The latest news from the Rheinmetall Group 3/2006

NEWSLINE

Stock market

Especially in recent years stockholders have benefited positively from the excellent performance of the Rheinmetall group (pages 5 – 8).

Networked

The airportable light armored 120mm mortar vehicle based on Wiesel 2 is the heart of the new Airborne Mortar Combat System (p.10+11).

EGR cooler

Pierburg has developed a new EGR cooler module. Series-production of the efficient system is to start soon (details on pages 14 + 15).

Elrob 2006: Technologies

Less risks with robots

Hammelburg/Düsseldorf. Robots help reduce risks. In May 2006, the training grounds of the GE infantry school at Hammelburg in Northern Bavaria served as a meeting point and test area for advanced robotic systems. More than 30 companies and universities from eight European nations presented state-of-the-art technologies at the first European Land Robot Trial (Elrob) staged by the German armed forces and FGAN (Research Establishment for Applied Science) – mostly with a view to military application potential. Düsseldorf-based Rheinmetall Defence with systems from its subsidiaries Rheinmetall Landsysteme (RLS), Rheinmetall Defence Electronics (RDE) and telerob provided by far the most comprehensive and wide-ranging vehicle presentation.

The US military has been using robotic systems for military purposes (e.g. in Afghanistan and Irak) for some time now. Small remotely-operated vehicles are e.g. driven along risky or suspicious roads to look for and neutralize explosives. Elrob has for the first time given suppliers the chance to present their latest technologies and the military application potential of robotics to possible users. Organizers and observers agreed that Elrob has given participants the chance to demonstrate possible mission scenarios for the armed forces in Europe, practically under live conditions.

One of the major suppliers participating in the event at Hammelburg was

(Continued on page 2)

Photo: Angela Blattner

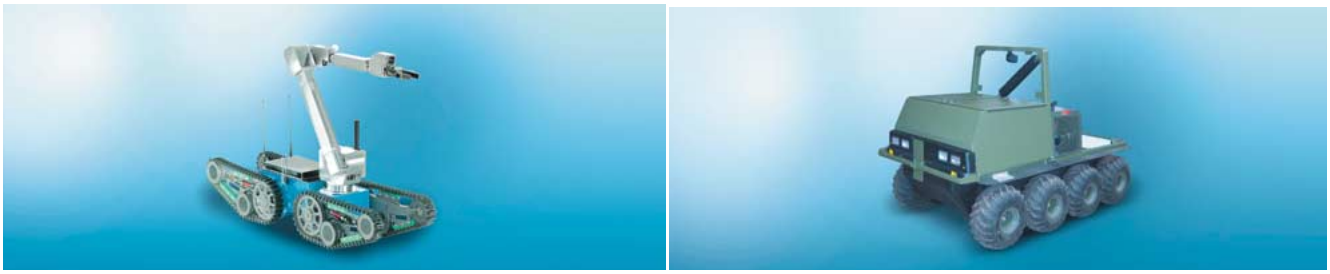
WIDESPREAD EXPERTISE: Numerous premieres presented at the Eurosatory 2006 in Paris once again confirmed Rheinmetall Defence's leading position as a European land systems supplier. Several thousand visitors including the French Defence Minister Michèle Alliot-Marie (2nd left) were impressed by the many different system innovations and high-tech products with which Rheinmetall demonstrated its competence as a systems company and supplier of complete solutions. Pictured here: Michèle Alliot-Marie on her tour of the Rheinmetall stand, accompanied by Rheinmetall CEO Klaus Eberhard (r) and Dr. Daniel Berger (l), acting as Eurosatory stand sales manager for the duration of the exhibition, in his main profession Vice President Sales for Europe and North America at Oerlikon Contraves AG in Zurich (further details on the Eurosatory 2006 on Newsline 12–13).

Royal Air Force orders ammunition

London/Düsseldorf. The British armed forces have awarded Rheinmetall a € 24 million contract for 244,000 rounds of aircraft ammunition. Earmarked for the Royal Air Force's Tornado fighter aircraft the ammunition will be used for training and combat operations alike. It will be delivered in series during the period 2008-2010.

Completed as a proprietary development and containing no explosives, Rheinmetall's FAP (frangible armor piercing) round is a highly effective new multipurpose round for modern military aircraft. The UK order represents a breakthrough in the international market, and is certain to attract the notice of other Tornado, Eurofighter and Gripen user nations.

The 27mm x145 FAP round is specially designed for use in the Rheinmetall BK 27 aircraft cannon. Suitable for air-to-ground and air-to-air operations, FAP rounds enable effective engagement of contemporary modern armored air and ground targets.



Rheinmetall technology for hazardous missions: Unlike competitor systems, the new EOD robot telemax (photo right) developed by telerob combines the performance characteristics of large robots with the mobility of small systems. Developed by Rheinmetall Landsysteme: The Smover concept implemented in the Trobot (Tactical Robot) – an 8x8 vehicle of the one-ton class with multi-mission capability – is designed for equipping conventional tactical vehicles for hybrid, i.e. manual or unmanned, operations.

Rheinmetall Defence at the Elrob 2006: Technology for hazardous missions

Robots help to reduce the risks

(Continued from page 1)

Rheinmetall Defence. The Düsseldorf-based group – which is also the German center of competence for UAV technology – has been actively involved in EOD (Explosive Ordnance Device) robotic activities for some time now. System development work currently has its main focus on reducing the risk to personnel in high-risk missions.

Of the suppliers participating in the event, Rheinmetall presented by far the widest range of systems. RLS presented its Trobot vehicle with multi-mission capability and the Wiesel 2 Digital serving as command and control station for the Quattrocopter (aerial reconnaissance), and the new telemax robotic system developed by the Rheinmetall subsidiary telerob. Kiel-based RLS presented a Caracal (belonging to the family of armored command and multipurpose vehicles) equipped with a driving robot. Additionally, telerob from Ostfildern showed its successful tEODor robot which is already deployed in numerous countries. Bremen-based RDE showed its mobile reconnaissance robot Foxbot. The demonstrations on the four prepared courses (UXO and IED = unexploded ordnance and improvised explosive devices; urban and non-urban) met with considerable interest on the part of government officials and military representatives.

telerob sales manager Christian Herbst was pleased with the performance of the new telemax robot: "The younger sibling of our successful tEODor robot was the only vehicle to demonstrate its capabilities on all four courses (UXO, IED, urban and non-urban). Representatives of the German military and other armed forces (e.g. from the Netherlands) were highly impressed by the functional capabilities of the system used to neutralize explosives; the advantages of the TCP manipulator control were particularly notable."

telerob Fernhantierungsgesellschaft from Ostfildern demonstrated that remotely operated robotic systems can be put to other uses besides the neutralization of explosives. Christian Herbst: "Looking at the medium to long term future, I think we will broaden our market base in this area." Incidentally, the German Ministry of the Interior recently placed an order for six telemax robotic systems.

Commenting on the successful Elrob premiere, Dr. Hermann Grosch, head of the product department Technologies at Rheinmetall Landsysteme GmbH (RLS) in Unterlüß noted: "Our Trobot vehicle in which the so-called Smover concept has been implemented for the first time (see also Newsline article "Substitution systems for high-risk missions") has demonstrated that robotics must be seen as an additional retrofit capability in this context. The vehicle can naturally still be used as a conventional manned vehicle, and Trobot will be used in the unmanned mode only when necessary for tactical reasons. This is an important advantage over special vehicles which can only be used in the robotic role and therefore require considerable logistic support."

Grosch adds that the Elrob presentation also showed that robotic applications are not limited to unmanned driving. "Robotics should also take account of mission equipment – this being a crucial part of the Smover concept. This also explains why the paratroops have expressed a particular interest in the basic Trobot vehicle, a Centaur from the Canadian manufacturer ODG (Ontario Drive & Gear of New Hamburg, Ontario), which has been converted by RLS: the vehicle has excellent terrain capabilities, can be dropped with a parachute and can float. Grosch: "The reactions to the four-day event in Hammelburg have prompted us to investigate whether it would make sense to market the system as an independent product in the near future."

The mobile reconnaissance robot Foxbot developed by RDE gave an impressive demonstration of its capabilities. RDE robotics expert Dr. Klaus-Peter points out: "Our system gave a successful demonstration both on the urban and the non-urban course, and the feedback from military observers was very good. Representatives from the German MoD, the contracting agency BWB, the Army Office and Army Schools were extremely impressed by the state-of-the-art featured." Developed under contract to the BWB, Foxbot is a mobile robotic system designed for use from the Fennek reconnaissance vehicle. The system was recently delivered to the Munster Armor School for test purposes (s. pages 3+24).

NEWSLINE

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Substitution systems for high-risk missions

Robots can serve as an intelligent substitute for personnel in high-risk or extremely exhausting missions. Unmanned systems provide a standoff capability that significantly improves the protection and survivability of troops, and widens the operational scope of the modern military.

Robotics are already used widely for aviation and underwater applications. Many of the world's armed forces deploy unmanned air vehicles (UAVs) and autonomous underwater vehicles (AUVs), and efforts are now in full swing to identify future defence and security applications for unmanned ground vehicles (UGVs), of which only very few matured systems are already in service.

The EOD (Explosive Ordnance Disposal) robot is one example of a technologically mature robotic land system. Used to detect and neutralize unexploded ordnance and explosive devices, the robotic systems developed by the Rheinmetall Defence subsidiary telerob Gesellschaft für Fernhantierungstechnik mbH are already successfully deployed on the market. The technology employed provides an excellent platform for the ongoing development of unmanned land-based systems. Some of the systems presented at the Elrob 2006 land robot trial are highlighted below:

★ The mobile robot Foxbot is a small radio-controlled robot featuring semi-autonomous capabilities giving additional support for optical and acoustic reconnaissance operations. The separate wireless transmission of data, command signals and video images allows vehicle command within a radius of 1 km. Thanks to the individual transmission of images, Foxbot can be controlled even in skip zones.

The reconnaissance variant of Foxbot features optronic sensors allowing day and night vision. These can be elevated to a height of 120 cm above the ground and can be swiveled by 360°. For acoustic reconnaissance, Foxbot can be equipped with an integrated antenna for locating and tracking noises. The robot also has a stereo acoustic capability. By virtue of its modular design, Foxbot offers multi-mission capabilities, so that it can also be used in an NBC role.

Substitution systems from Rheinmetall Defence for high-risk missions: Trobot with the integrated Smover concept and the radio-controlled Foxbot from RDE, Bremen.

★ Unlike competitor systems, the EOD robot telemax combines the performance characteristics of large robots with the mobility of small systems. It is small enough to operate in underground train carriages, buses or aircraft yet large enough to effectively neutralize suspicious items in the overhead luggage bins of all modern aircraft.

It is the first vehicle of its size to feature a four-track running gear, giving it extraordinary mobility. Gradients of 45° and ditches measuring up to half a meter in width are no obstacle to this robot. telemax is the only EOD robot currently available to be equipped with a "tool center point".

The German Ministry of the Interior ordered six new telemax robotic systems.

★ Rheinmetall Defence's Smover concept (Smart Maneuvering of Vehicles by Robotics) implemented in the Trobot (Tactical Robot) – an 8x8 vehicle in the one-ton class with multi-mission capability – is designed for equipping conventional tactical vehicles for hybrid operations (i.e. manual or unmanned). Trobot can be equipped with mission modules for transport tasks, for use as a weapons carrier, for reconnaissance purposes, NBC analysis or medical task.

The applications are multifaceted: Vehicles equipped with Smover technology can be used as unmanned reconnaissance or weapons platforms, as recovery vehicles in critical areas or in an NBC reconnaissance role. Another important application is the remote control of the command vehicle of a convoy from a vehicle traveling further behind it.

