

Bosch Engineering and Ligier Automotive present high-performance vehicle with a hydrogen engine at 24h race in Le Mans

June 8th, 2023
PI11671 BEG MBC/Cd

- ▶ Ligier JS2 RH2 demonstration vehicle presented as part of the 100th anniversary celebration of the 24 Hours of Le Mans
- ▶ 3.0-liter hydrogen engine with combined port fuel and direct injection provides 420 kW
- ▶ Comprehensive hydrogen safety concept combines components for active and passive protection

Abstatt (Germany), Magny-Cours (France) – Just a few months into a joint innovation project, experts from Bosch Engineering and Ligier Automotive have built a high-performance vehicle with a hydrogen engine. The demonstrator is based on the Ligier JS2 R race car, which was modified for hydrogen operation. With this innovation vehicle, both companies demonstrate the potential that alternative, climate-friendly drive systems have for high-performance applications such as motorsports. The Ligier JS2 RH2 was officially presented to the public for the first time today as part of the 100th anniversary of the 24 Hours of Le Mans. “Hydrogen engines offer a huge potential for high-performance applications, especially in motorsports. By constructing the demonstration vehicle, we illustrate our many years of expertise as an engineering service provider and, in particular, our competence in the complex environment of hydrogen”, says Dr. Johannes-Jörg Rüger, president of Bosch Engineering GmbH. Jacques Nicolet, president of Ligier Automotive adds, “The Ligier JS2 RH2 shows that Bosch Engineering and Ligier Automotive are ready to tackle tomorrow’s challenges by offering innovative solutions to integrate new energies.” The Ligier JS2 RH2 has already been driven on test tracks in Germany and will be further developed and tested during the summer.

In the project, Bosch Engineering oversaw the overall vehicle design and played the key role in developing the concept for engine and tank system, and a comprehensive multistage hydrogen safety system. Ligier Automotive was responsible for the global vehicle dynamic performance, the design of the

monocoque, and the chassis adaptation of its existing Ligier JS2 R. They also optimized the mechanical components for use with hydrogen and led their overall integration into the new vehicle. The vehicle features a V6 hydrogen engine and a carbon monocoque that integrates three 700-bar type IV hydrogen cylinders from Hexagon Purus. These tanks match the requirements on the dimensions, performance, and safety for the high-performance demonstration vehicle. The 3.0-liter biturbo charged V6 engine already has an output of 420 kilowatts and will be optimized even further in the coming weeks. It is based on a volume-production gasoline power unit that the experts at Bosch Engineering have converted for use with hydrogen. In particular, this involved adapting the ignition and the entire injection system. Not only does the engine concept ensure very lean combustion, with especially low nitrogen oxide emissions up to partial load. It also delivers a very high specific output. Another challenge while developing the engine was to achieve stable combustion without preignition at high loads and engine speeds of over 7,000 rpm.

The vehicle's multistage hydrogen safety concept includes the storage system with its high-pressure tanks as well as the pressure controllers and supply lines to the engine and injection system. For example, integrating Hexagon Purus hydrogen tanks into the vehicle's carbon monocoque ensures optimized packaging and a high level of safety in the event of a crash. Separation of tank, gas control components and engine compartments plus a passive ventilation concept through pipes and chimneys ensure that gases are specifically removed to the outside in a failure situation and avoid entering the passenger compartment or closing to hot parts from engine bay. In addition, leaks in the system are detected by an extensive sensor system. Rürger explains, "Depending on the type and severity of the defect, the system triggers a multistage active safety concept, ranging from a warning to the driver on the display to a shutdown of individual line circuits up to an entire system shutdown."

Adapting the Ligier JS2 R to integrate the hydrogen system was key to the project's success. "We decided to replace the existing structure with a carbon monocoque and worked closely with our sister company HP Composites and the R&D specialist Carbon Mind on this aspect of the project," explains Julien Jehanne, plant manager at Ligier Automotive. "We have relied on all our experience as a racing car constructor and created a custom-made carbon monocoque. With our current Ligier range of cars and the expertise we have developed in the past years, we have all the tools to design and build reliable high-performance cars integrating new energies."

Bosch Engineering has already been working on concepts for hydrogen engines since 2016 and provides services for high-performance applications, as well as for

other areas. Not only does Bosch Engineering benefit from its many years of experience as a development partner for super sports cars and motorsports. It also has extensive specific expertise in dealing with hydrogen. For the development and application of hydrogen drives – both as internal-combustion engines and with fuel cells – there are specially equipped test benches operated by certified, trained personnel, a hydrogen filling station, and workshops with all the necessary ventilation technology.

