

TurboNews

Magazine for Friends and Customers of BorgWarner Turbo Systems 2/01

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Editorial

TRACKING INNOVATIONS FROM ASHEVILLE TO KIRCHHEIMBOLANDEN

Future-oriented

Dear Reader,

you just received the new edition of TurboNews with many interesting news on BorgWarner Turbo Systems.

For the first time, TurboNews reports on a project of the BorgWarner group which is also of extraordinary importance for the division Turbo Systems. Innovations are a decisive factor for competitiveness both for us and our customers. BorgWarner has recognised this and established a unique innovation process about which Simon Spencer – Innovation Champion with BW – reports.

In this issue we will again present two examples for the application of our products which impressively show the efficiency of our company in the areas passenger car and commercial vehicle turbocharging. The interview includes impressions of a quickly growing market with further increasing demands. Alfred Weber, Vice President Passenger Car Turbochargers, gave this interview to the TurboNews editors.

In this issue, too, we will present one of the BW TS locations. This time, we will visit the United States, that is the BorgWarner Turbo Systems facilities in Asheville, North Carolina. This location has seen many innovations - in particular the construction of the North-American tech center which is an important step on the way to product leadership.

And finally we would like to repeat our request to send us any suggestions or comments! We are looking forward to your feedback. But now, enjoy reading!

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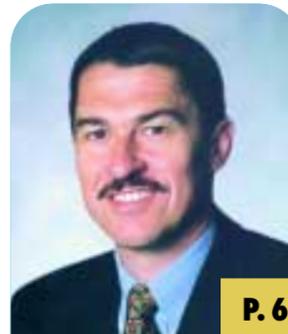
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Free-revving and très chic: the new Renault Clio Turbodiesel



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Commentary

LEE WILSON ON THE FUTURE OF BORGWARNER

Innovations are our driving force



For Lee Wilson, the innovation capability of BorgWarner is the decisive factor for a competitive edge in the future.

As many of you know, BorgWarner held a Worldwide Leadership Meeting in the first week of June, in which all executives of the BorgWarner group took part. This year's meeting included an Innovation Summit whose objective was the development of innovative product ideas to even better serve our global powertrain customers. This ongoing collaboration between otherwise independent operating divisions has already led to products such as the Dual Clutch Transmission, and will continue to ensure our continued position as a product leader.

That Innovation Summit, as well as BorgWarner's innovation process, is unique in our industry, and will be described later in this issue by Simon Spencer, our corporate Innovation Champion. We will also introduce several key individuals from various regions within Turbo Systems, who were recently recognised for their innovative contributions to Product Development, as well as Customer and Operational Excellence.

In the first six months of the year, we experienced a slight softening of the sales in North-America, along with first signs of a declining demand for commercial vehicle turbochargers in Europe.

Fortunately, our innovation capability in the segment of commercial vehicle turbochargers and passenger car turbochargers resulted in an above average growth. Thus, we will continue to be able to strengthen the foundations of our growth. Such successes demonstrate clearly that the focus on Product Leadership is the right one for our company and our industry, and that the BorgWarner innovation process is the perfect engine to drive that success.

MAN PRESENTS THE NEW 12.8L SIX-CYLINDER IN-LINE

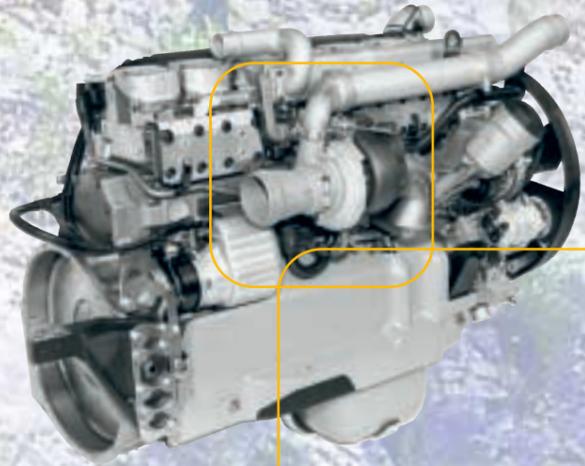
Successful on the road

For years, the perfect cooperation between MAN and BorgWarner Turbo Systems has time and again led to excellent products. The most recent example for this successful cooperation was presented at the IAA 2000 in September: A new 12.8l six-cylinder in-line engine with 375kW/510HP and a maximum torque of 2,200 Nm.