The vehicle can be quickly converted to unmanned operation by switching over to the integrated robotics function. The vehicle – including its reconnaissance and weapon systems – is then controlled from a command console via a wireless link. If necessary, autonomous driving along a preprogrammed route is likewise possible. Obstacles are detected automatically in this case.

The robotics retrofit kit is based on tried-and-tested sensors already used in very small robots. A standard commercial off-the-shelf PC performs tasks like signal evaluation, algorithm calculation and system control. A laptop, handheld or pocket PC can be used as control console for the system.

Successful overall qualification of the Pierburg group

“Drive” optimizes process landscape

Neuss. A central team at Pierburg has set itself the task of enhancing and standardizing the group’s business process at all its sites across the globe. 23 members of the automotive supplier already met for their first kick-off meeting last summer. Carsten Werheit, one of the team members notes: “By creating uniform processes, the project aims to reduce redundancies and increase the transparency of processes at all Pierburg plants in order to establish common standards by cooperation. When we first started to analyze the situation last summer we found that central processes were not uniformly defined as a result of which coordination efforts were higher.”

A brief review: To meet and secure the strategic and operational objectives of Pierburg’s new mission, Pierburg launched its “Drive” project (Newsline 2/2005). At the same time, the group’s new and efficient business unit structure enabled Pierburg to enhance its market- and customer-oriented focus on the market. The balance between the units was achieved by a carefully tailored matrix organization. The main aim of the “Drive in Processes” sub-project was to introduce a common project management in order to allow effective communication and cooperation. The ultimate result was to serve as a common model for the entire group.

Composing: René Dahlmanns

The process applied was as follows: Initially, so-called key-users (process modelers) and the team leader were chosen. The entire team consisting of 43 people set itself the task of analyzing the situation at the individual plants and in the technical units. This sub-project was given top priority because process management is the link between strategy and operational processes.

A lot has happened since the early days of the project in the summer of 2005. Project activities commenced with so-called road shows staged at all Pierburg plants. These aimed to give all employees the same information, providing a communication and discussion forum where the “Drive in Processes” and solutions already implemented were presented, potentials were shown and – what was particularly important – questions raised by employees were answered. Additionally, a process modeling and training manual was prepared.

One essential element of “Drive in Processes” is the process modeling tool Mega. This software instrument shows all the process sequences of all departments in flow charts with their related responsibilities, the linked documents and the data and information flow. This has made the processes transparent, and interfaces/sequences can be improved where appropriate. Werheit: “We felt it was important that all employees should be able to find themselves in the process model; this is achieved by the software which is based on a simple principle much like the Internet.” Pierburg employees can access the information in seven languages. This guarantees the same level of information around the world. One positive side-effect of the “Drive in Processes” project has been the certification which has since taken place. Carsten Werheit: “Right from the start, we sought to introduce a uniform project management and to meet the standard 16949.”

Margitta Zapke, the “Drive in Processes” project member responsible for the overall organization and performance of the audits and certification explains: “The first complete certification of the Pierburg group (consisting of eleven plants and ten central departments in Neuss) according to the international quality standard ISO/TS 16949:2002 by the TÜV Rheinland was the first step toward harmonizing and enhancing Pierburg’s processes, and cooperation between plants worldwide and the central departments in Neuss. The overall certification was possible thanks to the dedication of all involved, especially as the target date was brought forward to reduce cost. TÜV auditors Martin Zimmermann and Peter Strompen subjected the processes and interfaces to a thorough review during their audit of Pierburg plants and central departments.”

Findings made are now being evaluated and analyzed in order to make maximum use of many locally applied concepts throughout the group. “The results of the international audit were presented to the management board and plant managers at the Plant Manager Quality Meetings on June 13, 2006. The results of the overall certification will now help to optimize the Pierburg process landscape. For instance, the necessary standardization of internal audits that will be achieved by introduction of a common audit management system in SAP at all sites.”

What are the next steps of the “Drive in Processes” project? In the second step, a simplified and comprehensive system of key indicators will be defined. Although a number of such indicators already exist today these are not yet fully interlinked so that only certain areas can be measured with their help. Carsten Werheit points out: “Once we have revised and unified our system of key indicators, we will link these to the processes in order to be able to control our targets more easily and clearly in future. After all, it is only possible to improve something that can be measured.”

Although there is still a lot of work to do, the Neuss-based automotive supplier has already achieved a good deal. Overall project manager Dr. Karl Wübbeke is full of praise: “The team and all the others involved in the “Drive in Processes” project have done a fantastic job in the last year – and they have managed to do this on top of their normal work. Project weaknesses have been identified and discussed at length. The new, distinctly improved processes will help us to make a big step toward our objective of Business Excellence in all areas of the group.”

Patricia Machura

Focus rouses investor interest

Rheinmetall stock was first listed on the stock exchange on November 14, 1894. Ever since then the Düsseldorf-based group has secured funds for its investments and other activities from the capital market. As in the early days of its existence, the group's stock (of currently 36 million shares) is in free float, the majority of stockholders in 2006 being institutional investors.

Especially in recent years stockholders have benefited positively from the excellent performance of the group thanks largely to the consistently strong focus on the two core sectors Defence and Automotive which has resulted in an impressive rise in the price of Rheinmetall stock. The increase in dividend to 90 cents approved at the stockholders' meeting on May 9, 2006 is just one further sign of the success of Rheinmetall business operations. Although the situation at the beginning of 2000 (just six years ago) was anything but easy: In the 1990s Rheinmetall like many other companies had diversified extensively and consisted of five business units.

This relatively broad spread of activities made the group less attractive (conglomerate discount). At the beginning of the 21st century, new economy equity (keyword: new market) was in demand. By contrast, companies of the so-called old economy of which Rheinmetall with its classical product portfolio was a member were rated as old-fashioned and were therefore considered less attractive. Investors showed low interest in Rheinmetall stock and the market price had developed accordingly. The same was true for stock market capitalization, being the value of a company at the stock exchange (measured as the product of the market price times the number of shares distributed).

In early 2000, the executive board of Rheinmteall AG initiated its Clear Directions strategy, signaling a radical change in direction with the following main objectives: concentration on core areas of work, strengthening earning power and profitability, and reduction of debt. The group has undergone a fundamental change with this strong focus: the concentration on its core sectors Defence and Automotive, a massive reduction in debt over the last few years, optimized balance sheet structures and the successful improvement in operating performance have had and continue to have a positive effect on analysts and investors.

Simultaneously Rheinmetall has improved regular reporting on business developments by e.g. publishing quarterly reports. Open communication aimed at improving transparency is also underlined by road shows and telephone conferences for stock analysts. All of this has had a positive effect since the awareness of Rheinmetall on the stock market has improved markedly. More and more analysts are publishing studies and assessments of Rheinmetall, institutional investors have displayed an increasing interest in discussions and subsequent capital commitments. Two further events have enhanced the attractiveness of Rheinmetall stock for institutional investors even further: the rise in the number of shares in free float following the placement of Röchling stock on the market in November 2004, and the creation of only one category of stock in May 2005.

★ Following the complete divestment of the majority shareholding of the long-standing shareholder – the Röchling family – the distribution of Rheinmetall stock price nearly doubled. Overall, 15.2 million shares (stock majority of 42.1%) changed ownership and have been held by numerous institutional investors since that time. This has led to a fundamental change of stockholder structure: stock is distributed more broadly and has been internationalized. With 8% of stock held by private shareholders and 21% by institutional stockholders in Germany, the share of institutional investors from abroad amounts to 61%.

★ In May 2005 Rheinmetall converted 18 million non-voting shares into voting stock. Since the index of the German stock exchange only takes into account one type of stock and the free float, this had two positive effects on Rheinmetall stock: firstly, all 36 million shares of the group are included in the calculation for the MDax and not just the preferred stock (as in the past). Secondly, 100% of stock is in free float, so that the stock has a much higher weighting in the MDax. Additionally, trade liquidity has been raised substantially. At the end of 2005, the market capitalization that is of relevance to the index amounted to around 1.9 billion euros, this being much higher than the year-earlier value of 0.7 billion euros.

The higher market capitalization and improved liquidity of stock has lastingly consolidated the group's position on the MDax. In terms of market capitalization, Rheinmetall ranked 11th at the end of 2005 (27th in 2004) and in terms of trading volume it was 18th (compared to 28th in the previous year).

The market price showed an equally positive development. With preferred stock rising by 55% and common stock by 63% in 2004 alone, Rheinmetall AG was able to continue the dynamic upward trend in 2005. Starting at a level of 39,10 euros at the end of 2004, common stock continued to rise in value to 53,26 euros by the end of 2005.

The positive development in market price has been assisted by the professional Investor Relations support at Rheinmetall.

To satisfy the need for adequate information on the capital market, the executive board and IR managers keep interested parties informed about business developments, the current situation and strategies, targets and results of the group at conferences and road shows at home and abroad.

The success of the IR activities is also underlined by the coverage by analysts. Nearly all important brokers in Germany have Rheinmetall on their research list. The growing number of foreign institutes observing and analyzing Rheinmetall stock is particularly pleasing. Analysts of the renowned investment bank Goldman Sachs recently (in March 2006) rated Rheinmetall equity as "outperform", setting the price target at 77 euros.

"Business policy must be understood"

Düsseldorf. The recent initiation of coverage by the investment bank Goldman Sachs shows that analysts think Rheinmetall stock offers considerable potential. It also underlines the ongoing interest of the capital market in the development of Rheinmetall. These two facts influence the work of Rheinmetall's Investor Relations (IR team), especially as the growing interest of analysts and fund managers has raised the demand for information and also the expectations of actors on the financial markets. These requirements clearly need to be satisfied – while the question of how the Rheinmetall group can meet these expectations in future likewise needs to be answered. Newsline met Franz-Bernd Reich, Investor Relations manager at Rheinmetall AG to find out more about the IR activity. Since joining Rheinmetall in 2000, the 46 year-old IR expect whose hobbies include the opera and history has witnessed the sharp rise in value of Rheinmetall stock to an all-time high.

Newsline: Can you explain the tasks and objectives of Investor Relations?

Reich: *The task of an Investor Relations department is to look after the relations between a business and its stockholders. Depending on the stockholding structure, one main focus is on so-called institutional investors – in other words fund managers, investment managers and insurance companies – while stock analysts working for banks and brokers whose opinions directly influence investor decisions to buy or sell stock are equally important.*

Newsline: And how would you define the role of IR activities in terms of accounting?

Reich: *One could say that IR teams deal with the equity capital whereas borrowed capital is generally taken care of by the treasury management.*

Newsline: Which instruments and measures do you employ to reach the objectives outlined?

Reich: *The most important instrument is direct communication with analysts and investors. Talks with institutional investors are often – but not always – held at investor conferences or so-called road shows. The conferences for investors are generally staged by banks whereas we ourselves organize the conferences for analysts.*

Newsline: How often do such meetings take place?

Reich: *To give you an idea of the importance of these contacts: in 2005 Rheinmetall held around 330 meetings with this group of persons, including 15 road shows and 11 investor conferences.*

Newsline: Another significant event in this context …

Reich: *… is naturally the annual stockholders' meeting during which the executive board delivers its report on the past fiscal and stockholders vote on important resolutions. IR work naturally also includes the relevant documentation such as annual and interim reports as well as specific presentations in which the IR team is involved.*

Newsline: What is the distinguishing feature of IR work?

Reich: *First and foremost this is a good and successful business policy, but this alone will not suffice. The business policy has to be understood by the capital market. And this is where IR comes into it. Stockholders must be assured that their money is well invested.*

Newsline: So put in a nutshell it would be fair so say…

Reich: *… that a badly managed business will not succeed on the market in the long term even if it has a good IR team. A well managed company with a bad IR team will not be as successful as it could be. Good Investor Relations help to answer questions investors may have so that they can then weigh up the chances and risks of a company correctly – in line with the returns they expect from their investments.*

Newsline: What exactly do you tell your clients?