Press photo/s: #900ac935, #6e6e7516, #5442f7d2, #f4fed2ed, #3e9fe11a

Contact person for press inquiries:

Bosch Engineering

Ligier Automotive

Cornelia Dürr

Elsa Nicolet

Telefon: +49 7062 911-1986

Telefon: + 33 (0) 6 16 36 77 30

E-mail: Cornelia.Duerr@de.bosch.com

E-mail: e.nicolet@ligierautomotive.com

About Bosch Engineering GmbH

Bosch Engineering GmbH is a wholly owned subsidiary of Robert Bosch GmbH and is headquartered in Abstatt, Germany. As a systems development partner to the automotive industry since 1999, the company with its more than 3,300 associates offers development services for powertrains, safety and convenience systems, and electrical and electronic systems – from the original concept to series production. Specialized in electronics and software, it draws on Bosch's proven large-scale series production technology to develop tailored solutions for a wide variety of applications in passenger cars, commercial vehicles, off-highway and recreational vehicles, and in rail applications, ships, and industry. Bosch Engineering GmbH also coordinates all the Bosch Group's motorsports activities.

Additional information can be accessed at www.bosch-engineering.com.

Mobility is the largest Bosch Group business sector. It generated sales of 52.6 billion euros in 2022, and thus contributed almost 60 percent of total sales. This makes the Bosch Group one of the leading automotive suppliers. The Mobility business sector pursues a vision of mobility that is safe, sustainable, and exciting, and combines the group's expertise in the domains of personalization, automation, electrification, and connectivity. For its customers, the outcome is integrated mobility solutions. The business sector's main areas of activity are injection technology and powertrain peripherals for internal-combustion engines, diverse solutions for powertrain electrification, vehicle safety systems, driver-assistance and automated functions, technology for user-friendly infotainment as well as vehicle-to-vehicle and vehicle-to-infrastructure communication, repair-shop concepts, and technology and services for the automotive aftermarket. Bosch is synonymous with important automotive innovations, such as electronic engine management, the ESP anti-skid system, and common-rail diesel technology.

The Bosch Group is a leading global supplier of technology and services. It employs roughly 421,000 associates worldwide (as of December 31, 2022). The company generated sales of 88.2 billion euros in 2022. Its operations are divided into four business sectors: Mobility, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT provider, Bosch offers innovative solutions for smart homes, Industry 4.0, and connected mobility. Bosch is pursuing a vision of mobility that is sustainable, safe, and exciting. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to facilitate connected living with products and solutions that either contain artificial intelligence (AI) or have been developed or manufactured with its help. Bosch

improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is “Invented for life.” The Bosch Group comprises Robert Bosch GmbH and its roughly 470 subsidiary and regional companies in over 60 countries. Including sales and service partners, Bosch’s global manufacturing, engineering, and sales network covers nearly every country in the world. With its more than 400 locations worldwide, the Bosch Group has been carbon neutral since the first quarter of 2020. The basis for the company’s future growth is its innovative strength. At 136 locations across the globe, Bosch employs some 85,500 associates in research and development, of which nearly 44,000 are software engineers.

Additional information is available online at www.bosch.com, www.iot.bosch.com, www.bosch-press.com, www.twitter.com/BoschPress

Ligier Automotive

Ligier Automotive is a manufacturer based in France (Magny-Cours, Amilly) and in the US with Ligier Automotive North America (Denver, North Carolina) with around 100 associates. It offers one of the largest range of cars marketed under the same brand: from sports prototypes (Ligier JS P4, Ligier JS P3, Ligier JS P320, Ligier JS P2, Ligier JS P217, Ligier Nissan DPi), to single-seaters (Ligier JS F3, Ligier JS F4 and Ligier JS F422) and GT with the Ligier JS2 R. Since 2014, it built around 580 racing cars. Ligier Automotive is the first and unique car constructor since Ferrari in 1998 to have won the 24 Hours of Daytona, the 12 Hours of Sebring and Petit Le Mans the same year and the only French car constructor to have won the 24 Hours of Daytona. Ligier Automotive is also the preferred partner of major OEM vehicles manufacturers to design and produce their concept cars and special vehicles.

Additional information may be accessed on www.ligierautomotive.com/en/