This engine, which is used in the new TG-A, is not only the flagship of the MAN fleet but also a symbol of the excellent technical competence and efficiency of BW TS. The six-cylinder is an ultra-modern engine including exhaust gas recirculation and a turbocharger K31 with waste gate. The special challenge when developing this engine was to observe the strict EURO3 standard and to simultaneously guarantee favourable fuel consumption and a further improved

dynamic performance. Thus, a turbocharger with waste gate was the preferred solution. Even at low engine speeds, the K31 guarantees rapid build-up of boost. Thanks to its excellent efficiency, it also ensures brilliant fuel consumption values. The extremely short development time from adaptation to the first series production posed a further challenge. Realisation was only made possible through the close cooperation in partnership with all staff involved from MAN and BW TS.

This powerful package with 12.8l is, however, only one of many MAN products incorporating the know-how of BW TS. MAN, e.g., purchases a large number of turbochargers from both European BW TS plants in Bradford (UK) and Kirchheimbolanden (Germany).



The new 12.8l six-cylinder in-line with powerful 375 kW / 510 HP.



Economic, environmentally-friendly and powerful – the new MAN leaves nothing to be desired.



Thanks to its torque of 2,200 Nm, even heavy-weight vehicles get going with the MAN six-cylinder.

ALFRED WEBER, VICE PRESIDENT PASSENGER CAR TURBOCHARGERS, ON THE SUCCESSFUL PAST AND THE PROMISING FUTURE OF BORGWARNER TURBO SYSTEMS.

Quo vadis turbocharger?

Alfred Weber is optimistic about the future of Turbo Systems.



Alfred Weber: The magic word for this success is "flexible production". This concept includes a comprehensive package of measures with the creative and intelligent employee at the center. Production management and skilled workers form one team which continuously improves the processes and is able to respond flexibly to the changing demands of our customers. In the past years, assembly and production have seen the consistent introduction of product- and customer-related island production. Depending on requirements, often differently structured islands were established which are oriented to varying production volumes – ranging from batch sizes of 1 to several 1,000 units per day.

The principle of satellite production is an important factor for the required capacity increases. We will further extend the core competences in the plant Kirchheimbolanden and assemble locally at the customer's in so-called "satellite plants". Thanks to this concept we will become even more flexible with regard to demand fluctuations. The first milestone of importance for this concept is our plant in Oroszlany, Hungary, which is to start production in August.

TN: Apart from the increase in the number of units, a change in product technology is to be seen. More complex products such as e.g. the VTG turbocharger or very small exhaust gas turbochargers certainly pose new challenges to various divisions?

displacement. BW is involved in almost all market launches of new engines in Europe – often even as exclusive supplier. Our KP-VTG was also successful. This year, we will increase the output to clearly above 1,000 turbochargers per day, beginning with the 4th quarter.

And in my opinion, the greatest internal success will again be in the successful balancing between capacity increase and maintenance of supply capacity. It is our supply capacity which has been one of our strengths for some years now and which is appreciated by all our customers.

TN: The rapid growth of the sales volume makes great demands on the production processes and flexibility. How did the company deal with this aspect in the past years and how does the strategy for the coming years look like?

Turbo News: The past year 2000 has been a very successful year for BW TS. In your opinion, which will be the greatest successes in the current financial year 2001, a year which had a very promising start?

Alfred Weber: In the financial year 2000 and the first six months of 2001, we were able to considerably strengthen our market position. The market introduction of the KP turbocharger was very successful and we were able to establish ourselves as second series manufacturer in the segment of VTG technology.

The KP technology provided us with a competitive edge in the class of small diesel engines from 1 to 1.5 l

These challenges lead to promising solutions for the market of tomorrow and the future. The development of electrical control systems for the VTG turbocharger and the regulated two-stage turbocharging R2S™ show how successful this cooperation is.