Reich: *In practice we find that investor interests vary greatly. Some may wish to hear more about the chances of success of our products on their respective markets. Others may want to find out more about our figures and request in-depth information about our balance-sheet and profit-and-loss accounts. Others again are more interested in possible investments or divestments.*

One important task for us is to study the many different activities in the Rheinmetall group with a view to their relevance on Investor Relations. Moreover, we need to collate all the information so that we can give stockholders short and detailed answers to their questions.

Newsline: What does an IR manager do on a normal working day?

Reich: *A normal day is determined by the activities already outlined. We talk to analysts and investors and receive questions from them. We also spend a lot of time preparing for road shows and conferences, or collecting data for company presentations and analyst conferences.*

Newsline: Your team …

Reich: *…collates the relevant information on business processes so that this can be used for discussions with experts. In other words, we spend time preparing presentation documents and answering a whole variety of different questions.*

Newsline: As to the answers supplied. Are any individuals or groups given preferential treatment?

Reich: *Definitely not! One of our fundamental rules is that everyone should be given the same treatment, meaning that any stockholder is given the same answer to the same question. None of our investors should be at an advantage or disadvantage on grounds of the information supplied. Anything else would be a serious infringement of capital market legislation.*

If important circumstances or events so require – i.e. anything having a possible impact on our market price – we are obliged to communicate important information by way of ad-hoc notifications. This is done by simultaneously informing our most important partners in the capital market through a standardized notification controlled by the Federal Banking Authority (BaFin).

Newsline: What qualifications, capabilities and expertise does an IR manager need to have?

Reich: *German companies started employing IR experts from the early nineties onwards, so that there was no common qualification program for this activity before then. Consequently, the qualifications leading to this type of job in our group vary greatly.*

(Continued on page 7)

“Business policy must be understood”

(Continued from page 6)

Newsline: You yourself studied economics, graduated in 1985 and then went on to work for renowned banks like DZ Bank and Dresdner Bank.

Reich: *Yes, extensive business management know-how – especially finance, accounting and in-depth understanding of the capital market – is essential for an IR manager. Added to this, IR experts have to be sufficiently flexible to adapt to new and very specific subjects. On account of the growing number of rules and regulations, we often also have to understand legal aspects of our work.*

Newsline: What about foreign languages?

Reich: *An excellent command of the English language is vital as many of our investors come from abroad and most of our discussions are held in English. Furthermore, most of the reports, sales notes, morning comments and other studies by analysts are written in English.*

Newsline: What about an „insight“ into our own workings?

Reich: *One of our main tasks is naturally also to deal thoroughly with the products of our group and its different subsidiaries. This is especially important when the products vary significantly as in the case of Rheinmetall whose portfolio ranges from exhaust gas recirculation valves, plain bearings, pistons and engine blocks to armored infantry fighting vehicles, fire control systems and Ahead ammunition.*

Newsline: What do you find fascinating about your job?

Reich: *To observe and be involved in the successful management of a major corporate group. The job is multifaceted with a host of different intellectual and practical challenges. What I find particularly interesting is that all the activities of a group are ultimately identified and quantified by key figures and tailored exactly towards the attainment of certain earnings targets. I am fascinated by the way these targets are reached with different products on different markets and hence with very different business models.*

Newsline: What would you say is typical of your profession and what is specific to Rheinmetall?

Reich: *The close cooperation with the executive board and ongoing talks with various stockholders and target groups are typical elements of the IR profession. This naturally involves a lot of traveling including regular trips to different cities like London, Frankfurt, New York, Boston, Paris, Zurich or Stockholm in order to meet important investors.*

Newsline: When did Rheinmetall first introduce Investor Relations?

Reich: *Up to the late 1990s, Investor Relations were far less important than today; this will have been similar in other companies. Besides, Rheinmetall only had a relatively small number of institutional investors alongside the major shareholder Röchling. In those days, cooperation with analysts was more important, and their findings were quoted in the media much more frequently than nowadays. Analysts were regarded as “journalists of the banks”. As a result, IR tasks were carried out by the PR team.*

Newsline: How are you organized today?

Reich: *An Investor Relations department within the central communication unit was first created in 2000. In those days, IR was looked after by just one person. In 2004 the team was expanded to include Franka Schielke and Rosalinde Schulte beside myself so that we now have three full-time persons dealing with this activity. Information processing is facilitated by the fact that we are part of the communication unit, thus ensuring that the communicate with one voice outside company.*

Photo: Danetzki + Weidner – Composing: frei-stil

A lot of people equate the stock market with a crystal ball and magical power. In fact, it has nothing at all to do with this, as jokingly indicated by Rheinmetall’s IR team consisting of Franka Schielke (l), Franz-Bernd Reich (management) and Rosalinde Schulte (r). Investor Relations is a strategic management function aimed at supplying the capital market with reliable information on the objectives, business strategy, market environment, past and future business developments and also future perspectives for the company. IR experts aren’t clairvoyants but are part of a clear-cut business function. They act as the information and communication interface between the company management on the one hand, and investors, analysts and small shareholders on the other hand. It is their job to make sure that the policies and performance of their company are understood on the capital market – because this will convince stockholders.

Free float of stock then and now

Düsseldorf. On April 13, 1889, representatives of renowned German banks and wealthy individuals announced to a notary public that they had founded "a stock company under the name of Rheinische Metallwaaren- und Maschinenfabrik". They paid in a sum of 700,000 Reichsmarks, the biggest chunk of stock worth 224,000 marks being held by the Berlin bank C. Schlesinger-Trier & Cie. Other major stockholders were the engineer Richard Quitmann, the two Frankfurt banks Erlanger & Söhne and Gebr. Sülzbach, and Heinrich Ehrhardt.

On November 14, 1894, Rheinmetall stock was for the first time officially listed at the Berlin stock exchange. Capital has been increased on various occasions since then, notably also in 1903 when the Düsseldorf-based bank Trinkaus joined the group of stockholders, raising capital stock to 9.3 million marks. Even then none of the stockholders held more than 20% of the stock capital in Rheinmetall.

This changed in 1909 when the major competitor from Essen – the steel casting works Fried. Krupp AG – acquired a 40% stake in Rheinmetall. With the German Reich, Rheinmetall then had a majority stakeholder for the first time: by way of a capital increase the government-owned Vereinigte Industrieanlagen AG (VIAG) acquired a 51% stake in Rheimetall, ousting Krupp out of its leadership role. Krupp thereupon shed the greater part of its stock capital in the 1930s.

During World War II, German stock corporation law gradually became null and void under the national socialist regime and free stock trade with Rheinmetall Borsig AG stock (as the company was called from 1936 onwards) was largely prohibited. The Reich Ministry of Economy laid down the stock price and forbade stockholder meetings from 1944 onwards. The company's last annual report from that period was published in 1940 and the last (unpublished) annual report dates back to the year 1943. The German Reich has secured complete control over the entire group by law.

When official stock trading recommenced in September 1949, Rheinmetall-Borsig stock was listed in Frankfurt and Berlin, and was classified with six percent of the nominal value in line with the percentage quotation common at that time. The 51.8% stockholding of the German Reich held by trustees of the western allies was taken over by the German government through the German bank for aviation. In 1956, the government handed over its majority shareholding to the Röchling family.

Source: archives of Victoria Versicherungen

Berlin, corner Friedrichstrasse – Unter den Linden in 1894, the year when the Rheinmetall stock was first officially listed on the Berlin stock exchange. The annual stockholders' meetings of Rheinmetall AG have been held in Berlin since 1932.

Manufacture for the German armed forces and NATO members as well as diversification into non-military activities led to a continual rise in stock price. Successes have confirmed Rheinmetall business policy to be on the right track: for the first time since 1943, a six percent dividend was again distributed for fiscal 1960. In subsequent years, the capital which had been converted from 75 million Reichmarks to 15 million deutsche marks on June 21, 1948, as a result of the currency reform was repeatedly increased: in 1967 to 37.5 million marks in order to strengthen the capital of the defence subsidiary Rheinmetall GmbH; in 1972 to 60 million marks to expand packaging and forming capacities in the civil sector; in 1980 to 90 million primarily for the purchase of Jagenberg AG. In 1984 Rheinmetall issued preferred stock in the amount of 45 million marks for the first time, one part being as employee stock leading to a further capital increase to 135 million marks. The most recent rise was in 1998 when capital was raised to the current level of 180 million marks or 92 million euros.

With the arrival of the 21st century, the group introduced sweeping changes to its structure in order to make the Rheinmetall share which had reached an all-time low of seven euros more attractive not only for private and institutional investors but also for the Röchling family. The capital market rewarded Rheinmetall's successful reorientation to only two sectors (Defence and Automotive) with a steep rise in stock price. The departure of the former stockholders – the Röchling family – at the end of 2004 and the broad distribution of capital at the stock exchange caused the stock price to rise even further, so that nominal and preferred stock reached record values.

The broad distribution of stock capital then made it possible to combine the two stock types – common and preferred – at the stockholders' meeting in May 2005 and to give each share the same voting rights. This meant that the share of voting stock in public float was doubled from 18 to 36 million and increased stock trading considerably. The ongoing rise in share price raised the market capitalization of Rheinmetall stock; moreover, the Rheinmetall stock in the German MDax with a free float of 100 percent is now weighted much more strongly than before the combination of stock types.

Dr. Christian Leitzbach

Kolbenschmidt is GM's 2005 Supplier

KS Kolbenschmidt GmbH was named as a General Motors Supplier of the Year for its overall business performance in providing GM with world-class parts and services. The award was recently given at GM's Vehicle Engineering Center at the General Motors Technical Center in Warren, Michigan. "We consider KS Kolbenschmidt to be a role model for all suppliers. They are recognized as a GM Supplier of the Year because they exceeded our expectations in 2005," said Bo Andersson, vice president of Global Purchasing and Supply Chain. "KS Kolbenschmidt is one of the best in the world and we thank them for their hard work and commitment to helping make GM vehicles the best in the world." Rainer Fluhr, chief executive officer of KS Kolbenschmidt: "Together with my colleagues at KS Kolbenschmidt we are proud of having been nominated once again as one of GM's Global Suppliers of the Year for 2005. We achieved this prestigious award as a result of our innovative technology and high production quality that was accomplished through a major commitment from everyone at the piston division of Kolbenschmidt Pierburg. Our business philosophy to be successful is to offer innovative products, outstanding quality and absolute customer satisfaction." The GM Supplier of the Year award began as a global program in 1992. Winners are selected by a global team of executives from purchasing, engineering, manufacturing and logistics who base their decisions on supplier performance in quality, service, technology and price. This year, General Motors honored 85 suppliers for their outstanding performance throughout 2005. An international auto industry vendor with over 30 locations in Europe, North and South America, Japan and China, the Kolbenschmidt Pierburg group generates annual sales in the region of € 2.05 billion. Across the world employees develop and produce components, systems and modules for every aspect of the engine. Kolbenschmidt Pierburg is a subsidiary of Rheinmetall AG. The company has approximately 11,700 employees at its five automotive divisions. The KS Pistons division develops, builds and markets pistons for internal combustion engines in autos, commercial vehicles, ships, stationary engines as well as small-bore pistons for a variety of applications.

Kolbenschmidt Pierburg under the bonnet: the new Cadillac BLS from General Motors.

Group sales rose by 13 percent in first quarter

Group gets off to a good start in 2006

Berlin/Düsseldorf. Rheinmetall got off to a good start in 2006 and, with its two corporate sectors Automotive and Defence performing well, is continuing last year's progress. As announced by Rheinmetall chairman Klaus Eberhardt at the group's annual stockholders' conference on May 9, 2006, in Berlin, group sales were boosted by 13% to € 852 million in the first quarter of 2006 (compared with € 756 million in the related year-earlier period).

