# Demo Book

## Study Day – High Performance Hydrogen Internal Combustion Engine

**Event information:**

Organized by the Society of Automotive Engineers

19 March 2026

Hosted by Université d'ORLÉANS

**Demonstrators:**

HORIBA

ARESIA

HydroTeam

FORVIA

PHINIA

Pipo MOTEURS

LIGIER

BOSCH

Jasper SWERTS - H2 Powertrain Engineer

Joshua LACEY - Associate Professor

Martijn SCHELLIS - Head of H2 Powertrain Engineering

HydroTeam is a student engineering team from KU Leuven developing an innovative hydrogen internal combustion engine race car. The project brings together more than 60 students from multiple disciplines, including mechanical, electrical, software, aerodynamics, and powertrain engineering who collaborate closely with industry partners on the design, manufacturing, and integration of a high-performance prototype.

The mission of HydroTeam is to demonstrate the potential of hydrogen as a sustainable solution for high-performance mobility, with the long-term ambition of competing in the 24 Hours of Le Mans by 2030. Beyond racing, the project serves as a technological platform for innovation, applied research, and hands-on education, preparing the next generation of engineers to shape the future of sustainable mobility.

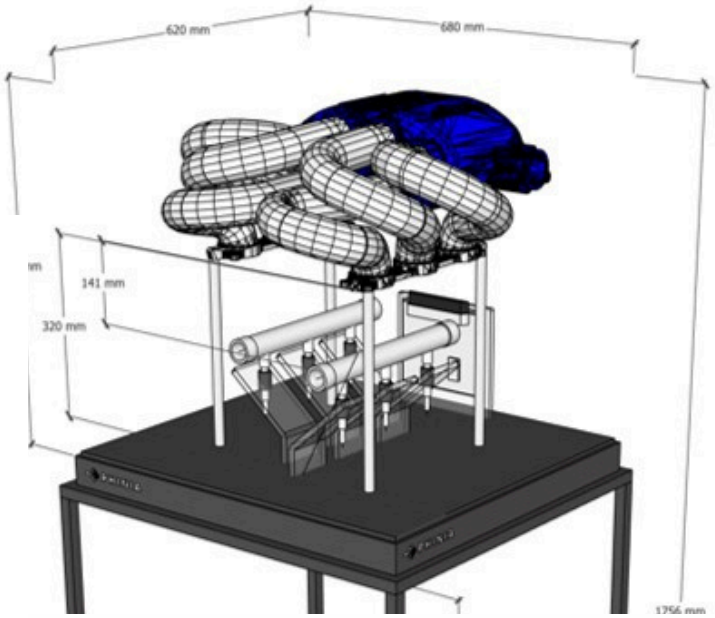
FORVIA


Julien HERGOTT - Cryogenic Systems Engineering Manager

Pierre TIPNER - Head of Engineering Sales / CCE / Managing Director


Laurent DORADOUX - Senior Engineering Manager

Baudouin GOMOT - Gasoline Advanced Component Application Manager




**Build in May 2025**

**Content: 6 $H_2$ Injectors, 2 rails, ECU, Intake Planum from Alpine**

**Display Size: 1756 H x 716 x 656**

**Crate: Handle with care - Do not tilt the crate need to stay standing**

**- dimension L 86cm x W 80cm x H 198cm –**

**- Total weight 123 Kg**

PHINIA

## 2024/2025 Alpine Alpenglow Hy6 Hydrogen Internal Combustion Engine

| Twin-turbocharged V6 100-degree | |
|---|---|
| **Displacement** | 3500 cc \| 213.6 cu in. \| 3.5 L. |
| **Bore** | 95.0 mm \| 3.74 in. |
| **Stroke** | 82.3 mm \| 3.24 in. |
| **Valvetrain** | 24 DOHC (4.0 valves per cylinder) |
| **Hydrogen Injection System** | PHINIA 40bar H2 Direct Injector<br>PHINIA H2 Injector Driver |
| **Power** | 740 BHP (544.64 KW) @ 7600 RPM |
| **Torque** | 568 Ft-Lbs (770 NM) @ 5000 RPM |
| **Redline** | 9000 RPM |
| **Top Speed** | 306km/h (190mph) during demo laps at Le Mans |