We want to be the future technology leader for the diesel segment – and the first choice for our customers!

TN: Turbocharging will also be more and more important for gasoline engines. Which endeavours are undertaken by BW TS as technology leader in this segment to be able to continue to offer its customers cutting-edge solutions?

Alfred Weber: The principles of the cooperation with our customers also apply to the gasoline engines. In this segment, however, we have a better starting position: we understand ourselves as market leader in Europe. With the further development of the turbocharging technology we support our customers in the innovative solutions of "downsizing". "Downsizing" means that large-volume naturally aspirated engines are replaced in the next generation by smaller, extremely powerful turbocharged engines. This necessitates a comprehensive package of measures since both fuel consumption and pollutant emissions have to be reduced dramatically. The turbocharger must withstand up to 1,050° C which requires that new materials are used. Furthermore, the problem of the cold start cycle has to be dealt with. In this respect, we are able to present a bypass turbine housing as the ideal solution. The major component of our solution approach for a downsizing system is the eBooster™, an electrically driven compressor which is an excellent complement to the turbocharger and which considerably improves the performance. As a whole, we are faced with many challenges – but we will defend our position as market leader with innovative technologies.

Alfred Weber: To be honest, it was about time that we established ourselves in the market as second series manufacturer of VTG technology. The volume will considerably increase in the next two years for several sizes. This means extensive changes in production and assembly structures. The cooperation between development and production, too, must be further intensified.

The new small turbochargers with speeds up to 280,000 rpm also pose a considerable challenge. At last, our success will depend on the cooperation between all divisions of the company.

TN: Thanks to the turbocharger, the diesel engine in passenger cars experienced a major breakthrough. Which developments are carried out by BW TS to offer its customers solutions for the future?

Alfred Weber: The close cooperation with our customers and our own



innovation capability are the key factors. Our passenger car strategy focuses on the cooperation with the development departments of our customers. We support the leading engine manufacturers in their endeavours to reduce fuel consumption and emissions and to improve dynamic and performance.

TN: Of which importance is the recently announced joint venture with Hitachi in Japan?

Alfred Weber: This information has been released only a few weeks ago and is an important milestone in the strategic development for the passenger car segment: We established a joint venture with Hitachi, the so-called Hitachi-Warner Turbo Systems, which will ensure access to the Japanese customers. Together with our locations in the USA and Europe, the establishment of a third foothold in Japan makes us a real global player.

On the one hand, the Japanese market is of utmost importance for the turbocharging technology. On the other hand, this new joint venture is a consistent response to the globalisation endeavours of our customers. Daimler-Chrysler/Mitsubishi, Ford/Mazda, GM/Isuzu or Renault/Nissan will in future develop engines for global platforms in various parts of the world. Our customers will use all resources gained through their world-wide cooperations. And to be able to continue our successful cooperation with our customers in future, we, too, have to show global presence.

We have found a good partner with Hitachi which will promote our activities in the Japanese market. First joint visits to customers have already shown very positive starts.

TN: In your opinion, what will be the main challenges for BW TS in the years to come?

Alfred Weber: The major challenge will be the continuous, successful realisation of many small individual steps: to continue to grow more rapidly than the market, to increase the market share and at the same time to achieve the results objectives. In doing so, we can earn ourselves the huge investment means we need for our growth. Because it is only by this way that we will be able to guarantee our jobs in future.

TN: Mr. Weber, thank you very much for this interview.

BORGWARNER TURBO SYSTEMS LEADING WORLD-WIDE IN NORTH CAROLINA

Excellence in any respect



The Asheville operation is one of the world's largest commercial diesel turbocharger plants.

FAST FACTS

The Asheville plant in figures:

Built	1981
Total floor space	250,000 square feet
Employees	450+
Output	350,000 diesel turbochargers/ 658,000 vibration dampers

Asheville, an important North-American location of BorgWarner Turbo Systems, is located at the heart of the beautiful Blue Ridge Mountains in North Carolina. In the past, this area has been well known for its textile industry. Today it has a diverse manufacturing and commercial base.

