this is to develop a strong automotive network (see box).

A SPECIAL CHARTER

The naming of NTN-SNR as Key Supplier marks a new chapter in relations between the two companies. It lays the foundation for a much closer collaboration in the coming years. *"This distinction reaffirms the ambition of PSA Group to build close relations with this supplier for the long term within the automotive network"*, declared Mr Quilhot in his speech.

Within PSA Group, a Charter specific to key suppliers has been created with the naming of regional delegates. In addition, top-level meetings will be scheduled on a regular basis.



GROUPAUTO prepares its members for the arrival of the hybrid



Philippe DE MIRIBEL
Goupauto Marketing Director

By 2020,
7,3%
of vehicles
will be hybrids

According to American consultants JD Power, by 2020 hybrid vehicles will represent 7.3 % of the world automobile market. That is a five percentage point increase over 2010.

Hybrid vehicles combine an internal combustion engine with an electric motor to improve energy efficiency. The result is that they can use up to 50% less fuel than a traditional car.



By creating the Hybrid and Electric label, Goupauto enables its retail and repair stores to demonstrate a new expertise in a market for the future.

An interview with Goupauto Marketing Director Philippe de Miribel.

O'mag : Some of your group's outlets will soon bear the label "Hybrid and Electric". Why this label?

Philippe de Miribel : To certify to the competence of our retail, parts and repairs outlets – Top Garage, Top Truck, Top Carrosserie, etc. – that have chosen to undergo special training for hybrid and electrical vehicles. The training will be made available as part of our G School programme and the label will be rolled out by the end of 2011. This initiative enables our members to better meet the new needs of the market. Furthermore, motorists who have switched to these new kinds of cars will be delighted to discover an alternative offer to those of franchise holders for their car's maintenance and repairs.

O'mag : Currently, hybrid and electric cars only represent a tiny fraction of the automobile market. Isn't this initiative a little precocious?

P. de M. : Hybrid vehicles still make up only 2.2% of the global automobile market, even though the first models were on sale 10 years ago. What we are now seeing are the signs of an acceleration in this market and we want to be in a strong position. With the launch of our Hybrid and Electric label, we are offering all members of the network - from parts suppliers to in-house repairers – an opportunity to prepare for the arrival of a new generation of vehicles. It is a good illustration of

Goupauto's vocation to accompany its partners in the changing market.

O'mag : Besides training, are you planning any other support measures?

P. de M. : Firstly we are going to make our members aware of the importance of this evolution and the need to prepare for it. Progress on electric engines has been so slow over the last 10 years that we have grown accustomed to talk of it like a background noise, you get used to hearing about it and not reacting to it. Now is the time to wake up and Goupauto is going to drum up the troops.

Aside from making people aware of the training itself, professionals need equipment and tools as well as the logistics required to supply the spare parts.

We will help the designated outlets to communicate: advertising signs and dedicated communication material will be made available so they can inform their clients. Motorists will then know that franchise holders do not have a monopoly on the maintenance and repair of hybrid and electric vehicles. They can find the same service for a better price with us.

This way we will create a virtuous circle: consumers will have more faith in these new vehicles when they see maintenance and repair offers becoming more accessible.

O'mag : How can a supplier like NTN-SNR help you in this project?

P. de M. : Hybrid and electric technology is still not common but we must master it as quickly as possible in order to give our partners a commercial

More than 2,200 retail and repair members in France!

Created in 1969 by 15 electro-dieselists in the west of France, GIE Arvro became Grouauto in 1985. The Group is one of the European leaders in spare parts and service suppliers for the automobile industry (retailers and garage owners). In France, Grouauto has developed more than 500 spare parts retailers under its four trade names: Grouauto and Partner's for light and commercial

vehicles, G-Truck for heavy goods vehicles and Color Services which supplies bodywork paints. The Group also has eight garage/repair trade names (Top garage, Top Truck, Top Carrosserie, etc.), to which 1,700 members are affiliated. Each member of Grouauto participates in the capital of the structure, which creates numerous advantages for the Group with a combined central purchasing function.