For the first three months of 2006 and at € 34 million, the Rheinmetall group's EBIT was slightly above that of the first quarter of 2005 (€ 33 million). Combined with a net interest expense lowered by € 1 million, EBT was lifted from € 21 million to € 23 million. The group's net income advanced by € 4 million to € 17 million, this in turn leading to a significant rise in earnings per share, rising to € 0.45 in the first quarter of 2006 following € 0.31 in the related period last year.

Compared to 2005, the Automotive sector increased its 3-month sales by around 15 percent to a commendable € 564 million, well above market growth. Automotive's EBIT for the first quarter added up to € 32 million, thus repeating the high year-earlier level despite partly difficult market conditions. By rigorously focusing on emission reduction, diesel engine technology, and the use of lightweight materials, Rheinmetall Automotive has made sure that it can largely benefit from global car-making trends in future, too.

In a weak first quarter – typical of this industry – Defence managed to boost sales to € 286 million, up by around 10 percent compared to the year-earlier period. With its products for improved mobility, networking, reconnaissance and enhanced protection of soldiers, Rheinmetall Defence is benefiting from the modernization needs of the armed forces in Germany and within NATO.

At € 3 million, Defence's EBIT outperformed the comparable figure for 2005 by € 2 million. This encouraging development is attributable to added sales and a more competitive cost structure.

Addressing some 260 stockholders and stockholder representatives in the Maritim Hotel Berlin, Rheinmetall chairman Eberhardt noted that the successful start into 2006 reflects the profit-oriented performance of the group. "Rheinmetall's strategic focus on growth and earnings has been confirmed by business developments in the first quarter of 2006. Thanks to this sound growth, we have managed to assert ourselves very well in spite of a partly difficult environment and we have achieved good progress in our two corporate sectors."

New Wiesel-based reconnaissance and combat unit

Networked mission command

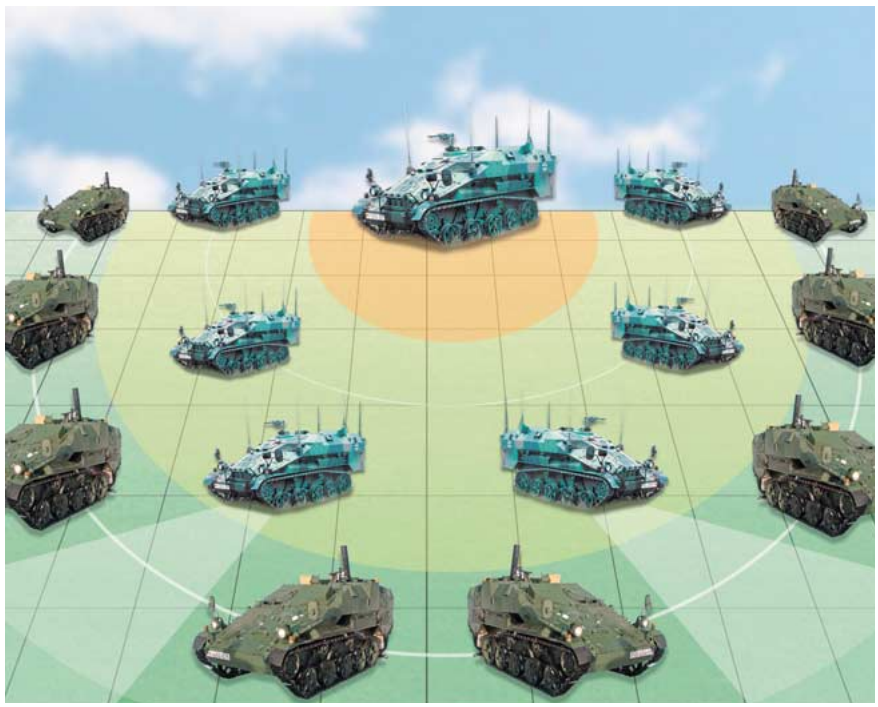
Kiel. The airportable light armored 120mm mortar vehicle based on the Wiesel 2 is the weapon carrier and hence also the heart of the Airborne Mortar Combat System consisting of various Wiesel units. Small in size with a low silhouette, extremely mobile but nevertheless capable of long mission durations, the armored mortar vehicle is operated in reconnaissance and combat networks that are interconnected by modern technologies.

By virtue of its integrated observation equipment (high-definition daylight camera and thermal imager of the third generation combined in one housing), the Forward Observer (FO) Wiesel is capable of reconnoitering targets independently and radioing target coordinates and target images to the command vehicle of the Airborne Mortar Combat System where the crews of the company C2 vehicle, platoon vehicle and fire control vehicle then jointly determine the further course of action for the mortar troops.

The networked mission command structure ensures that command vehicles which are likely to be in different places and operating independently of one another are constantly in contact and can continually exchange important mission data. The command and information system of the army establishes the connection between the mortar combat unit and higher-level command echelons, supplying information that is crucial for effective combat operations to the units.

This is where, for instance, the self-generated reconnaissance data are exchanged and compared with results from external sources to the benefit of both; the correlation of as many different sensors as possible is vital for the relevance and up-to-datedness of tactical data. The system network – in effect, the eyes, ears and brain of the armored mortar – continuously supplies the latter with the latest mission data, allowing the immediate and flexible adjustment to changing threats and situations.

While the actual mortar system waits for its mission orders from a safe hiding place, the "network" judges the situation, keeps in touch with the higher command echelons and, based on its information superiority, prepares a comprehensive assessment of the tactical situation as the basis for further combat.



Composing: René Dahlmanns

RLS has developed the airmobile reconnaissance and combat unit Wiesel 2 – composed of six different airportable Wiesel 2 variants – for the infantry. For the first time, Rheinmetall is now offering a complete weapon system worldwide capable of being transported by helicopter or aircraft, ranging from the forward observer vehicle (2nd row from bottom, 2nd vehicle from left) and forward air controller (2nd row from bottom, 2nd vehicle from right), to the company C2 vehicle (top center), the platoon leader and fire control vehicles (left and right of C2 vehicle) through to the actual Airborne Mortar Combat System (being the eight vehicles on the outer circumference).

When the time is right, the mortar Wiesel receives its mission orders from the command and weapons control system, relocates to its fire position and engages the designated target with the correct ammunition. On account of its speed, the vehicle will have left its fire position and returned to its hideout even before the first rounds have reached the hostile position (hide, hit, run, hide) – an invaluable advantage for survival.

Photo: WTD 91 Meppen

Tested in Yuma: Wiesel mortar vehicle.

To support surgical operations where maximum precision is essential to avoid collateral damage, the Wiesel vehicle operating as Forward Observer to reconnoiter and verify targets can be equipped with an additional laser target marker. Operating jointly with the system network, the vehicle then serves as a Forward Air Controller (FAC) to illuminate high-quality assets for the use of laser-guided munitions of the air force and navy.

The airportable reconnaissance and combat unit generally known as the Airborne Mortar Combat System is more than just a unit designed to enhance the effectiveness of the mortar system. It is a system network offering the high mobility required for future mission scenarios, short dwell times in fire positions, networked operations command and the ability to perform and assist joint operations of the different military services. **Frank Rogge**

Wiesel-2 based mortar vehicle undergoes hardness tests

Weapon carrier for airportable units

Yuma/Älvdalen/Unterlüß. A 120mm mortar that is armored but can nevertheless be transported with a CH53 helicopter – this is the heart of the light armored mortar vehicle which Rheinmetall Landsysteme GmbH (RLS) has developed on the basis of the Wiesel 2. The armored vehicle is the weapon carrier of a new, advanced reconnaissance and combat network for infantry units composed of six different airportable Wiesel 2 variants and has been designed by RLS.

For the first time, Rheinmetall is offering a complete weapon system – ranging from the forward observer vehicle, the company C2 vehicle, the fire control and platoon leader vehicles and the forward air controller to the actual mortar combat system – capable of being transported by helicopter or aircraft. Based on the proven technology of the versatile Wiesel 2 vehicle family, and using its flexibility and mobility, this advanced Airborne Mortar Combat System enhances the effectiveness of airportable troops significantly.

The centerpiece of the combat unit – the new Wiesel mortar vehicle – was subjected to extreme heat tests in the desert of Arizona last summer. Between January and March 2006, an RLS team then accompanied the modern weapon system to Sweden where cold tests were performed. Both test series carried out at temperature ranging from -32°C to +48°C served to demonstrate the vehicle's suitability for operation under extreme climatic conditions.

The gun developed by technicians of Rheinmetall Waffe Munition GmbH for the Wiesel mortar vehicle is a 120mm muzzle loading weapon with a new type of ammunition developed by Rheinmetall, offering a range of up to 8 kilometers. Not only conventional ammunition (HE) but also IR fog and illumination rounds can be fired from the vehicle, and such ammunition can be provided with a programmable fuze in future.

The armoring, NBC protected ventilation system, advanced system technology and also relatively high speed of the Wiesel mortar vehicle capable of traveling at speeds up to 70 kph (for safety reasons limited to 50 kph when operated in "civilian" mode) all afford maximum protection to the crew.

The combat process is largely automated: target coordinates are transmitted digitally to the mortar while the fire position is being approached; only the actual charging process is performed manually. The system computer of the mortar vehicle computes weapon laying. When the grenade has been fired, the gun tube retracts into its loading position in less than two seconds, a hatch opens automatically and the gunner reloads the weapon.

The crew of three (two less than common in the M113 mortar system so far used by the German armed forces) does not have to leave the vehicle and can fire up to three rounds in less than 20 seconds from a fully protected compartment. Since the position of the vehicle changes slightly on account of the recoil force, weapon laying is automatically re-computed after each shot in preparation of the next round. The high firing rate of the mortar allows the crew to fire more grenades and then to leave the position even before the grenades have hit their target. The vehicle is long gone before it can be engaged by hostile forces.

The weight of the new Wiesel is relatively low. Indeed, the installation of the weapon system presented quite a challenge to the engineers of RLS. In the end, experts actually managed to integrate a gun with up to 25 ton recoil force in the lightweight, airportable Wiesel 2.

Cord-Jürgen Dammann, head of product management for lightweight weapon carriers, is convinced the new armored mortar vehicle has a promising future as underlined by the great interest of US military in the Arizona tests. The heat tests in the summer of 2005 were followed by cold tests in the Swedisch Älvdalen region earlier this year.

As an essential part of the Airborne Mortar Combat System, the Wiesel mortar vehicle demonstrated its capabilities during the tests in Yuma and Älvdalen. These tests also served to verify the serviceability of the fire control system at extreme angles and the effects of dust, heat and cold on the electronic components and precision mechanics of the vehicle. Other vehicles such as the forward observer Wiesel are to follow, thus continuing the success story of the already 400 delivered Wiesel systems. The highly mobile vehicle will be used as a mortar gun carrier for the very first time, literally allowing the infantry to take off into the air.

Christian Thalheimer

Photo: Wehrtechnische Dienststelle 91 - Meppen

In the summer of 2005 the new Wiesel mortar vehicle –one of the most important elements of the new reconnaissance and combat unit designed by Rheinmetall Landsysteme GmbH (RLS) on the basis of the Wiesel 2 vehicle – was exposed to extreme heat tests in the desert of Arizona. Between January and March this year, an RLS team then accompanied the modern weapon system to Sweden where cold tests were performed.