The Asheville plant specialises in producing commercial diesel turbochargers, turning out the S series range of products from the S100, primarily for agricultural and industrial equipment, up to the S500 for generator sets and marine applications. The facility machines all the major components and also performs final assembly and testing. The customer base for the Asheville produced turbochargers includes Caterpillar, Mack, and John Deere.

Last year, for turbocharger manufacturing, a so-called "super cell" for machining turbine housings and bearing housings was installed at the plant. This highly-automated production cell guarantees complete processing of the unmachined parts to finished parts which can be assembled without manual intervention. The quality of the parts produced is second to none.

The Asheville plant also manufactures vibration dampers for commercial diesel

and automotive applications. The damper customer base consists of International, John Deere, Saab, New Holland, and Caterpillar. The damper group is a leader in elastomer technology and vibration control.

Sales, application engineering and product development groups for North American customers are located in Asheville and Indianapolis, Indiana. By year-end all of this staff will be consolidated on the Asheville campus, making Asheville the North American center of expertise for all aspects of engine boosting. In close cooperation with colleagues in Kirchheimbolanden, Asheville supports and advises North American customers in connection with commercial diesel turbocharging.

The Asheville plant is QS 9000 certified. Continuous improvement is a top priority and is carried out by teams as part of daily activities. The Asheville plant has received the John Deere Supplier of the Year award, the Achieving Excellence Partner Status award and various other customer certifications.

This year, Asheville hosted the annual BorgWarner's Worldwide Leadership Meeting where 100 of its key executives from 13 countries gathered to discuss corporate strategy.

Motivated teams are the backbone of production.



Gary Bergman, plant manager at Asheville, and Karl Walther, VP Integration and project manager Tech Center, at the first cut of the spade for the new Tech Center.

TURBO SYSTEMS IS BUILDING A NEW TECH CENTER IN ASHEVILLE

Concentrated competence

Anybody desiring to lead in the booming North-American turbocharger market must be able to respond quickly to the demands of the customers. BorgWarner Turbo Systems is able to do this – and this is to be ensured in future, too, thanks to a new tech center. Directly at the production location in Asheville, a state-of-the-art facility of more than 2,000 sqm will be built for the growing turbocharger market in North-America.

completed at the end of 2001, and further highly-qualified staff will be recruited for design and development in Asheville.

James Verrier, Vice President and General Manager of BW TS North-America



The new tech center will replace its predecessor at the location in Indianapolis. At the same time, the facility in Asheville will supplement the recently established technology center in Kirchheimbolanden which is the worldwide BW TS competence center for the development of passenger car and commercial vehicle turbochargers. Both centers together form the backbone of BW TS turbocharger development on a global level. The tech center in Asheville will be equipped with test banks for turbochargers, engines and engine systems.

summarises the benefits: "Upon completion of this tech center, the departments of development, production and sales and application of BW TS North-America will be grouped under one roof. This will maximise productivity and ensure that the company gets closer to the markets."

Employees from Indianapolis will be re-located to this center, which is to be



The new super cells are a further steps towards the future.



KIRCHHEIMBOLANDEN RECEIVES ENVIRONMENT CERTIFICATE AFTER THOROUGH PREPARATION

It takes time to do a DIN well

Tanja Schmidt, environment representative, and the winners of the environment sweepstakes.



For years, "environment-friendly" has been an important key word in the automotive industry's advertisements. The fact that this is much more than merely a lip-service to Borg Warner Turbo Systems, was proven by the location Kirchheim-

bolanden in March 2001 with the certification pursuant to DIN EN ISO 14001 – also in the interest of the customers for whom an ecological sense of responsibility is of the same importance as quality.