"By making the maintenance and repair of hybrid and electric vehicles more accessible, we are contributing to the development of these markets",

advantage. Our knowledge is fed by dialogue with our suppliers and we are counting on the commitment of each of them to help us progress. It's the case with the bearings NTN-SNR provide for these new types of vehicles, as well as the logistics solutions they can provide.

O'mag : The Hybrid and Electric label is one example of the services Grouauto provides its members. On a broader scale, what other services does your grouping offer to professionals?

P. de M. : Under our brand, retailers benefit from an advantageous parts purchasing policy as well as an extremely reactive supply chain network with nine

regional platforms that can ensure same-day delivery. Grouauto deals directly with suppliers so that retailers do not have to worry about individually sourcing parts. We participate in their business action plans and the development of product offers. And finally, some retailers can also benefit from sponsoring.

As for garages, they are equipped with a networked computer system which enables them to place orders easily. We provide technical training; we help our outlets - often garages that used to be independent - to become multi-make specialists. We also support them in obtaining our Pare-brise center (windscreen centre) label which promotes our expertise in glazing – lights, sun-roofs etc... The same support is available for our Utilitaire service center (commercial vehicles centre) label which specialises in repairing commercial vehicles. Lastly, garages affiliated to Grouauto benefit from the visibility and prestige of an International trade name.



NTN-SNR : a major partner for Grouauto

The NTN-SNR group figures among Grouauto's main distribution network partners. In particular, it supplies wheel bearings and ranges of tensioners and guide rollers for light vehicle as well as wheel bearings for heavy goods vehicles under the trade name G-Truck. *"By turning to NTN-SNR, Grouauto bet on a leading brand, whose reputation and quality of service represents a plus for its network,"* emphasised Laurent Dumont, Spare Parts Sales Director (France and Belgium) for NTN-SNR.





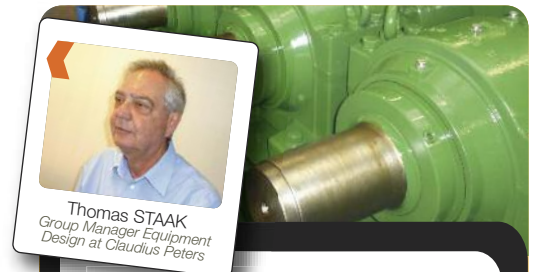
THE CHALLENGE OF CEMENT WORKS

With extremely high temperatures, heavy loads and a dusty environment, the reliability of bearings in a cement works is certainly put to the test. NTN-SNR supplies bearings for the η-Cooler, a clinker cooler developed by the German parts manufacturer, Claudius Peters, and offers maintenance as part of its customer support.

In August 2011, the Tanzania Portland Cement Company (TPCC) cement works in the suburb of Da es Salam was shut down for maintenance. Engineers from the German company, Claudius Peters, a specialist in cement work equipment, had been called in to change two bearings on the clinker cooler— a delicate operation requiring the removal of the hammer crusher to a clean area. The engineers were assisted on site by

NTN-SNR's Experts & Tools department, which supports customers in the implementation of maintenance solutions. "The services we offer not only include training, auditing, diagnostics and the supply of products and tools, but also technical assistance in the field," explains Marc Eicke, Manager of the Experts & Tools Department in Germany.

⁽¹⁾ The product of a heated mixture of limestone and silica is ground to produce cement.



Thomas STAAK
Group Manager Equipment
Design at Claudius Peters



CLAUDIUS PETERS

Claudius Peters is one of the great names in German industry. Established in 1906, the Group specialises in handling, storage and processing equipment for materials such as cement, coal, alumina and gypsum. It also has an Aeronautics Division, which supplies Airbus with stringers for the wings on its aircraft. Claudius Peters' head office is in Buxtehude, near Hamburg (Germany), where the group has 45,000 square metres of factory and a state-of-the-art engineering centre. It has regional offices in Europe, America, China and South-East Asia. Claudius Peters has been a subsidiary of the UK engineering group, Langley, since 2001.



