

## Driving the Future Engines of Innovation

With creativity and a passion for performance, precision, and perfection, MAHLE Powertrain, is constantly researching future engine technologies to ensure that the company is prepared for their introduction as soon as they are proven.

The company is a leading development partner of the automobile and engine industry, with unique system competence in the area of combustion engines and engine peripherals—earning its place among the top three system suppliers for Piston Systems, Cylinder Components, Valve Train Systems, Air Management Systems and Liquid Management Systems. It is a subsidiary of MAHLE Group, a top 30 automotive supplier globally, with annual sales of 5.1 billion Euros, 70 production plants and approximately 38,000 employees worldwide, including more than 2,000 development engineers who are working on future-oriented products, systems, and processes.

MAHLE's demonstrated ability to significantly outpace average industry growth rates has been a driving force of ongoing expansion, growing competence, and investments in innovation. For more than 80 years, the company has been setting new industry standards and making its customers successful.

Considering the factors of high performance, economy, environmental compatibility, safety, reliability, comfort, cost-effectiveness—the demands on a modern vehicle are already complex.

This is not unfamiliar to those on the front lines of automotive innovation. In today's highly flattened global economy, the automotive market has long been characterized by enormous price pressure, making the supply of precise and reliable products a basic prerequisite for operating successfully. Adding fuel to this challenge are more recent imperatives affecting the entire automotive industry. Specifically, expected government restrictions of carbon emissions to offset global warming combined with the urgent need to increase fuel economy to temper skyrocketing energy costs.

Studies have shown that land-based passenger cars and commercial vehicle traffic only accounts for approximately 12 percent overall of total man-made carbon production.\* Nevertheless, the automotive industry is faced with reconciling technical progress with human, ecological, and economic factors. As a technology leader, MAHLE wanted to understand where it could best leverage its innovative strength to create new engine technologies that would meet these marketplace demands.



### Fast Facts

**Industry**  
Automotive

**Headquarters**  
Stuttgart, Germany

**Challenge**  
Reduce fuel emissions and increase fuel economy

**Solution**  
Used Goldfire to identify potential gaps in the market and support rapid development

**Benefits**  
*"We need to move fast to seize new growth opportunities and make sure our customers benefit from our innovations at the earliest opportunity. Goldfire helps us quickly carry out research and development projects by giving us a development platform with rapid and intelligent access to our internal systems, databases, and worldwide patent literature."*

- Hugh Blaxill  
Chief Engineer  
MAHLE Powertrain, Ltd.

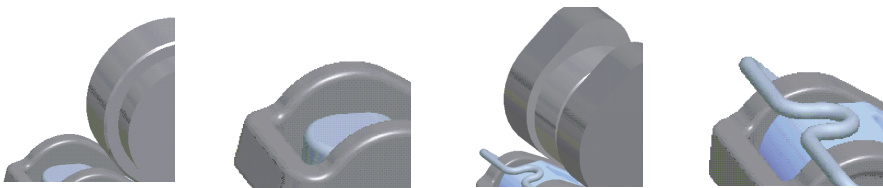
MAHLE researchers study technologies that may seem theoretical at present, but later prove to be the future of the engine industry. Known for using the latest innovation tools and adhering to a structured approach to product design based on proven methodologies, MAHLE turned to Goldfire, the optimal decision engine, to support their efforts.

With Goldfire's robust innovation capabilities, the team is able to call up visual models of their system design, then tap into the tool's power to achieve a particular innovation task. In this case, the team wanted to explore ways to gain improved fuel performance without needing to change the basic system design.

Goldfire was used to quickly carry out an incredible amount of research into the technology landscape to identify where the market was covered, and where there were potential gaps—all while using MAHLE's core engine system design as a starting reference point. The findings from this played a strong role in identifying a credible direction for development of a certain type of engine cylinder and downsizing technology that would improve fuel economy.

Armed with the precision and speed of Goldfire-enabled research, the team rapidly developed a new valvetrain and deactivation system, leading to 2 patents (Figure 1) and a joint-development project with an original equipment manufacturer (OEM).

Figure 1. Patented Valvetrain Solutions



On the second project, MAHLE used Goldfire to get around patent obstacles from other companies in the field related to turbocharging capability for downsized engines. The impressive culmination of this work is a 50/50 joint venture with Robert Bosch for the development, production, and sale of exhaust gas turbochargers for passenger cars and light commercial vehicles. The new entity, "Bosch Mahle Turbo Systems GmbH & Co. KG" commenced business in June 2008. Both companies regard the exhaust gas turbocharger as one of the key technologies for the sustainable reduction of fuel consumption and carbon emissions.

Hugh Blaxill, chief engineer at MAHLE Powertrain shared, "Without Goldfire there would have been a high risk of reinvention or investment to later discover we were infringing on someone else's patent. Goldfire turbocharged our engineering efforts, which made a difference in seizing this market opportunity."

Not only has MAHLE secured its innovative leadership in the marketplace, it has again taken the industry forward by designing engines for a more sustainable future.

## Goldfire Usage Highlights

MAHLE's commitment to innovation and precision is supported by Goldfire's robust and integrated technology tools:

- ▶ Function Models to visually articulate engine systems and investigate untapped innovation potential
- ▶ Integrated Semantic Technology to research interdisciplinary concepts from MAHLE's internal systems, Goldfire technical content and worldwide knowledge
- ▶ Goldfire Intelligence to review and protect solutions as new intellectual property

Global 2000 manufacturers in more than 40 countries rely on Invention Machine's Goldfire platform for product innovation, process improvement and market expansion. For additional information, please visit [InventionMachine.com](http://InventionMachine.com).