Driven by performance

Press release on the business development in the 1st half of 2009 and outlook for the MAHLE Group

1. Business environment/economic situation in the automotive industry

Global economy faces most severe recession since the 1920s

According to estimates by leading business experts, the global economy currently faces the most severe recession since the 1920s. Against this background, forecasts on the expected vehicle production for the current year have been adjusted once more. For passenger cars and light commercial vehicles, a decline of 13.4 million units in worldwide production, which corresponds to -20 percent, to 52.6 million units is currently anticipated for 2009, after an already weak preceding year.

Europe

As a result of the economic slowdown in Europe, it is expected that the 2009 production figures for light commercial vehicles, forecast in the year 2008 in the amount of 22.8 million units, will be off target by 28 percent. At 16.4 million units, the currently forecast production of passenger cars and light commercial vehicles for the year 2009 falls below the production volume of 2008 by 4.1 million units (-20 percent). Having contributed disproportionately to growth during the past years, today's expectations for the Central and Eastern European countries are that the decrease of 23 percent will be even higher than in Western Europe. The main reason for this negative development is the drop in production in Russia and Turkey, which has to be cut back by up to 45 percent due to the falling demand. In Western Europe, Great Britain, Sweden, and Austria fall short of the production volumes of the previous year with declines of more than 30 percent. From today's perspective, even Spain, Germany, France, and Italy are expected to miss the previous year's levels by up to 20 percent in spite of various incentive schemes .

NAFTA region

In the NAFTA region, the production of passenger cars and light commercial vehicles has been hit much worse by the financial crisis than in Europe. As a consequence of the recession and the insolvencies of General Motors and Chrysler, not only the sales volumes of the "Big Three" but also those of the Asian and European manufacturers have collapsed. Thus, a decrease in the production of passenger cars and light commercial vehicles is expected as compared to the already weak previous year by 4.7 million units (-37 percent) or 5.9 million units, respectively, in comparison to the original forecast for 2009. Particularly affected by the cuts in production are the sport utility vehicles (SUV), which were extremely popular in the past.

MERCOSUR region

So far, the development of the production of passenger cars and light commercial vehicles in South America exhibits significantly less impact from the global economic turbulences. Due to the stable economic development in Brazil during the first few months, a comparably moderate decline in production by 8 percent to 3.5 million units is expected for this region.

Asia/Pacific

In the countries of Asia, the production of light commercial vehicles will, with a few exceptions, significantly miss the levels of the previous year. Especially the considerably weakened exports of the Japanese and Korean manufacturers, who have to cope with a decline of production volumes by 34 percent and 17 percent, respectively, will cause the production to fall below last year's level by 4.2 million units (-15 percent). Despite the anticipated increase of production levels by 9 percent to 2.2 million units and by 10 percent to 8.2 million units, respectively, the Indian and Chinese manufacturers are only partially able to compensate for the declining production in the other countries of Asia.

Commercial vehicle forecasts also adjusted downward considerably

In view of the massive impact of the economic crisis on the transportation sector, the forecasts for the worldwide commercial vehicle production figures had to be lowered significantly, as well. Therefore, it is expected that the worldwide production of commercial vehicles and buses will dwindle in the course of the current year by 31 percent to 2.2 million units.

Europe

In the meantime, the forecast for the usually high number of relatively new commercial vehicles was halved compared to the production volume of the previous year. With 436,000 units, production fails to reach the amount expected in 2008 for the year 2009 by 49 percent.

NAFTA region

After the significant decrease in commercial vehicle production for the NAFTA region in 2008, a further reduction by 31 percent is predicted for the year 2009. From today's perspective, a production volume of merely 310,000 units must be reckoned with under these circumstances.

MERCOSUR region

For the production of commercial vehicles in South America, a slight decrease by 24 percent to 172,000 units is forecast.

Asia/Pacific

Also with respect to commercial vehicle production, the countries of Asia have been most successful in evading the downward trend with a decline of 23 percent to 1,245,000 units. At the same time, the disproportional decrease in Japan (-45 percent) cannot be offset by the moderate business development in China.

2. Business development in 2009 and outlook

During the first six months of the current business year, Group sales fell by EUR 850.5 million (-31.9 percent) as compared to the previous year. First consolidations mitigated the decline in sales by EUR 50.6 million. Fluctuation of the exchange rates between the euro and the U.S. dollar, Japanese yen, and Chinese RMB had a positive effect on reported sales in the amount of EUR 38.6 million (+1.4 percent). The exchange rate-adjusted organic shift in sales thus amounted to EUR -939.7 million (-35.2 percent).