Newsline

Pacemaker for modernization of armed forces

Rheinmetall impressively underlined its position as a leading supplier of ground forces equipment with numerous technological highlights and world premieres at the Eurosatory in Paris (June 12 to 16, 2006). Dr. Daniel Berger, acting as Eurosatory stand sales manager for the duration of the exhibition, in his main profession Vice President Sales for Europe and North America at Oerlikon Contraves AG in Zurich, concluded that the exhibition was a full success: "Numerous novelties and a convincing range of subjects impressed the many visitors at Rheinmetall's stand and attracted high-ranking delegations from practically all the relevant customer countries. We succeeded in presenting the high-tech products and capabilities of Rheinmetall as a systems company and supplier of complete solutions." Like many other official political and military representatives from numerous nations around the world, French Defence Minister Michèle Alliot-Marie had accepted the invitation from Rheinmetall's executive board to find out more about the latest solutions conceived by the defence systems specialist to meet future military requirements. More than 40 delegations were counted at the stand on the second day alone!

The trend is away from heavy armored battle tanks toward lighter, highly mobile and networked systems – as reflected by the changed needs of the armed forces and the industrial activities presented at the Eurosatory at Villepinte outside Paris.

The subjects chosen for the exhibition underlined the group's determination to drive the modernization of the armed forces with advanced products and technologies. Protection in operation, network-enabled capabilities, air defence and equipment for highly mobile rapid reaction forces and for the soldier of the future were the main areas covered by Rheinmetall's convincing system solutions.

The armored vehicles on show were particularly impressive. The Gefas protected vehicle system presented by Rheinmetall Defence was a unique world premiere. Gefas is based on a revolutionary development concept: focusing strongly on crew protection, the versatility and flexibility of the vehicle are unrivaled. By virtue of its modularity, a whole range of different variants are conceivable (the version presented in Paris was for convoy protection). Unveiled on day one of the exhibition, the full-scale model was one of the main attractions at the Eurosatory. The reaction of visitors was so positive that Rheinmetall Landsysteme has decided to build the first prototype as early as 2007.

The highly mobile, airportable reconnaissance and combat unit Wiesel 2 with light armored mortar – likewise based on the Wiesel 2 – was another world premiere at the Eurosatory. This unique networked solution from Rheinmetall Defence is an entirely new concept developed in response to the growing importance of international conflict management missions.

The light mission vehicle Tokeh from Rheinmetall is a feasibility study for an innovative and versatile product tailored specifically to the needs of military airborne and special forces. The advanced vehicle system from Rheinmetall Landsysteme GmbH is a trendsetter. Tokeh is Rheinmetall's answer to the changed needs of the military in terms of rapid reaction forces and their new transport helicopter, the NH90. The new vehicle with its folding windscreen and roll-bar as well as height-adjustable chassis is the only system of its type that can be transported in the NH90.

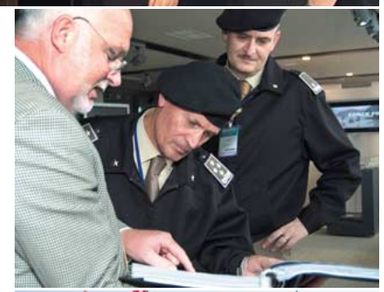
The new Puma armored infantry fighting vehicle first presented to international experts on May 2, 2006, on the occasion of the 50th anniversary celebrations of the army in Munster satisfies the military demand for high strategic and tactical mobility coupled with maximum protection and outstanding combat power. The vehicle allows troops to react appropriately and flexibly to challenges at any time and with the intensity needed.

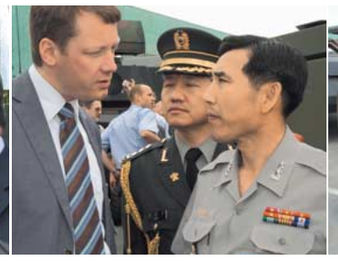
Rheinmetall's Canadian subsidiary Oerlikon Contraves Canada presented a prototype of its MMEV system (Multi-Mission Effect Vehicles) for the very first time. The Canadian armed forces have chosen the system to replace the existing ADATS air defence systems, existing LAV III vehicles of the Canadian forces serving as carrier platform. MMEV is to combine the capability of fighting ground and airborne targets in a modern platform and is to have a range of rocket types – self target-seeking or laser-guided. Operated in conjunction with an ultramodern X-Tar 3D radar, likewise from Rheinmetall, and advanced sensor technology, long-range reconnaissance and air surveillance will be possible using existing reconnaissance and command systems. 22 such systems are to be procured.

NEC (Network Enabled Capabilities) was another important activity presented in Paris. Visitors were shown not only the Battle Management System for air defence from Oerlikon Contraves but also the NEC lab from Rheinmetall Defence Electronics GmbH (RDE). Sensors, effectors and command and support systems of various levels are interconnected to a network by the appropriate IT infrastructure. Such networks are vital for interoperability and multi-national operational command structures.

So-called IEDs (Improved Explosive Devices) are among the most lethal devices used by terrorists and extremists and pose a serious threat to soldiers in mission areas. In the past, there was no effective protection against IEDs. Rheinmetall Waffe Munition (RWM) offers a mobile HPEM system (High Power Electromagnetics) with which IEDs can be triggered from a safe distance or their remote fuses immobilized by radio or mobile telephone. Rheinmetall has developed a modular protection concept for vehicles. This can be integrated in doors, bonnets or roof structures, or can be retrofitted. The system produces an electromagnetic protection zone around the vehicle or in a system network around a whole convoy. The threat from remotely controlled IEDs is reduced significantly for HPEM-protected vehicles.

Numerous other exhibits at the Rheinmetall stand emphasized the group's ability to enhance the robustness and combat power of the military and to afford maximum protection to its personnel. Rheinmetall is the leading European supplier for ground forces, be it with the powerful robotic systems Telemax or Teodor from the robotic specialist telerob, the armored vehicle Yak and Caracal, the modernized Skyguard 3 fire control system or the wide range of solutions for the medium and large caliber range and the related munitions.





Photos (20): Angela Blattner

Intelligent design allows effective NOx reduction

Series-production of new EGR cooler is to start soon

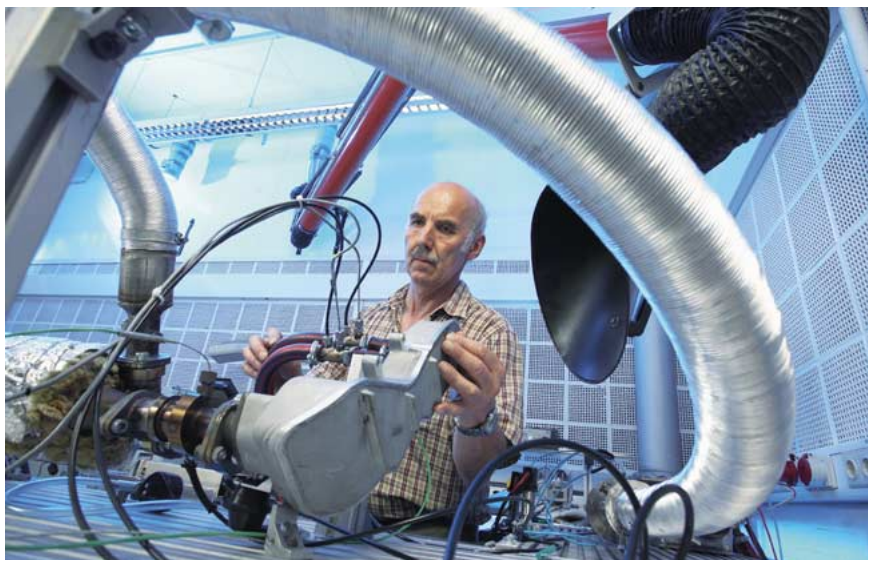
Neuss. Increasingly stringent exhaust emission requirements call for enhanced pollution reduction strategies. For diesel engines, this refers largely to further reductions in nitrogen oxides (NOx). Cooled exhaust gas recirculation is an important process helping to meet these requirements. Ultimately, the recirculation of cooled exhaust gas can reduce NOx emissions significantly (see also article "Cooled exhaust gas").

In order to meet present and future emission regulations – and based on the wealth of experience in the development and manufacture of exhaust gas recirculation systems – Pierburg Neuss has developed an EGR cooler module enabling the control of the EGR mass and the EGR temperature through selective cooling. The EGR cooler is a new development and is scheduled for series-production in 2007.

Using its extensive experience in emission reduction techniques, Pierburg's development team headed by project leader Hans-Ulrich Kühnel – and the team members Hans-Jürgen Hüsges, Uwe Rothuysen, Michael Sanders, Günter Thiel, Dr. Oliver Thomer and Dieter Thönneßen – has developed a new aluminum EGR cooler for diesel engines. Driven by its increased cooling capability, this product innovation provides a new form of exhaust gas circulation system using lamellar ribs. What makes this design so special? The new cooler concept is suitable both for high- and low-pressure systems and, subject to appropriate engine design, can be directly integrated in the intake manifold .

The cooler is made from die-cast aluminum. It transfers the heat from the redirected exhaust gas to the coolant. Depending on the engine operating point, it reduces the temperature of the exhaust gas by more than 600°C, thus helping not only to decrease the combustion temperature but also – as a consequence – to reduce the overall NOx emissions.

In the past, coolers were generally manufactured by special, complex welded steel constructions such that the production costs have been relatively high. Aluminum coolers are significantly less expensive than steel constructions. Hans-Ulrich Kühnel, head of the development department, points out: "Another advantage of aluminum is that its thermal conductivity is much higher than that of steel. Whereas stainless steel has a thermal conductivity of 14.7 W/mK (watt per meter/ Kelvin), the related value for die-cast aluminum is approx. 180 W/mK, i.e. about 12 times higher. The excellent thermal conductivity of aluminum allows high cooling performance even when overall design space is very limited."



Photos (2): Michael Rennertz

Test routine at the cooler test stand : test stand mechanic Günter Thiel shown here making the preparations for performance measurements on the die-cast aluminum EGR cooler. The sophisticated design of this unit allows the introduction of up to 800°C hot exhaust gas which is then cooled down to around 180°C.

The innovative lamellar rib design reduces the cooler sooting effect significantly, therefore it guarantees full cooler performance throughout its lifetime. "The special shape of the flow channel containing a lamellar rib structure is ideal because constant turbulent mixing of the exhaust gas is enforced by the interruptions. It directly prevents sooting, enables convective heat exchange by the roll-up of the boundary layer and allows material, pressure and heat exchange transverse to the main flow direction which ultimately has a self-cleaning effect," notes project team member Dr. Oliver Thomer, Pierburg innovation manager.

Thomer points out that so-called Kevin-Helmholtz instabilities are responsible for this process. "Vortices are generated at the shear layer of two parallel flow layers with different flow velocities. This is similar to the waves during a storm at high sea or the swirl of smoke from a joss stick in a room where the overall air is quite still."

To bring the engine as quickly as possible to operating temperature, the new EGR cooler is equipped either with an electrical or a pneumatic driven bypass flap. It routes the redirected exhaust gas flow inside the cooler to the integrated bypass channel until the engine has reached its normal operating temperature. Once the desired engine temperature is reached, the bypass is closed so that the cooler is activated. Now the EGR temperature will be reduced. Due to the resultant drop in combustion temperature in combination with the related oxygen decrease, maximum NOx reduction is achieved.

Another benefit derived from the new AGR cooler is outlined by development expert Kühnel: "The individual parts – in other words the EGR cooler itself, the bypass flap switching between cooler and bypass operation, and the EGR valve controlling the EGR rate – are formed to highly integrated and there-

(Continued on page 15)

Cooled exhaust gas

Exhaust gas recirculation (EGR) begins where nitrogen oxides originate, depending on the available quantity of oxygen and the combustion temperature. EGR offers a highly efficient means of reducing NOx emission in diesel and gasoline engines. Emissions have to be reduced to meet the existing emission limits of Euro 4 and future threshold values (Euro 5 from 2010 onwards) in combustion engines.