Based on the environment management system introduced, the company is fundamentally obliged to avoid negative effects on the environment. In addition, the location wants to continuously improve its ecological performance. When preparing the environment management system, first of all, all activities at the location Kirchheimbolanden relevant to the environment were examined and evaluated. On the basis of the data collected, standards in production, maintenance, purchase, and development could then be improved. The company's employees were also informed on and trained in the subject 'protection of the environment at the workplace'. "Efficient operational environment protection is only feasible with motivated and well-trained employees. We are therefore also promoting the environment awareness

of all employees through special motivation programs", said Tanja Schmidt, environment representative of 3K-Warner and overall in charge of the introduction and realisation of the program.

An environmentally friendly company policy of course includes the economical use of raw and process materials as well as energy and water. Residual and waste material, too, have to be recycled or disposed of in an environmentally compatible way.

In this respect, the effects on all areas of the environment are continuously recorded. 3K-Warner regularly verifies the realisation of statutory environmental regulations and reviews the observance of environmental objectives. In order to be able to guarantee that the location achieves its objectives, an environment representative was appointed. The management thus emphasises again that all employees are obliged to realise and live this environmental policy day by day.

The introduction of environment management is accompanied by comprehensive training measures and posters and further campaigns.



TS INTRODUCES RADIO SYSTEM FOR 146 CNC MACHINES

Remote-controlled

With the ultra-modern radio DNC system for CNC machines, BW TS saves hundreds of thousands of DM annually.



The CNC programming of production machines has long since established itself as modern and economic production concept. The fact that continuous improvements and related changes in organisation and processes in the Kirchheimbolanden plant are necessary, results in continuous re-positioning or re-grouping of machines. This re-location of machines would, however, be subject to a lot of trouble if traditional DNC concepts via wiring would be used.

In the past, profitability analyses thus favoured a program transfer via floppy disk. And this despite the fact that DNC would long have led to an improved process cycle. Michael Renett, work scheduler for commercial vehicles, states: "The DNC link has long since been a matter of discussion in our division. Approximately three years ago, a cost comparison was made which showed that the program transfer via floppy disk is by far more economic."

In 2000, the subject was again discussed at Kirchheimbolanden. New DNC systems with radio transmission proved to be an interesting solution option. Michael Renett, who promoted and managed the introduction of radio terminals, was convinced of the benefits of the DNC systems as compared to the floppy disk solution: "For one, the machine operator saves a lot of time because collecting the floppy disk from the toolshop takes several minutes. Now, he just requests the desired CNC program from the CNC machines and the server automatically sends this program to the machine."

Further saving potentials result from process planning. In the past, a program folder was prepared which contained a floppy disk with the CNC program, the uncoded text and tool sheets. The folder was archived in the toolshop and had to be collected when needed. The employees then downloaded the program to the machine and later returned the program folder to the toolshop. If the machine operator made changes to

the program, the folder had to be returned by the toolshop to the work scheduler who in turn entered the changes into the computer. Then, a new hardcopy was printed and the folder was returned to the toolshop.

BW TS used approximately 6,500 programs last year. Michael Renett knows from his own experience: "The tedious handling has been a permanent cause for trouble. This problem was finally solved by using the DNC link. If an employee makes changes in the CNC program at the machine, he sends the program back to the server in a directory for optimised CNC programs. We then compare it with the original and decide whether the change is to be used in future. Furthermore, we saved the entire administration for the toolshop."

In mid-November, the radio DNC system was ordered for all 146 CNC machines and was installed completely by Christmas.



Michael Renett and Thomas Oppmann from the supplier of the DNC technology in front of a CNC machine with radio system.



BW TS BRAZIL SUPPLIES TO IVECO ENGINE PRODUCTION IN SOUTH AMERICA

Campinas revs up

The long cooperation between Iveco Sofim and BW TS in Europe is now broadened by a supply agreement for turbochargers for the Iveco engine production in South America.

The Fiat Ducato cuts an excellent figure in any situation.



The Fiat 2.8l diesel engine is charged using a K14 turbocharger by BorgWarner.



An enthusiastic announcement was made at the factory, about our new contract with Iveco. The turbocharger K14 for the 2.8 l DI-diesel engine used in DUCATO and DAILY vans will be produced in Campinas and sent to the engine plant in Sete Lagoas at Minas Gerais state.