The significantly over proportional decline in sales in the first half-year was caused by three main factors:

1. Massive reduction of stock in the OE passenger car sector.
2. Distinctly over proportional production cuts in the commercial vehicle sector.
3. Massive market share shifts in Europe from diesel engines to lower-priced gasoline engines in the compact class division as a result of scrapping incentives.

From the second quarter of 2009 onward, sections of the non-automotive MAHLE business, such as the products for small and large engines or industrial filtration, likewise recorded marked decreases in sales as compared to the corresponding period of the previous year.

Due to the further significant deterioration of the sales development in the first half-year of 2009, which was even sharper than estimated according to the already pessimistic plan, the cost reduction measures initiated as early as at the end of 2008 were not sufficient to avoid losses during the first half of the year. In order to return to the normal sales and return on investment levels in the medium term, structural measures were agreed upon in the first half-year that clearly go beyond the restructuring program introduced in 2008.

To this end, a notable streamlining of the organizational structure and set-up of the Group was launched. The automotive OE activities, formerly consisting of five product lines, were grouped into two business units: Engine Systems and Components as well as Filtration and Engine Peripherals. At the same time, the industrial activities of the Group were integrated into two organizational units. Through this step, which allows for a reduction of the Management Board, the Management Committee, and headcount at all management levels, a cut of all overhead costs by 20 percent will be achieved within the next twelve months. In addition, further structural measures derived from this step are planned in order to bring all cost structures of the Group into line with sales expectations, which are also lower in the medium term.

The measures initiated to date have led to a monthly improvement in the revenue development and provide the possibility of achieving a break-even result in the second half of the year. However, the prerequisite is a stable sales level in the second half-year, which would result in a forecast range of annual sales between EUR 3,750 to 3,900 million.

At the regional level, we expect a persistently difficult development in the European as well as the North American market for the second half-year, whereas South America and parts of Asia, particularly China, have returned to satisfactory growth rates and positive results over the last few months.

As for the number of employees per reference date of June 30, a year-on-year reduction from 50,729 to 44,431 was achieved. Furthermore, a downward adjustment was made to the number of temporary staff by 1,888. The significant decrease in staff numbers within the Group has been possible, in particular, through the flexible adjustment measures in North and South America, while the instruments of short-time work and a reduction of the weekly working hours were applied at most of the European locations. Nevertheless, a loss of productivity could be observed at most of the locations with short-time work in comparison to a normal capacity utilization of the plants.

Compared to the previous year, the number of employees in Germany fell from 9,280 to 8,804. For the German locations, a general prolongation of the short-time work agreement until the middle of 2010 was settled with the works councils. This implies the option to shift to 100-percent short-time work with regard to certain plant and functional divisions. For the plant in Alzenau, Germany, this option was agreed for a period of 24 months. In turn, the Management Board approved a prolongation of the location and job security agreement until the end of the first quarter of 2010.

For the second half of the business year, MAHLE expects an easing of the situation on the markets and a slight revival in individual market segments. Overall, we assume that annual sales will range between EUR 3,750 and 3,900 million, equalling a decline in sales of 22 to 25 percent in comparison to 2008. From today's perspective, considerable growth rates are not to be expected for the year 2010, as further declines compared to 2009 are foreseeable for some sub-divisions, such as industrial engines and passenger car engines in Europe.

Based on the initiated and planned structural measures and their implementation in 2010, we nevertheless expect to see a significant improvement in revenue.

3. MAHLE daycare facility

On July 22, the ground-breaking ceremony was held for a new corporate kindergarten for the children of our employees at the Stuttgart site in Germany. The opening is scheduled for the fourth quarter of 2009. MAHLE thus makes a significant contribution to the reconciliation of work and family life.

On the premises of the company in the Glockenstraße, a two-story building will be constructed that will provide enough space to accommodate a daycare facility for about 20 children between the age of six months to three years as well as around 20 additional children at an age between three and six years. In the future, this place will offer the youngest of the MAHLE family plenty of room to enjoy themselves. Planned opening hours are Monday to Friday, 7 a.m. to 7 p.m.

With this facility, MAHLE intends to actively support employees who return to work after maternity and parental leaves—and definitely in its own interest: In this way, they can continue to share their expertise and operational experience during times of child education.

The idea of an in-house kindergarten already came up several years ago. In the course of a survey concerning the demand in this regard, it became evident that there exists great interest among employees in a daycare facility that operates during working hours. This concept is now being implemented in cooperation with the Kinderzentrum Kunterbunt e.V. in Nuremberg, Germany.