Compared to the Euro 1 norm of 1992, the current Euro 4 standard requires 86% less sooty particles and 74% less nitrogen oxides in diesel engines. Euro 5 defines limits that are nearly half of those accepted under the Euro 4 standard. Euro 5 will mean that diesel engines must not emit more than 5 mg of soot particles and max. 200 mg NOx per kilometer. In effect, this means that Euro 5 allows 98% less soot, 96% less hydrocarbons and nitrogen oxides, and 98% less carbon monoxides than before the exhaust standard was introduced.

Besides the exhaust gas that is recirculated as a result of valve overlap in the engine (internal EGR), larger quantities of exhaust gas can be recirculated via the EGR valve into the intake system and mixed with fresh air before flowing into the cylinder (external EGR).

In terms of recirculation quantity and temperature, internal EGR is, however, less efficient than the cooled external EGR process which is why the latter is state-of-the-art for diesel engines. Since the thermal capacity of recirculated gas is higher than that of air, the peak combustion temperature is lowered; less nitrogen oxides are produced as a result of this. The oxygen concentration in the cylinder is additionally reduced, causing the combustion temperature and rate of combustion to drop. This process is highly effective since there is a disproportionately high rise in nitrogen oxides as a function of higher combustion temperatures.

Unlike e.g. stochiometrically operated spark-ignition engines where gasoline and air is mixed in such a way that each fuel molecule theoretically has the corresponding number of air molecules needed for combustion, exhaust gas recirculation in diesel engines does not work on the basis of a higher charge mass but uses the reduced oxygen concentration of the cylinder charge.

The reduction of the recirculated exhaust gas temperature upstream of the re-entry into the cylinder (by means of an EGR-cooler) as a function of the charge has a positive influence on NOx formation at high combustion temperatures. Additionally, the cooled exhaust gas on the intake side has less volume so that the engine can absorb more air mass at the same charge pressure. This reduction has a favorable impact on particle emission and fuel consumption. The recirculation of cooled exhaust gas helps to reduce NOx emissions by more than 70%, depending on the operating point. Cooled exhaust gas recirculation is therefore the preferred solution for influencing NOx formation in diesel engines.

New EGR cooler from Pierburg: Intelligent design allows effective NOx reduction

Series-production is to start soon

(Continued from page 14)

fore compact module. This is an advantage of the aluminum material, the EGR module and the intake manifold can also be combined to one component." The result is an innovative intake manifold module with integrated exhaust gas recirculation and exhaust gas cooling system.

The application of a new welding technique for aluminum die-castings, the so-called friction stir welding (FSW), enables the welding of all internal interfaces. As a result we achieve a temperature-resistant and heat transfering connection of all components.

Besides meeting the mentioned stringent requirements – e.g. high cooling performance, minimum sooting and temperature resistance to high exhaust gas temperatures – the new EGR cooler module offers the added bonus of low weight on account of the chosen aluminum. Moreover, the selection of the special corrosion resistant alloy and the design properties ensures all the relevant requirements regarding service-life.

Photo: Michael Rennertz

Clearly delighted about the excellent results of the first trials with the new aluminum die-cast EGR cooler Dieter Thönneßen (c), Michael Sanders (2nd r), pictured here with Hans-Jürgen Hüsges (r) and – from l – Dr. Oliver Thomer and Mirnes Hasanbasich.

The basis for present success was the consistent further development of the Pierburg III cooler – an integrated prototype used as a reference and subject to continuous optimization throughout the whole development process. The results – in particular the advantages of the concept – have been achieved in close cooperation with Pierburg's customers. The result is self-explanatory: the first EGR cooler module is planned for series-production next year.

Kühnel is quite optimistic about the success of the new Pierburg product: "Driven by increasingly stringent emission regulations, diesel and also turbo charged, direct injecting spark-ignition engines will be inconceivable without EGR cooling in future." Pierburg's aluminum cooler offers car manufactures a cost-effective alternative to conventional pricey steel coolers. Experts are sure that further series-launches with high production rates will follow in the future.

Newsline interview with Peter Erich Baumer from Oerlikon Contraves AG

Successes on South American market

Düsseldorf/Zurich. Rheinmetall Defence stands for innovation and extensive experience in the field of armored vehicles, weapons, munitions, air defence and electronics – a fact that is also recognized in South America. At this year's Fidae exhibition in Santiago de Chile – besides the LAAD show in Rio de Janeiro the most important biennial aerospace and defence trade show in South America – Rheinmetall Defence presented its wide-ranging capabilities as a leading defence systems company. Peter Erich Baumer is sales director at the Swiss Oerlikon Contraves AG group and also Rheinmetall Defence's sales coordinator on the South American continent. Newsline asked him about Rheinmetall's position on the growing market in South America.

Newsline: You have been working on the South American market for many years now. Oerlikon Contraves, the group for which you work, is a well-established supplier of short range air defence systems to the armed forces there.

Baumer: *Yes, our 35mm air defence systems with the Superfledermaus and Skyguard I fire control units are fielded in four South American countries, and interest in our Skyshield fire units is strong. Naturally numerous 20mm air defence guns from Oerlikon Contraves still exist on this continent.*

Newsline: Which possibilities and requirements for modernizing existing air defence systems have you identified?

Baumer: *Various modernization projects in a number of Latin American countries are currently being targeted.*

Newsline: The 35mm Millennium gun which the Danish Navy intends to introduce has demonstrated that you can also offer top technology in the medium-caliber range for naval applications. Is there a similar demand in South America?

Baumer: *Yes, there is. An important project being carried out in cooperation with a European shipyard is currently in the contract phase.*

Newsline: Besides air defence and naval guns, which other products are being marketed successfully in the region?

Baumer: *Rheinmetall is mainly associated with armored vehicles in this region. Products that are already fielded include the TAM armored vehicle, the Fox as an armored 6x6 transport vehicle, the Condor as an armored 4x4 vehicle and the armored recovery vehicle on a Leopard 1 chassis.*

In Brazil, we are working on a possible development cooperation for the URUTU III, the program for a new 6x6 armored personnel carrier. The Brazilians have announced their intention to include technology from abroad, preferably from Europe.

In Argentine, we stand good chances of winning a contract for the overhaul/modernization of the TAM and VCTP – both based on the Marder chassis. The Condor vehicles of the Uruguayan Army currently in service with the UN in Congo are also potential candidates for overhaul.

Newsline: Rheinmetall is one of the world's leading suppliers of large caliber weapon systems such as the 120mm weapon system of the Leopard 2 main battle tank (MBT) and the 155mm weapon of the self-propelled howitzer PzH 2000. How important is the transfer of Leopard tanks from the German inventory to the Chilean forces for you?

Photo: Angela Blattner

Sales coordinator Peter Erich Baumer.

Baumer: *Naturally, we are proud of the fact that the Leopard 2 MBT is now being introduced in South America. Rheinmetall Defence will give the Chilean armed forces logistic support for the introduction of the new tank and is offering various systems for retrofit and upgrade such as e.g. enhanced thermal imaging equipment.*

Newsline: Rheinmetall is also one of the leading suppliers of 120mm caliber ammunition for armored combat vehicles. Have you identified any sales opportunities on the South American continent?

Baumer: *We hope to secure further munitions contracts beyond the initial requirement which will be covered (with the involvement of Rheinmetall) in conjunction with the handover of the tanks. Due to the great climatic differences in Chile, we believe our DM 63 ammunition is especially well suited for the region as its powder is temperature-independent.*

Newsline: The retrofit of Leopard MBTs could offer further chances in future.

Baumer: *Yes, we certainly hope so. Vehicle retrofit is highly complex and we can offer comprehensive solutions to meet future demands on such tanks. Our solutions involve not only technological innovations for combat improvement (retrofit) but also the replacement of components that will no longer be in the logistic supply chain in future, and naturally also new developments in the family of vehicles, e.g. recovery and engineer vehicles.*

One system presented in connection with combat improvement is our EOSS fire control system which was exhibited at the Fidae defence show. EOSS has already been tested successfully on the Leopard 1 MBT in Chile. We also presented a version of our successful family of guidance systems which is also of interest to the Chilean Army for its Leopard 2A4.

Newsline: Force protection was an important issue at the Fidae. How did Rheinmetall products contribute to the protection of soldiers in action?

Baumer: *The protection of armed forces against threats from the air and ground is a comprehensive task involving the functions surveillance, alarm, defence and reaction.*

We offer convincing solutions ranging from sensors and intelligent networks to effectors. For example, our observation and reconnaissance equipment BAA with its day and night vision capability is ideally suited for the surveillance and protection of objects including convoys and field camps. The system is invaluable when it comes to protecting soldiers and objects in out-of-area missions in all climatic zones.

By virtue of improvements to the system and new developments for the Ahead ammunition, the Skyshield 35 system can now also fight terrorist threats with so-called RAM (Rocket, Artillery, Mortar) rounds. This confirms the capabilities of the Skyshield concept against threats from the air (aircraft, cruise missiles and air-to-surface guided weapons) and its ability to adapt to new requirements: Offering advanced sensors, fire control technology, weapon systems and unique ammunition, Skyshield 35 is a safe investment into the future!

Breakthrough for telemax

Bonn/Ostfildern. The telerob company of Ostfildern, Germany has scored a major success in marketing its new telemax bomb disposal robot, first unveiled last year. In a recent global request for tenders, Germany's Federal Ministry of the Interior specified a requirement for a compact EOD robot. Its mission would be to support existing tEODor robots – already in service with Germany's former Federal Border Guard (BGS) for many years – in situations where the tEODor would be too large to operate, e.g. in aircraft and public transport scenarios.

During multiple field trials, the telerob robot, which is literally bristling with innovative technologies, demonstrated that it was the system best able to meet the extremely demanding requirements of Germany's new Federal Police. For example, the telemax was the only vehicle which, despite its small dimensions, was capable of opening an aircraft overhead luggage bin and removing a suspicious object.

telerob is especially proud of the fact that the internationally renowned GSG9 anti-terror force opted for the telemax over the products of various German and international rivals, all of whom took part in the competition. To give the Federal Police's bomb disposal engineers time to familiarize themselves with the new system prior to the World Cup, telerob delivered the first two vehicles in the record time of just three months. This flexibility, coupled with the Swabian robot maker's reputation for excellent service, was certainly another argument in the telemax's favour.

New armored infantry fighting vehicle presented to public for first time

Puma attracts crowds in Munster

Munster/Düsseldorf. The public got its first look at the German Army's new Puma armored infantry fighting vehicle (AIFV) during the Army's fifty-year anniversary celebrations in Munster. In the presence of several hundred guests including politicians, the military, industry, and the media, the first prototype gave a strong impression of its importance for current and future military missions.

Puma meets the military requirements for a vehicle with high strategic and tactical mobility while still offering its crew maximum protection and outstanding firepower. This vehicle gives soldiers the ability to react immediately to new challenges while exhibiting flexibility and the appropriate level of intensity.

During the anniversary celebrations in May this year, co-managing directors of PSM GmbH (responsible for producing and developing Puma) Dr. Peter Hellmeister and Rainer Huth stressed the following: "Puma is a joint effort between our country's land systems industry and the Army that fully expresses Germany's technological leadership in ground fighting vehicles. In international comparison, Puma offers a hitherto unequalled level of performance, especially with regard to the safety of soldiers in the vehicle." PSM GmbH, a joint venture between Krauss-Maffei Wegmann and Rheinmetall Landsysteme, is the prime contractor responsible for the development and production of the system.

Photo: A.Bienert/IMZBw

Attracting crowds: The new armored infantry fighting vehicle (AIFV) for the German armed forces was presented to the public for the very first time during the Army's fifty-year anniversary celebrations in May this year. The new vehicle is based on a completely new vehicle design that reflects the armed forces' new mission profile.

The German Army is expected to order 410 vehicles with a total value of approximately 3 billion euros. The political decision on series production of this armored infantry fighting vehicle is expected in 2007. An order was already placed at the end of 2004 for delivery of five pre-production vehicles as well as logistics and training services.