Maintenance in a cement works is crucial. The installations must be able to operate for 24 hours a day, 340 days a year. In the event of the slightest technical fault, production will stop for a week, and with temperatures as high as 1,400°C, it is two days before any repair work can begin. In addition to the problem of heat and the colossal loads involved, there is the ever-present problem of dust. "Few industrial environments can claim to be so extreme," says Thomas Staak, Group Manager Equipment Design at Claudius Peters.



NEW OIL LUBRICATION SYSTEM

In 2008, NTN-SNR developed a new bearing system for the hammer crusher on Claudius Peters' latest clinker cooler model, the η -Cooler (see box). This bearing has a closed-loop oil lubrication system, which simplifies maintenance. "Before that, the bearings on the crusher were lubricated with grease. The grease was exposed to dust, it had to be constantly applied, and the accumulation of grease on the bearing outlets had to be removed regularly," explains Thomas Staak.

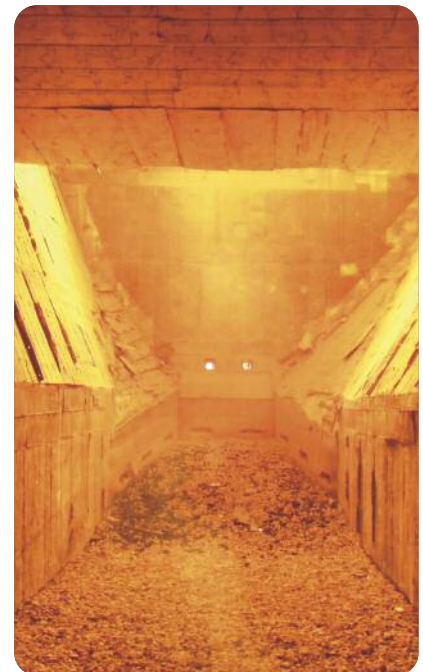
The new system took several months to develop. On the first installations, oil leaks appeared on the drive shaft shortly after the equipment went into service. NTN-SNR

Experts & Tools then improved the bearings' leak resistance by adding a second segmented felt sealing ring to each housing. But further work was needed. In late 2010, a team from the Experts & Tools Department visited Claudius Peters' Engineering Centre in Buxtehude (Hamburg) to perform some bench tests. Their investigation revealed that the felt rings used to seal the bearings were shrinking due to the effect of the heat – reaching 130°C inside the bearing. So NTN-SNR's Engineers worked on a new solution. "We decided to mount one continuous felt seal ring, for dust protection from the environment, and one radial seal to prevent oil leaks. The tension of felt sealing ring onto the shaft was reduced and in addition, we added a special grease chamber fed by a single-point grease lubricator at the point of contact with the drive shaft," explains Marc Eicke.

After more than 300 hours of testing, the solution demonstrated perfect leak resistance, and NTN-SNR supplied Claudius Peters with a kit, containing the bearing and its new sealing system. This kit will be installed at two cement works in Egypt and at the TPCC site in Tanzania, with the assistance of NTN-SNR's teams. "Our collaboration has been growing over the last few years," Thomas Staak is keen to point out, "and we are counting on their expertise to develop new innovative products in the future".