The facility is partly financed through subsidies from the public sector and partly by MAHLE and the parents themselves.

4. Preview of the IAA 2009

The combustion engine still offers great potential. MAHLE sees good chances to reduce the CO_2 emissions alone by optimizing the combustion engine and the complete vehicle by up to 40 percent – at acceptable additional cost of 2,000 to 3,000 euros per vehicle.

At the Frankfurt Motor Show 2009, MAHLE basically presents technical areas promising a particularly high optimization potential. These include:

1. Minimization of friction loss (Power Cell Unit – PCU, valve train systems, controlled oil and coolant pumps)
2. Optimization of charge exchange (CamInCam® camshaft, cylinder shut-off system)
3. Optimization of the combustion process (Exhaust gas recirculation technologies)
4. Downsizing (MAHLE Technology Demonstrator, Exhaust gas turbo charging)

1. Minimization of friction loss – using the example of the controlled oil and coolant pumps

Controlled pumps make engines more efficient

The controlled MAHLE pendulum-slider oil pump supplies lubricating oil to the engine as and when needed. Overall, this enables a CO_2 reduction potential of up to 2% in the New European Driving Cycle (NEDC) and 3% under actual driving conditions.

Engine accessories such as the oil pump and the coolant pump are essential for engine operation. However, the engine power required to operate these pumps is lost for the powertrain of the vehicle. This is why attempts are made to minimize losses in the engine accessories. Controlled oil pumps are a smart solution in this regard. They require little drive energy because they supply only as much lubricating oil as the engine needs and at the correct pressure—unlike non-controlled oil pumps. The patented MAHLE pendulum-slider oil pump is ideally suited for efficient control of volume and pressure.

Patented pendulum-slider oil pump

With an overall efficiency of 65 to 70% and a volumetric efficiency of more than 92%, the pendulum-slider oil pump converts an extremely high proportion of the drive energy into delivery output. Thus, compared with other pump types such as the external-gear pump and the vane pump, it operates with a considerably greater efficiency. This is made possible by the internal structure of the pump: Rather than using sliding gaskets to seal off individual pump cells, this pump uses pendulums supported in the outer rotor of the pump, which enables a rolling motion without sliding in grooves on the internal rotor.

By employing this principle, the pump not only operates with very little friction but is also resistant to abrasive particles, which can enter the oil during engine operation. Consequently, the pendulums are protected against excessive wear and the pendulum-slider pump retains a high level of efficiency during the entire service life of the engine. Depending on its installation size, this versatile pump is suitable for high speeds of up to 14,000 rpm, is quick to provide just the right pressure, and can be positioned in various locations.

The delivery pressure and displacement volume are created by adjusting a slider that surrounds two rotors, which are positioned off-center with respect to one another. The pump is suitable for single-stage, multiple-stage, and fully variable control operations. The fully variable control principle offers the greatest CO_2 savings potential.

Coolant pumps

In the future, controlled pumps will be used to convey coolant as well. In contrast to oil pumps, coolant pumps operate with an impeller. Because of the controlled operation and minimal mechanical wear of this type of MAHLE coolant pump, the coolant circuit can also be a contributing factor to reduced CO_2 emissions in the driving cycle.

2. Optimization of charge exchange – using the example of the CamIn-Cam® camshaft

Fuel savings with variable valve train systems

Innovative MAHLE solutions for a more variable valve train system can be integrated with only minor modifications in vehicle engines and result in fuel savings of up to 17% with the right combination.

In a variable valve train, valve opening times can be adjusted independently on the intake side and exhaust side. This mechanism can be used to produce effects that generate more torque even in the low rpm range. In addition, variable valve train systems increase engine output and support the operation of highly relevant systems for exhaust gas handling, such as exhaust gas recirculation (EGR). MAHLE solutions significantly reduce fuel consumption and emissions at very low adaptation cost for the valve train.

CamInCam® technology

The MAHLE CamInCam® camshaft, consisting of two camshafts, one inside the other, provides for variability in the valve train. For example, when this camshaft is used on the exhaust side of a four-cylinder turbocharged engine, higher torques and an earlier response of the turbocharger can be achieved—something that until now could only be achieved with cost-intensive twinscroll turbochargers or two-stage pressure-charging systems.

What's more, the MAHLE CamInCam® technology makes it possible to independently adjust opening times of the intake and exhaust valves, even in "simple," commonly used OHV and SOHV engines. In an American OHV V8 engine, a torque gain of 9% and fuel savings up to 7% were achieved by retrofitting with CamInCam®. In a European four-cylinder SOHC engine, fuel consumption decreased by 3% to 8%.