According to José Rubens Roque, Manufacturing Manager and responsible for the introduction of the K series in production, this new turbocharger represents a boost at Campinas operations, as well as the consolidation of the K series in Brazil. The forecasted yearly production is of 25,000 turbochargers.

THE KP35 GETS THE NEW RENAULT TURBODIESEL GOING

Small, light-weight, powerful!

The increasing demand for engines with favourable fuel consumption due to the markedly increased fuel prices also led to a considerable increase in the sales of diesel passenger cars. The automotive industry is now increasingly developing powerful diesel engines with low fuel consumption for smaller cars to meet the demand for small cars. Following this trend, Renault launched a completely new direct-injection diesel engine used e.g. in the Clio.

All K9K engines are produced in Valladolid, Spain, and are available in two versions. Renault offers a 48kW version without charge-air-cooler and a maximum torque of 160 Nm at 2,000 rpm. The customers may also choose a more powerful version with charge-air-cooler, 60 kW and a maximum torque of 185 Nm at 2,000 rpm. Both aggregates are characterised by their high torque value - and low consumption. They are equipped with a turbocharger KP35 with waste gate and will initially be used in the Renault cars Clio and Kangoo.

Simultaneous to the introduction of the new K9K engine of Renault, a four-cylinder 1.5l Common-Rail turbodiesel, BorgWarner Turbo Systems presented a further size of the market-leading turbocharger family KP. Renault chose BorgWarner Turbo Systems as exclusive supplier for the entire engine family K9K which again demonstrates that BW TS's KP series is the market leader in the segment of small diesel engines.

Apart from its excellent thermodynamic properties, the KP35 convinces above all because of its compact design and low weight of only 2.6kg. Together with the KP31 which is used in the Smart CDI engine, this engine further demonstrates the competitiveness of the new KP series which was especially designed for the demands of the new small diesel engines.



The highlight of the new K9K is the industry-leading technology of the KP35 turbocharger by BW TS.



FROM INNOVATION PROCESS TO PRODUCT LEADERSHIP

Thinking is the better part of valour

The claim of BorgWarner to product leadership is clearly oriented to maximum customer benefit. This means that BW wants to be known by both its customers and its customers' customers as the company with the most advanced powertrain solutions in the automotive industry. This is a significant challenge for us.

To do this we must surface ideas faster, screen the best ideas from all the others, and move to develop those ideas with speed and quality. To do this each team member must be involved; from understanding market opportunities and new technologies to generating great powertrain ideas to building, testing and delivering those ideas to the market.

We have identified innovation as one of our five strategic areas of focus. We know that our industry demands not only continually updated components, but also totally new components and systems. We have put in place an Innovation Board to guide our development of a robust innovation process and a set of tools and techniques to support that process. The focus is to move from ideas to results with as much speed and attention to quality as possible.

We define innovation as the tangible and intentional result (product or process) from which we and our shareholders derive value. The purpose of innovation is business value; bringing the value into being is the process of innovation. To support all of us in this we have developed an intentional business innovation process that can improve our ability to generate results.

BorgWarner has an ambitious innovation agenda

We have set an ambitious growth target. We will see this growth through our existing products as well as through new, yet to be defined products and service.

At BW our agenda will drive us to:

- Implement and consistently improve BW's innovation process in line with the product leadership proposition to profitably grow the business through innovation
- Identify and evaluate global market opportunities that lead to appropriate products and innovative solutions
- Ensure continuous invention of new products and renewal of existing products and core technologies
- Allow us to quickly bring to market new products and applications that meet or exceed customer needs
- Continuously monitor and improve the innovation process
- Discover best practices of other product leadership companies and continually infuse them in BW's process where appropriate
- Design an innovation infrastructure and establish implementation plans



The role of Simon Spencer, "Innovation Champion" at BorgWarner

An Innovation Champion with BW has many tasks. The champion provides leadership and support to the Innovation Board and manages

the end-to-end innovation process. He defines criteria and process stages and monitors their compliance. In order to develop innovations in a market-oriented way, the Innovation Champion is in constant contact with various BorgWarner councils such as e.g. Marketing & Sales or Technology.