The Puma armored infantry fighting vehicle is based on a completely new vehicle design that reflects the armed forces' new mission profile. New types of missions aimed at peacekeeping and peacemaking require a highly mobile weapons system that is ready for international deployment yet still provides the highest possible protection. Puma gives its crew a level of protection against threats like mines and anti-tank weapons (widespread in the world's crisis regions) that was previously unavailable in comparable vehicles.

Puma offers two different levels of armor. The Level-A version is suitable for transport in the upcoming A400M transport plane. Despite its high armor protection it is rapidly deployable to a variety of locations. "At 31.45 tons total weight, the Level-A Puma will fully meet the customer's specifications for transport in the A400M," according to Rainer Huth and Dr. Peter Hellmeister.

At Level-C, rapid on-site adaptation with modular elements gives the vehicle the best protection against mines, hollow charges, and medium-caliber weapons that is currently available. Roof elements are also adaptable to shield the crew against bomblets.

Photo: Thomas Klink

KS Aluminium-Technologie AG in Neckarsulm is treading new paths in holistic data acquisition in quality and logistics management. "It now applies an innovative EDP system that allows in-process data to become a transparent quality feature – including the CV of engine blocks during their passage through production," comments IT manager Rainer Schmidt, in charge of the project.

ATAG in Neckarsulm uses state-of-the-art production data acquisition

Engine blocks now with fully transparent CV

Neckarsulm. KS Aluminium-Technologie AG is treading new terrain in holistic data acquisition for quality and logistics management, and now uses an innovative EDP system that allows production data to become a transparent quality feature. This Neckarsulm company benefits from a new production data acquisition system (PDA) through gains in speed and responsiveness—two factors favorably impacting on production control. What's more, the more efficient warehousing mechanisms avoid tied-up capital while the documentation reliably tracks vital analysis data for continuous production optimization and, at the same time, directs this data to important destinations. These analyses contribute toward continuous quality improvements.

ATAG's OEMs also stand to gain from the innovative system. They can receive a CV on each engine block tracking in detail its journey through production. For carmakers this spells an advantage when diagnosing the engine in its entirety. Moreover, deliveries can now be predicted with precision – thanks to exact location determination now possible for each engine block currently in production. And, required product modifications through possibly necessary reworking can be carried out at short notice.

The highly modern PDA system now makes it possible to log each and every engine block right from the casting cell and acquire its data at every machining and processing stage – from the birth of the parts to online dispatch to the customer. The data is directly available for electronic evaluations and analyses; thus, any necessary downstream quality improvements can be initiated immediately. Furthermore, products can be located at any time for reliable delivery date commitments. For each one of the presently around 5,000 engine blocks registered daily through PDA there is a detailed CV that offers the company and its customers the advantages already stated.

IT manager Rainer Schmidt, responsible for the PDA system at ATAG, explains: "The concept is a major step toward 'transparent production.' Thanks to the highly modern and technically advanced system, measurements and other vital data from the entire production process can now be recorded at every stage of production. In this way we are able to compile a fluent flow of documentation on every engine block. The system is, moreover, easy to operate. After only a short training period, production employees can deliver their input (e.g., simply by pressing the touch terminal at the workplace)," comments the EDP specialist on the subject of production control.

It is especially this on-site input which makes the PDA system so interesting for its efficiency: "Our system is a shop floor control concept which concentrates on on-site data entry, i.e. directly where this information emerges. Each employee takes on additional responsibility for the quality of engine blocks—and now even for data quality. The innovation meant extensive investments in plant, equipment and know-how on the part of ATAG including new PDA terminals in production, scanners and unmanned cameras as well as special employee training."

Moreover, the PDA system is part of the new TPM concept. TPM (Total Productive Management) aims at improving the production processes by concrete measures and projects, hence raising the company's efficiency. An essential aspect of this is to involve employees in problem solutions.

In recent months, the PDA system has been individually tailored to the production control and manufacturing processes at the Neckarsulm engine block plant. First it was necessary to find a suitable way of getting a code onto the engine block for subsequent registration. Says Rainer Schmidt: "The labeling system, identifying each en-

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ATAG in Neckarsulm uses state-of-the-art production data acquisition

Engine blocks now with transparent CV

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gine block as an individual, has to be resistant to high temperatures, machining processes of any kind (e.g. milling and sawing) as well as humidity and x-rays," notes the 48-year-old software specialist.

"So," Schmidt goes on, "we opted for a machine-readable data matrix code. To apply this code, the metal is embossed by needle dots to give it something comparable to a barcode; labeling is additionally provided by human-readable characters (numbers). This identifying process takes place directly after casting, thus still in the casting cell, so that every engine block can be internally registered right from the start. Here in the cell the code undergoes its acid test at a temperature of more than 250 °C. And the data matrix code is also automatically readable by scanners and cameras." Uninterrupted product tracking along the entire process chain is ensured by heavy-duty industrial computers prepared for this comparably "tough" environment. Along with unmanned cameras, these computers are installed as PDA terminals.

Photo: Thomas Klink

Clearly identified: with handheld camera, ATAG employee Albert Grötzinger captures the data matrix code embossed on to the engine block. The crankcase identification number is then relayed to the PDA terminal shown in the background.

The documentation used to be handwritten by employees in production so that transmission channels were relatively long and, possibly, mistakes crept in due to the transmission processes. Schmidt outlines the business advantage of the new system: "In the past, long rows of numbers had to be processed. A time-consuming procedure, for instance when compiling inventories. The attraction of the new PDA concept is that you can see at a glance where something might go wrong so that countermeasures can be taken in good time. This is possible since the data is acquired online and analyzed on the spot. We have successfully integrated this new concept, this sophisticated IT technology, directly into the production environment, and in real time and in a way that saves time," explains the EDP specialist.

The installation of the new PDA terminals and the unmanned cameras required much care. This is where Rainer Schmidt works hand in hand with Thomas Klein, responsible for the system's shop floor implementation. After having installed the units, Klein now makes sure that they are always working in the already mentioned "tough" environment and, at the same time, the production process is not impeded.

Under these circumstances a number of problems had to be solved initially. 47-year-old Klein recalls: "The hardware had to be adapted to the most varying criteria at each and every manufacturing station. This applies, for example, to the high post-casting temperatures or to the heat treatment (up to 500 °C), the particulates accruing when sawing or milling or the vibrations from the machines. As the data matrix code can only be read optically, unmanned cameras were installed which take a picture of the code during the machining process to enable identification. Special software processes this image and transmits the data online. The camera must be installed at a place where the code is easily legible; at the same time, it must not get in the way of the machines or tooling. The fully automatic camera is very rugged – with a housing specifically matched to the environment." After the camera has taken the picture, the employee responsible enters the data via the PDA terminal.

The engine block production unit benefits in many ways from the new PDA concept: shrinkage and porosities are noticed at once, reworking can immediately be planned, and, what's more, schedules are ideally controlled. The most important data is filtered and passed on to the next shifts.

Filtering the data – Schmidt continues: "Of course, the flood of data possible with our PDA system delivers an abundance of information that needs to be filtered in order not to oversee the really important signals and information. So we've established a traffic light system switching over to red, should immediate action be required. This can apply to noncompliance with tolerances and also to inventory pileup. In this case, the traffic light changes to red, for instance, when the minimum inventory is reached. This is of advantage in terms of logistics: inventory accumulation and the associated tied-up capital are avoided. In their fully developed stage we are presently targeting, these traffic light mechanisms would allow the transmission of information that calls for immediate action. This call for action might be relayed to the online computer or even via mobile so that the employees responsible are always informed and anywhere."

The real-time monitoring of inventories as well as selectively targeted quality improvement measures through the new PDA system (possible when needed), are major milestones on the road to holistic quality and logistics management. In deploying this highly modern data acquisition and analysis system ATAG is once again endorsing its role of innovative partner to customers in the automotive industry.

InnoBase: The innovation pipeline

Neuss. Modern innovation management (IM) is understood to mean the systematic planning, organization, implementation and control of all activities concerned with innovation processes in a company. In operational terms, this means collecting and managing ideas and idea potentials generated or available in a company in order to secure, stabilize or create competitive advantages in certain markets. This may involve qualitatively new processes, products, technologies and strategies which are successful on the market and have a positive influence on the economic performance of a business. Innovation management, i.e. the utilization of ideas over their entire bandwidth, is therefore an important part of corporate strategy focussed on success and earnings. This is exactly what the Pierburg-wide project launched at the company headquarters in May 2006 seeks to do. In future, the entire workforce of the international automotive supplier will be able to contribute actively and creatively to this process – simply by using the InnoBase IT tool available in the "gate^{2}automotive" portal. The HypeIMT software program gives direct access to Pierburg's innovation pipeline.

InnoBase project kicks off at Pierburg headquarters

A central platform for innovative ideas

Neuss. Employees of the Pierburg group will soon be able to contribute their own business ideas to daily operations. Integrated in the "gate^{2}automotive" group portal, the InnoBase tool that is based on the idea management software HypeIMT will allow around 3,500 employees of the Neuss-based automotive supplier to add their creative ideas and innovative concepts to the selection, decision and implementation process far more easily and quickly by using the group's intranet. InnoBase is to be accompanied by an attractive bonus system with the working title Ideas & More which is under preparation.

It goes without saying that, to succeed on the market, an international player like Pierburg will always be looking for unusual and exceptional ideas. Clearly, it makes sense to use the knowledge potential and the technical know-how of the group's own workforce. And this is where InnoBase comes into it. In launching this project, the Kolbenschmidt Pierburg subsidiary is deliberately and directly approaching its creative staff, encouraging them to contribute their inventive talent – as a complement to Pierburg's own R & D activities.

Innovation manager Dr. Oliver Thomer on the strategic orientation of the group-wide project supported by the three areas Innovation Management, Idea Management and Patents and Licenses: "InnoBase has given us a central platform for employees wishing to put forward their own creative ideas and suggestions to benefit the company's future. The tool integrated in the "gate^{2}automotive" portal is a central organ and catchment area for all employees who want to actively and directly contribute toward the company's business process with their own ideas." In other words, InnoBase is Pierburg's electronic pipeline for good, innovative ideas.

Photo: Ariane Gehlert

Platform for ideas: Forging a creative future – this is what InnoBase allows Pierburg employees to do from their computers. Dr. Oliver Thomer (l) from the air supply development department and microelectronics engineer Mirnes Hasanbasic who wrote his bachelor thesis at Pierburg are pictured here showing how the tool works.

These are managed by the HypeIMT idea management software used to collect, assess, compare and select innovative proposals and suggestions. The program already used by other international businesses like Daimler-Chrysler, Mann + Hummel, Siemens, Hella, Freudenberg and Blaupunkt for their idea management is distinguished by its excellent quality – e.g. regarding the archiving structure – and efficiency (clarity, speed and work/time saving).

Thomer whose main job at Neuss is that of a group leader in the development of air supply systems notes: "Both ideas that are accepted and followed up and ideas that have been rejected are archived. Each Pierburg employee participating in the InnoBase project can observe the status of his or her idea. This allows the individual to identify the assessment criteria used to measure the quality of an idea."

Such transparency is coupled with efficiency: Electronic matching processes help to spot – and avoid – duplicate ideas, to accelerate the idea management process and manage all ideas in a clear and understandable manner.

Basically, InnoBase is an IT-based tool that is to address and stimulate the creativity and inventiveness of company staff. Creative heads outside the company – such as experts from Pierburg's international customer base – can also log into the innovation process. The direct link to good ideas is via the email address innovation@pierburg.com which is also included as a link on the Pierburg website.

Cooperation: RDE and Lufthansa Flight Training GmbH

Lufthansa opts for Avior laser projection system

Frankfurt/Bremen. Lufthansa Flight Training GmbH (LFT) has signed a cooperation agreement with Rheinmetall Defence Electronics (RDE, Bremen) in order to achieve level D qualification under JAR-STD 1A for the Avior laser projection system before the end of this year.