PHINIA 44


PHINIA

# LCV SOLUTION

## With Hydrogen Internal Combusion Engine

**TYPE**
Carbon Free Combustion Vehicle
Retrofit design >95 %
common with diesel car

**POWER - TORQUE**
100kW - 340 Nm

**PERFORMANCE**
PTAC: 3.5 tons,
Top Speed: 130 km/hr

**RANGE**
Autonomy up to 400 km

**CAPACITY**
Carry up to 1100 kg

**DISPLACEMENT**
Purely run on Hydrogen
(no more fossil fuel)

phinia.com

PHINIA

# MINIBUS SOLUTION

## With Hydrogen Internal Combusion Engine

**TYPE**
Carbon Free Combustion Vehicle
Retrofit design >95 %
common with diesel car

**POWER - TORQUE**
100kW - 340 Nm

**PERFORMANCE**
PTAC: 3.5 tons,
Top Speed: 130 km/hr

**RANGE**
Autonomy up to 400 km

**CAPACITY**
Carry up to 9 people

**DISPLACEMENT**
Purely run on Hydrogen
(no more fossil fuel)

phinia.com

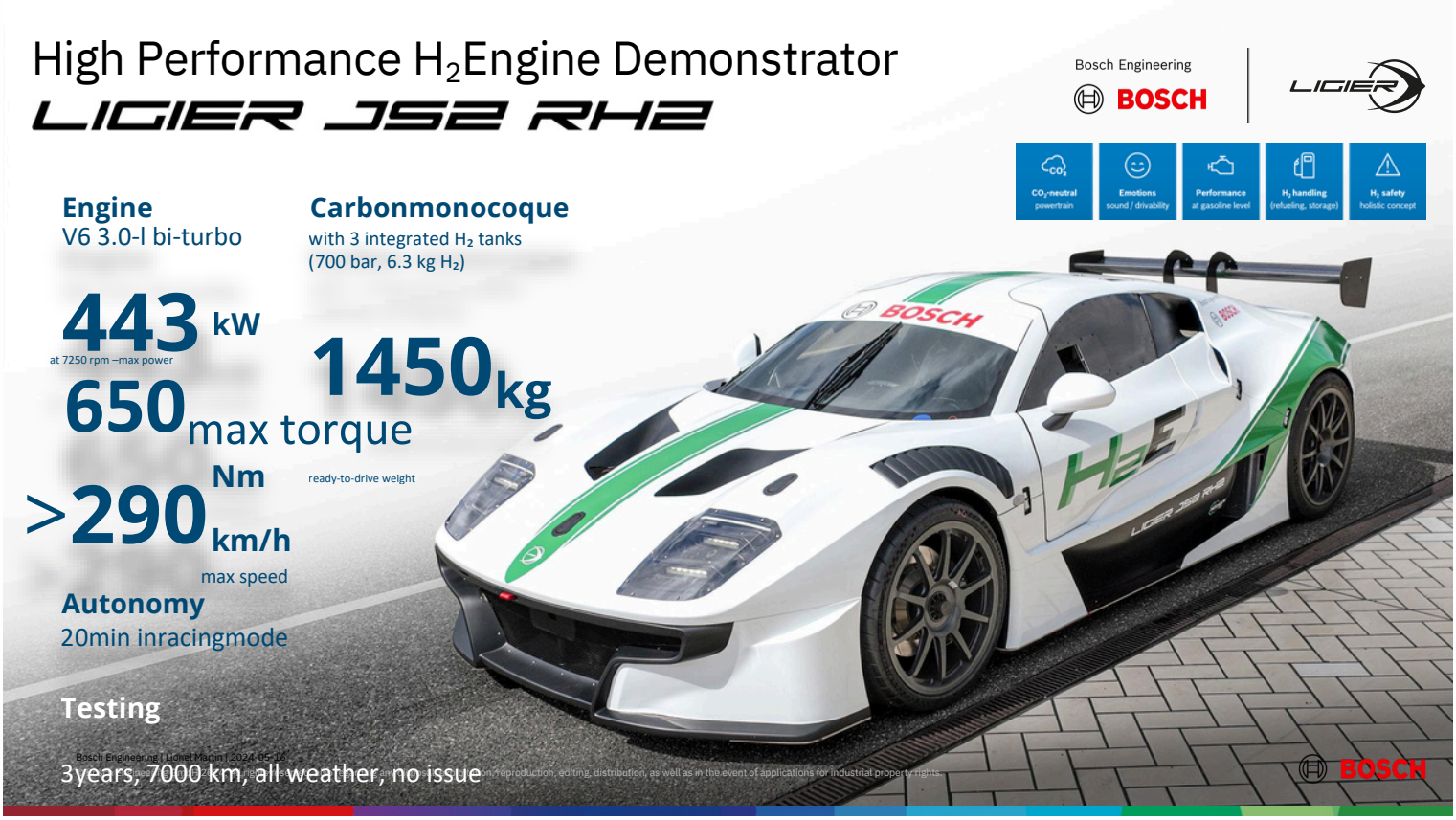
Thibault GAULAIN -
Hydrogen Engine Project
Manager

<u>Moteur PR2</u>
Conception 100% Pipo Moteurs
4 cylindres, 2.0L, turbo
Basé sur le moteur RX2 conçu pour le championnat du monde de rallycross.
Perfo essence : 600ch, 900Nm
Perfo hydrogène actuelle : 300ch, 400Nm à lambda=2
Injecteurs DI H2 haut débit Phinia


Lionel MARTIN - Product Manager H2

Pierre HUMBERT - senior project manager of engine control management and high performance H2 engine