η -Cooler: a new generation clinker cooler

As a supplier to the cement industry for over a century, Claudius Peters has developed numerous innovative solutions for clinker coolers, such as the hydraulic drive in 1975 and the roller crusher in 1979. It made a new breakthrough in the early 2000s, with the development of the η -Cooler (pronounced ETA Cooler), which incorporates a new transport system, comprising several parallel lines that can move forwards and backwards independently of one another, to best manage the clinker cooling process. Its modular structure also enables the η -Cooler to adapt to any number of configurations, and to offer a capacity of 1,000 to 13,000 tonnes of clinker per day. NTN-SNR supplies three types of bearing for this model: for the roller crusher, the hammer crusher and the transport system. The clinker cooler plays an important role in a cement works, by distributing and cooling the clinker from the kiln outlet, and transporting it to the crusher. There are currently more than 600 Claudius Peters clinker coolers in service around the world.





NTN-SNR HAS GREAT AMBITIONS FOR LINEAR GUIDANCE

NTN-SNR's Linear Motion Division is launching a range of linear guidance systems in Europe, offering one of the most comprehensive product lines on the market.

From moving a car chassis on an assembly line to positioning a component on a circuit board, the variety of industrial needs for linear guidance systems is infinite. Marketed throughout the whole of Europe since 2010, the NTN-SNR Linear Motion range, covers most of these applications. The range consists of four product lines, each containing hundreds of references, and includes: linear guides, linear modules, ball screws and ball bushings. Any of these products can be combined to design coherent and integrated solutions to serve all the demands of industry. Better still – they can also be customised on request.

NTN-SNR has been involved in linear technologies since 1985 and owns and uses around thirty patents in the area of rail linear guidance. The Linear Motion range includes conventional rail guides (BGX) and solutions with ball chains (BGC), which are capable of faster movement and have longer lubrication intervals. Standard rails offered are from 15 to 55 millimetres in diameter. "The main features of this range are its outstanding reliability and reduced noise level," says Ulrich Gimpel, who is responsible

for the Linear Motion range.

Since 1992, NTN-SNR has also been one of the pioneers of linear modules, components that are now seeing great success on the market. Its AXC and AXS range are built around semi-open aluminium profiles with cross-sections of between 40 and 460 millimetres. The range is completed by the double AXDL modules, which allow two rectilinear guides to be assembled in parallel within a closed section. "This offers new possibilities in the area of automation," says U.Gimpel.

CUSTOMISED PRODUCTS

The variety of drive (synchronous belt or ball screw) and guide options (roller or caged ball) guarantees an extensive range of possibilities. "Depending on the chosen configuration, a system can either achieve a speed of over 10 metres per second, transport loads weighing over a tonne, or position a component with a precision of 5 hundredths of a millimetre," according to U.Gimpel.

These two product lines are completed by a wide range of ball screws, with an external diameter of 4 to 80 millimetres and, in the last few months, a range of ball bushings with an internal diameter of 3 to 80 millimetres.

The Engineering Department at the Linear Motion Division's head office in Bielefeld (Germany) is available to provide support to customers and partners in the deployment,



assembly and maintenance of its guidance solutions. The Department can also customise products to cater for the specific needs of certain industries, and Linear Motion Engineers are available to visit customers to provide the perfect solution to their requirements. "Our customized solutions can be used in severe environments, such as clean rooms, food processing plants and medical laboratories," says the German Engineer.

A LEADING SUPPLIER

The sale of these products was originally targeted at Germany, where around 40% of the European market is concentrated due to the high level of industrialisation. With NTN and SNR joining forces in 2007, the Linear Motion Division now benefits from the much larger sales force throughout Europe. Linear

Motion has become an official Business Unit of NTN-SNR, and dedicated sales teams have been deployed in France, England, Italy, Spain and other countries. Partnerships have also been forged elsewhere, such as with LinMotion in the Netherlands (see box).