Lufthansa Flight Training has over 50 years of experience in the training of cockpit and cabin crews, and is one of the leading training providers in the market. Under the cooperation agreement, Rheinmetall Defence Electronics is going to upgrade an Airbus A-340 full flight simulator for LFT according to the specifications of the Avior laser projection system in order to have it licensed by Germany's Civil Aviation Authority (LBA).

This step would make the Avior laser system only the second projection system in the world, after the raster-calligraphic CRT, to be licensed for high-quality level D simulators. Laser technology gives the Avior system major advantages over CRT systems in terms of resolution (HDTV), contrast, brightness, depth of focus and color space, while also ensuring maximum fail-safety and availability. Laser projection requires virtually no mechanical components, which eliminates the job of replacing and regularly adjusting tubes, as is required with the raster-calligraphic CRT. This means that the life cycle costs (LCC) are considerably lower than those of the CRT.

The excellent black level that is characteristic of laser light enables night approaches of outstanding quality. At the same time, projection of the light points, which is important for civil flight simulation, is at least on a par with CRT projection. The compactness and light weight of the projection head (20 kg – 30 kg) permit a completely new approach to the design of future simulators because the laser system is up to ten times lighter than raster-calligraphic CRTs (200 kg – 250 kg).

With this project Lufthansa Flight Training GmbH and Rheinmetall Defence Electronics are breaking new ground with regard to important key technologies in the field of flight simulation, once again demonstrating their innovative strength. So it may not be long before pilots flying for Lufthansa and other airlines have the opportunity to test the world's first full flight simulator based on laser light.

In the military sector, laser projection from Rheinmetall Defence Electronics has been in use since 2003. Rheinmetall Defence Electronics was the first to deliver the Avior system to the German Air Force for the Tornado full mission simulator stationed in Holloman, New Mexico/USA. Two more systems – also for the German Air Force – are currently planned. The Indian Navy has likewise chosen the Avior laser projection system for its new MiG-29K simulator, which is due to be delivered in the coming year.

MLG 27 systems for Kuwaiti Navy

Düsseldorf. The US Department of Defense has placed an order with the Düsseldorf-based Rheinmetall group to deliver medium-caliber guns for the fast interceptor craft being supplied to the Kuwaiti Navy under the Foreign Military Sales Program. The total value of the framework contract for the MLG 27 light naval gun is approximately € 40 million; covering 12 systems, the initial order is worth around € 28.2 million. The Kuwait contract represents an export breakthrough for the product. At home, the MLG 27 has been selected to serve as the German Navy's new standard gun, with 87 weapons already installed. This state-of-the-art naval weapon system will enable Kuwait's MKV-C fast interceptor craft to defend themselves in new operational scenarios, especially against terrorist attacks but also in the fight against piracy and in anti-smuggling operations. Combining a highly dynamic gun carriage, precise optronics and advanced ammunition technology, the 27mm weapon system assures accurate engagement of lightweight, agile surface targets with a very high kill probability.

RDE wins two Thai orders

Bremen. Rheinmetall Defence Electronics in Bremen has received not one but two orders from Thailand to the value of several million euros. Between now and 2007 the company will supply the Royal Thai Naval Academy (RTNA) and the civil Merchant Marine Training Center (MMTC) with state-of-the-art simulation technology.

The Royal Thai Naval Academy has ordered a complete full-mission shiphandling simulator with the navigation and command system NACOS to cater for the navigational training needs of trainee officers in the Thai Navy. The simulator consists of 5 bridges, with the main bridge having 360° and each of the 4 radar cubicles having 240° external visualization.

The special feature of this system is that, for the first time anywhere in the world, a naval simulator will have its own night vision capability. To this end, RDE is fitting the simulator with the Avior laser projection system, which has already been used in flight simulation with great success. By using standard night vision equipment, the RTNA will now be able to see a night vision display on the external vision screen on the main bridge.

Around the same time, RDE received another order for equipment from the Merchant Marine Training Center (MMTC), this time for the first integrated simulation center ISC for Thailand. The training center, which is under the auspices of the Thai Ministry of Transport, is responsible for the training of prospective seamen in the fundamentals of navigation and ship management operation, and is the country's most important marine academy. By mid 2007 the MMTC will receive a full-mission shiphandling simulator consisting of 2 main bridges of identical design as well as 3 radar cubicles with external vision functionality. The company is supplying its SES 4000 full-mission ship engine simulator with the necessary consoles and control cabinets for realistic engine control training. A safety and security trainer will also be delivered as will a pre-training room with 30 workstations for essential part task training in ship engine technology.

Photos (2): Ariane Gehlert

A routine day for measuremen at Pierburg: technician Peter Schlabs (left) and coworker Rolf Schnakenberg measuring the pull-off forces of bearing retainers for a convertible hood frame. Here the adhesive bond between bearing support and retainer is being tested.

Pierburg in Neuss: concentrated resources in measurement benefit customers

New laboratory combines expertise

Neuss. As part of the restructuring and reorganization regimen for the Pierburg location in Neuss (including the convergence of test facilities), the three areas of testing for materials, components and for dimensional measurement have been merged in a new central measurement laboratory, which has been assigned to the central quality department.

"The historical development on the company headquarters in Neuss – with offices on Alfred-Pierburg-Strasse and production elsewhere on Düsseldorfer Strasse – resulted in two separately located testing laboratories for materials and component testing," explained Achim Brömmel, head of the department for quality and environmental management since the beginning of November 2005. "To streamline these laboratory areas, and with the new customer center on Alfred-Pierburg-Strasse in mind, a laboratory area would be created that is close by and directly accessible to internal customers. We therefore embedded the new materials laboratories, including the state-of-the-art chemistry lab, in the test facilities area for central development."

The result is the central measurement laboratory (CM) – a center that now combines all key measurement capacities and thus facilitates a more comprehensive approach to testing assignments. The combination of various laboratories and the resulting proximity to internal customers will improve the efficiency of day-to-day work. CM customers within the company include, for example, Corporate Purchasing, Preliminary Development, Development & Testing, the five newly created business units, the Quality department of the German and foreign plants, and the Warranty department.

"Our work includes the inspection and testing of products and components throughout all phases of development and also the examination of standard production parts and components," explains Sven Wagener, acting head of the quality measurement laboratory since the beginning of November last year. "The sooner we in the measurement laboratory are involved in the development process, the better. The numerous options available for measurement and testing as well as our many years of experience enable us to provide constructive support to the relevant departments at an early stage of development and to identify errors in design, materials selection, materials treatment, and manufacture."

Sven Wagener: Resources have been concentrated in the central measurement laboratory at Pierburg location in Neuss.

The central measurement laboratory currently has a staff of ten and consists of three areas – materials testing, component testing, and dimensional measurement – all of which can handle the most varied assignments flexibly and with the utmost competence. In fact, the measurement methods available for component testing provide valuabe assistance to the designers in their development work.

"We have state-of-the-art tensile and compression test equipment with up to 50 kN tractive force available to the design engineer for analyzing the design, connection or behavior of a component," points out mechanical engineer Peter Schlabs. Using the Accrat measurement system, for example, the proper functioning of a screw connection can be tested. For this the pre-load force is measured in addition to the torque and angle of rotation. This technique is much more precise and informative than simply using torque.

Schlabs adds: "Furthermore, our daily work includes the study of elastomers – these elastic synthetics are tested for their resistance to media. As part of this, changes in dimensions, tensile strength, breaking elongation and volume increase are determined. Investigations of the compression set (this is the proportion of permanent deformation after long-term constant deformation under pressure at a specified temperature; the smaller the value, the better suited the elastomer is for use in seals) and low temperature resistance testing are also part of our elastomer research. The data collected provides specific assistance to the design engineer in the selection of the proper elastomer and an exact specification for the supplier when producing this chemical product."

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Pierburg in Neuss: concentrated resources in measurement benefit customers

New laboratory combines expertise

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In addition to the measurement of development prototypes (so-called A, B and C prototypes) and first sampling of outsourced parts – these are components procured by Pierburg from suppliers – regular testing of series production also takes place. The daily routine of the measurement laboratory also includes the assessment of malfunctions, damage or loss and a determination of causes. Particularly in these usually sensitive cases, the measurement laboratory is asked to determine the cause of a product failure. In such cases, the primary focus for all participants is to find out how the malfunction or failure which occurred can be avoided in the future. "In addition to pure measurement and analysis services, we also provide technical assistance to our internal customers. For example, we provide advice in materials selection during the development phase of a product."

Cooperation with the corporate Warranty department also deserves particular mention according to Wagener, who was the group manager for materials testing and acoustics until recently. "With this department we regularly share and exchange useful information. And this is how it should be, because after all, warranty is a very sensitive issue, usually having to do with component or system malfunction or failure. So, mutual support in solving the problem is top priority. We approach the customer together and submit solutions to the problem."

In the future, the central measurement laboratory is expected to assume additional important tasks. For instance, the first sample test report to be generated in the so-called product release process for the company locations in Neuss and Nettetal is under discussion. A further objective is to have all A and B samples from prototype construction subjected to confirmation testing by the measurement laboratory. And in the not so distant future, it is planned to apply for official laboratory certification.

Photo: Ariane Gehlert

Concentrated expertise and extensive instrumentation: the state-of-the-art chemistry lab at the company headquarters in Neuss, where testing includes the type and purity of fuel samples. Furthermore, analyses are conducted to study chemical influences.

Instruments galore

Neuss. There are two materials testing labs (for metals and plastic) and a state-of-the-art, significantly expanded chemistry lab available for this area. The laboratories are used for material identification, determination of material properties and analysis of component failures (such as for evaluating ruptures, wear, corrosion damage and heat treatment problems). The materials testing techniques applied deliver values that describe the behavior of the materials under mechanical, thermal or chemical stresses. In both materials laboratories tests are performed using metallography and microscopy, on the one hand as proof of the required quality characteristics and on the other to look into cases of malfunction, damage, or loss. In the new chemistry laboratory, chemical technician Ranka Lubarda investigates such things as the type and purity of fuel or lubricant samples or performs particle analyses of metallic and polymeric materials for purposes of identifying elements and fillers. Furthermore, analyses are conducted to study chemical influences: a great variety of substances, media and materials are investigated and their chemical composition is checked.

Designing and dimensioning components and systems to withstand loads and stresses while at the same time optimizing production parameters is growing in importance due to competitive constraints caused by cost pressure. The highly qualified staff in this area support their colleagues in the various Pierburg development departments in their quest for the best technical solutions to problems by high-precision testing of the functionality and strength of components.

Indispensable tools

Neuss. The facilities for dimensional measurement are located on Düsseldorfer Strasse. Various precision instruments from well-known system manufacturers (such as Leitz, Zeiss, and Perthen-Mahr) are used for dimensional measurements. Ruled geometries (distances, angles), shape and position tolerances (symmetry, circularity, cylindricity), surface quality and run-out tolerances (concentricity, axial eccentricity) are measured on various instruments. High-precision 3-D coordinate measuring machines, which also allow components with larger dimensions to be studied, form the very heart of the measuring lab. The coordinate measuring units record the three-dimensional geometry of a component. The measurement is highly accurate: the greatest possible measurement tolerance is a mere thousandth of a millimeter.

Rheinmetall robotic systems
Technology for perilous missions

As Germany's Competence Center for both UAV technology and EOD systems, Rheinmetall Defence has been actively involved in robotics for many years. From this platform, Rheinmetall Defence is now addressing new technological challenges by developing, for instance, autonomous, unmanned vehicle systems for deployment in a wide variety of missions. The ultimate aim is always to minimize injury potential wherever operation would otherwise only be possible under maximum personal risk.
More information: **www.rheinmetall-defence.com**

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