3. Optimization of the combustion process – using the example of the fast-switching charge air valve

Control of charge air and exhaust gas streams essential for achieving ultra-high EGR rates

With dynamic flap and valve solutions, MAHLE lays the groundwork for utilizing exhaust gas recirculation (EGR) rates of up to 50% in the future without negatively impacting fuel efficiency. EGR rates in this range further reduce the nitrogen oxide emissions of an engine.

High EGR rates are an effective means for reducing nitrogen oxide emissions in combustion engines because the portion of gas remaining in the combustion chamber lowers the peak combustion temperature—resulting in decreased NO_x formation. Under certain operating conditions, however,

the exhaust gas pressure is not sufficient to feed an appreciable amount of exhaust gas into the charge air line. The drawback of all corrective methods used to date is that they drive fuel consumption up.

Fast-switching charge air valve

This is not the case with the mechatronic control flap system for the charge air line developed by MAHLE: Unlike current solutions, the fast-switching charge air valve does not operate as a continuous throttle and therefore does not affect the charge cycle work. The charge air valve is fitted in the charge air line upstream of the EGR feed point. In the fast-switching charge air valve, a brushless DC motor actuates a rapidly revolving flap, which briefly closes off the cross section of the charge air line each time it revolves. This temporarily reduces the charge air pressure level, and the recirculated exhaust gas can be metered precisely and directed into the charge air line. The high dynamic mechanism and flexible electronic actuation of the fast-switching charge air valve make it possible to achieve EGR rates that meet the requirements at hand.

During a test implementation in a commercial vehicle engine, ultra-high exhaust gas return rates of up to 50% were achieved across broad engine map areas with this solution. Significant advantages in NO_x emissions and specific fuel consumption, compared to conventional high EGR systems, were measured during the test. Thus, the fast-switching charge air valve also shows potential for achieving a significant reduction in the complexity of exhaust gas aftertreatment solutions.

4. Downsizing technology – using the example of a exhaust gas turbocharger for gasoline engine

The exhaust gas turbocharger—a key component for CO_2 savings

In partnership with Bosch, MAHLE has developed and validated exhaust gas turbochargers. Even for the further reduction of fuel consumption in gasoline engines, this provides a timely technology for downsizing.

If the goal is to generate as much power as possible with as small an engine as possible, there is no getting around supercharging the fresh air supply to the engine. The success of the diesel engine is thus inextricably linked to the exhaust gas turbocharger (EGT). In recent times, the EGT has quickly gained importance for the gasoline engine as well, since relatively small, fuel-efficient gasoline engines can only be placed on a par with their larger counterparts thanks to increased power output through supercharging. Bosch Mahle Turbo Systems has taken on this challenge and has developed exhaust gas turbochargers that already meet tomorrow's requirements today. The first two validated turbochargers cover the 65-kW-to-100-kW performance range in the gasoline engine sector and the 90-kW-to-120-kW class of diesel engines. The company plans to expand its EGT portfolio successively to include all engine performance classes.

Exhaust gas turbochargers for increasing requirements

The new exhaust gas turbochargers are designed for high-precision control accuracy: Precise electric actuators for the wastegate or variable turbine geometry (VTG turbocharger) in diesel engine applications make the EGT an electronically controllable system that enables continuous adaptation of compression to changes in engine operation. Specifically, compatibility with the low-pressure exhaust gas recirculation system (low-pressure EGR) is already assured for diesel engine EGTs. With this me-

thod, particularly high EGR rates can be achieved and therefore also low raw NO_x emissions. However, it also exposes the impeller of the EGT (air side) to hot exhaust gas. A wheel coating and the low-pressure particulate filter developed by MAHLE protect the compressor in such applications.

Precision and service life

Because the exhaust gas turbocharger operates at extremely high rotational speeds, the company produces turbine wheels and compressor impellers with shafts that are virtually free of original unbalance resulting from the manufacturing process itself. This reduces the load on the bearing points while ensuring running smoothness. Small gap widths between the turbine vanes and housing ensure highly efficient operation of the compressor and turbine. Moreover, the geometry of the turbines is optimized for quick response. With regard to the ever more popular automatic start-stop systems, the design of the rotor bearing is particularly robust and stable. Specifically for applications in gasoline engines, high temperature-resistant materials are used. When selecting such materials, MAHLE can draw on its own decades-long experience in producing EGT components.