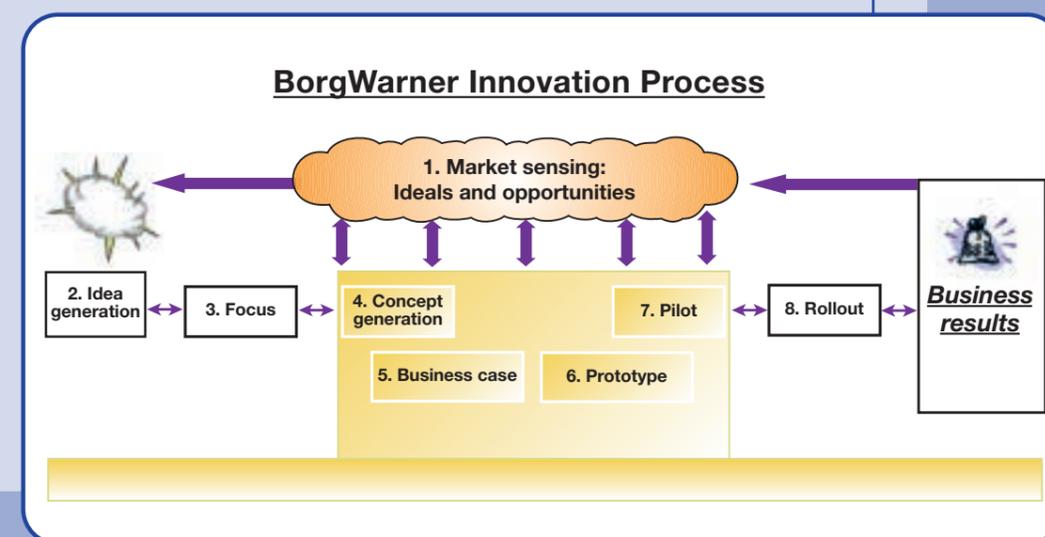
A further important task is the monitoring of the various cultures within BorgWarner, the innovation management has to consider. Simon Spencer furthermore promotes the "innovation spirit" in all companies of the BorgWarner group, supports any innovation activities and provides direction to project teams. He provides priorities and organises internal or external support. And finally, Simon Spencer is taking care of cross-business opportunities and their realisation.



The Innovation Process

At BW we have developed an innovation process (see diagram) that is a closed loop from Market Sensing to Business Results and back again. Each step in the process contains a set of activities that are supported by functional units and tools and techniques.

The key thing about Innovation at BorgWarner is to create new ideas and turn them into business results. We have a great track record of doing this. Watch out to see what we focus on, and how we bring these products to market!



TURBO SYSTEMS AGAIN SUCCESSFUL AT
BW INNOVATION AWARDS

And the winner is ...



At the this year's Innovation Awards, the staff at Turbo Systems made an excellent impression.

This year's Worldwide Leadership Meeting of BorgWarner took place in Asheville, USA, on 6th and 7th July. On the occasion of this meeting of top managers of all divisions, the Innovation Awards for excellent achievements in customer management, product development, and production optimisation were awarded.



Many employees from Kirchheimbolanden belonged to the winners of this year.

As was the case in the past years, Turbo Systems was again very successful. The following employees were awarded prizes for their excellent performance:

Product development titanium compressor wheel

Dave Decker, Indianapolis
Jaroslav Kierat, Kibo

Product development eBooster™

Cathrin Bergner, Kibo
Manuela Döbel, Kibo
Dr. Stefan Münz, Kibo

Product development noise test

Bernd Bienroth, Kibo
Thomas Fitting, Kibo
Helmut Stöner, Kibo

Customer management VW

Holger Gabriel, Kibo
Constantina Keller, Kibo
Andreas Kopietz, Kibo
Siegfried Ritter, Kibo
Thomas Romboy, Kibo
Edeltraud Wahl, Kibo

Customer management John Deere

Dave Morrow, Indianapolis

BW TS thus emphasises the claim to world-wide product leadership which is to be further strengthened with such excellent performances.

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