Faced with the market's increasing demand, NTN-SNR has significantly increased its production capacity. In addition to the Bielefeld plant, which opened in 2001 and produces linear modules, two other factories have come into operation: linear guides and ball screws are manufactured in Taiwan and ball bushings are made in Japan. Stock is still held centrally at Bielefeld to guarantee the shortest possible delivery times. "The market

needs solutions that are simple, effective and quickly available," U.Gimpel emphasises. Supported by the success of its range in Europe, the Linear Motion Division has great ambitions. It will



Our customized solutions can perform in severe environments,"

soon be extending the sale of its products to South America and Eastern Europe, which will most certainly be followed by North America and Asia. "The global market for linear guidance systems amounts to around 3.5 billion euros, barely a third of which is in Europe. We want to be a leading supplier and are giving ourselves the means to achieve this," U.Gimpel concludes.



Ulrich GIMPEL
Responsible for
the Linear Motion range

NTN celebrates 50 years IN GERMANY



On 14 July, NTN celebrated the fiftieth anniversary of its presence in Germany. The ceremony, which took place at NTN's European head office at Erkrath, near Düsseldorf, was attended by its CEO, Yasunobu Suzuki, the Director General of NTN-SNR Roulements, Didier Sepulchre

de Condé, and a large number of customers and colleagues.

NTN was one of the first Japanese bearing manufacturers to establish itself in Germany, when it opened a factory at Mettmann, near Düsseldorf, in 1961. Chosen for its ideal location in the heart of the country and the quality of its transport system, Düsseldorf is also home to Germany's third largest international airport.

The head office was originally established in the centre of Düsseldorf but it soon proved to be too small, so in 1973 it was relocated to Erkrath where it remains today.



"In 2009, our sales increased by 22%"

Specialising in linear guidance, Dutch company LinMotion, based in Veenendaal, distributes Linear Motion modules in the Netherlands. Richard Eshuis, its CEO, explains.

Why did you choose Linear Motion?

We have been working in the field of linear guidance since 1994 and our experience showed us that there was a high demand for complete systems. So in 2003, we started distributing Linear Motion modules in the Netherlands. With the AXC, AXDL and AXLT modules, you can build a pick-and-place unit in just a few hours!

How does this product range meet your customers' needs?

There are many characteristics that I could highlight. The quality of the products is very high, the range is one of the most extensive on the market, and you can choose the type of drive system. NTN-SNR also provides excellent technical support and can even customise its products. When we receive a complex request, their engineers help us find the solution that best meets the customer's needs. By the way, our slogan is "For every industrial application, we provide an individual solution with the NTN-SNR modules".

Is the range successful?

Yes, the demand for these products is increasing all the time because we are constantly finding new applications for them. In eight years, we have become one of the Netherlands' market leaders in linear modules. We estimate our market share to be between 35% and 40%. Even in 2009, at the height of the economic crisis, our sales still increased by 22%!

How would you describe your relationship with NTN-SNR?

We maintain very good relationships with the teams in Bielefeld, and the Division is a very flexible partner. We regularly visit customers together. NTN-SNR has increased its production capacity enormously in the last two years, which has meant even shorter delivery times for us. It also gives us the ability to expand. In 2010, we established ourselves in Benelux. The market there is very competitive but we have the strengths to stand out!

From the
NOBEL PRIZE
IN PHYSICS 2007

TMR:

The Next Generation of Magneto-Resistance

for Linear or Angular Speed / Position Measurement, BLDC Motor Control, Electronic Compass, Wireless Applications, ...



Focus



x10
more sensitive
than AMRs

A revolution for magnetic sensing

Our TMR technology can improve the performances of existing applications but is also opening the door to many new possibilities thanks to its:

- **Ultra low power**
100 to 1000x less than AMR, GMR or Hall, paving the way for energy harvesting & autonomous applications
- **Large air gap**
Several mm in front of a standard pole ring, e.g. for reading through a housing
- **Increased positioning tolerances**
For compensating mounting or running clearances, even at high temperatures
- **Exceptional characteristics**
Linear and bipolar measurement of magnetic field amplitude, no need of amplification and stabilizing magnet, low drift with temperature.

Partnership with :
SENSiTEC



PRIX 2010
Yves ROCARD
from the "Société Française
de Physique"



"The TMR sensor paves the way for a new generation of smarter bearings"

Ten years
of industry-research
partnership



With TMR (Tunnel Magneto-Resistive sensors), magnetic measuring technology developed in partnership with Nancy University and Sensitec, NTN-SNR signals a major new advance in the world of mechatronics, 15 years after perfecting ASB. Christophe Duret, Mechatronics innovation manager NTN-SNR, explains.

Imagine speed and position sensors that used 100 to 1,000 times less energy than current options, were easier to install, had better heat resistance and were sensitive to the slightest movement - and all at a lower cost. These are some of the - very real - possibilities which the Tunnel Magneto-Resistive sensor (TMR) offers; made-to-measure technology presented by NTN-SNR during the "Automotive meets Electronics" trade fair in Dortmund last May.

Some 15 years after SNR's ASB (Active Sensor Bearing) system, today a world standard, TMR opens vast fields of innovation in the "smart" bearings sector - and even beyond. "The applications we envisage go far further than just the instrumentation of bearings," announced Christophe Duret, Mechatronics Innovation Manager at NTN-SNR.

FROM MACHINE TOOLS TO THE AUTOMOBILE

Up until now, sensors have been built to measure the speed and the position of ball bearings through multipolar magnets mounted in the seal of the wheel bearing, as is the case in an ASB system. Tests have shown the advantages of tunnel magneto-resistive sensors in a number of industrial applications. Besides their exceptionally low power consumption which opens the doors to autonomous applications (see box below), they can also work with a wider air gap (the distance between the magnet and the sensor), which can be twice that of existing solutions. "This characteristic allows a relaxation in the positioning tolerance, makes assembly easier and reduces production costs," explained Mr Duret. The sensors also have a greater tolerance to mechanical and magnetic disturbances. Finally, they have better heat resistance which is a major advantage when used in close proximity to vehicle braking systems or combustion engines.



"We can envisage applications far beyond just the instrumentation of bearings"

Several R&D projects using these sensors have already been initiated by NTN-SNR and its partner Sensitec for industrial clients in fields such as machine tools and heavy goods vehicles. Other promising applications in the automobile industry are also envisaged, but will take a few years to come to fruition given the high qualification demands of this market. TMR is of great interest to key players who, like the NTN-SNR group, are committed to the development of electric vehicles.

Ideal for embedded applications

A TMR is composed of two conductive magnetic layers separated by an extremely fine insulating barrier (a few nanometres) which allows a "few" electrons to pass through. It is this highly-resistant barrier that gives tunnel effect sensors their low energy consumption. "A thousand times lower than an ASB sensor," notes Christophe Duret - which makes it an ideal solution for all embedded or autonomous systems (robotic, portable electronic equipment.....).

The story began in the year 2000 with the creation of a technology research team by Nancy's Henri-Poincaré University and the CNRS dedicated to the study of metallic nanostructures. Backed from the outset by SNR Roulements, this unit extended work carried out in the field of spintronics by Albert Fert, winner in 2007 of the Nobel Prize. In 2004, after a CIFRE⁽¹⁾ thesis (G. Malinowski), demonstrated the benefits of sensors using the tunnel effect compared to existing technology (notably Hall-effect sensors), SNR patented the TMR. It was to undergo new developments between 2005 and 2009 through the CAMEL (Capteur Magnétique à Effet tunnel) project as part of the ANR^{**}'s PNANO* programme supported by the Arve Industries competitiveness cluster. This fruitful dialogue between research and industry was rewarded in 2010 by the prestigious Yves Rocond prize. It led to the development and validation, in partnership with the German company Sensitec, of a new generation of sensors incorporating a TMR read-head and an innovative conditioning circuit.

⁽¹⁾ Industrial training through research convention
* Nanoscience and nanotechnology programme
^{**} National research agency

CNRS: French national centre for scientific research





Original parts guaranteed!