Vincent BAUDET - Powertrain Engineer & Hydrogen Specialist




On 8 June 2023, during the 24 Hours of Le Mans Centenary, Bosch Engineering and Ligier Automotive unveiled the Ligier JS2 RH2, a high performance vehicle with a hydrogen engine. This demonstrator is the product of the strategical and technical partnership launched between the two brands in November 2022

# CRYOGENIC TANK LH2

ARESIA
Bolder together

## Liquid hydrogen tank: 100% Aresia design of a double-shell aircraft-ready metal tank

### THE CHALLENGE

The decarbonisation of aviation to counter global warming and reduce consumption of rare resources has encouraged us to explore alternative energy sources.
Hydrogen has been identified as a future fuel for civil aviation use. But as hydrogen takes up more space, in order to carry an equivalent energy source it needs to be liquified and kept at -253°C. To begin to consider its integration in an aircraft we will need specialised reservoirs.

### INNOVATION

Specialising for many years in the development and construction of aviation reservoirs, ARESIA anticipated the emergence of hydrogen as a future energy source and has developed its own technology in the race to decarbonise future civil aviation.
Our reservoir allows the liquid hydrogen to be safely stored for several hours, and at the normal boil off rate we generate enough pressure to extract the quantity of hydrogen needed at the correct flow rate.

### APPLICATION

The decarbonisation of civil aviation.
A cryogenic liquid storage unit that is designed for use as part of an onboard aircraft system, providing variable flow distribution of pressurised hydrogen gas, designed by ARESIA and ready for production.



sales@aresia.com - T +33 1 47 94 66 20 - 13 Av. Marcellin Berthelot - 92390 Villeneuve-la-Garenne - FRANCE
aresia.com

# Système carburant embarqué à partir d'hydrogène liquide

Une innovation ARESIA protégée par 5 brevets

## Concept ARESIA pour la distribution d'hydrogène gazeux conditionné sous pression à partir d'un stockage liquide pour véhicules contraints en masse, encombrement et autonomie.

Cette maquette a été faite en partant du Cryotank v1 fonctionnel conçu et fabriqué par ARESIA, aux performances démontrées en 2024 par des remplissages à l'hydrogène liquide.

Nous y avons ajouté ici des éléments fabriqués par impression 3D qui représentent le système de conditionnement de l'hydrogène liquide en hydrogène gazeux pour une consommation par un moteur à combustion ou par une pile à combustible, équipements en développement chez ARESIA pour des véhicules spécifiques tel que pour la course automobile.

Le Cryotank v1 repose sur les concepts brevetés d'un réservoir optimisé en masse et robustesse pour la mobilité. Ce réservoir peut s'adapter à différentes applications et anticipe sa maintenance par sa démontabilité, sa inspectabilité et sa réparabilité.

ARESIA et Cryopal ont collaboré pour atteindre le niveau d'isolation cryogénique sous vide nécessaire au stockage d'hydrogène liquide à -253°C.

Sans cryopompe ni cryovanne à débit variable, l'hydrogène liquide se dirige vers des réservoirs tampons de compression isochore au nombre de 3 sur cette maquette.

Avec l'ISAE Supaero et CMP Composites, supportés par l'AID et l'ANR dans le cadre d'un projet ASTRID, nous allons prochainement fabriquer des réservoirs tampons capables de faire monter en pression et en température l'hydrogène liquide. Chaque réservoir tampon se rempli l'un après l'autre laissant le temps à son prédécesseur de délivrer l'hydrogène qui aura été réchauffé par le biais d'un circuit échangeur.

L'échangeur thermique est en développement par D.A.T.E.

Cette technique permet d'alimenter en continue un consommateur d'hydrogène à partir d'un stockage liquide et de subvenir aux variations de débits requises pour les accélérations véhicules.

# HORIBA

## Your Partner for Hydrogen Mobility

## *Emission Analysis*

### *Reliable Gaz Measurement for Hydrogen Engines*

## THE CHALLENGE

Hydrogen Internal Combustion Engines
*For the next generation of mobility*
- Engine Development
- Regulatory compliance

**Key Gases to Monitor:**
$H_2$ | $NO_X$ | $NH_3$ | $N_2O$

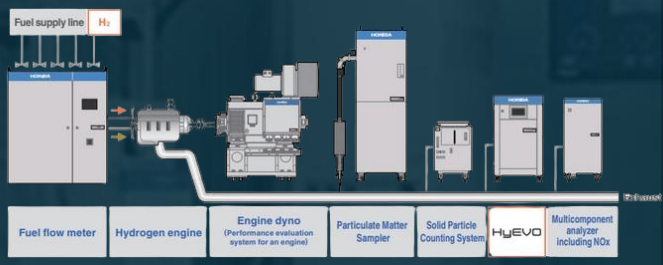
## SPOTLIGHT PRODUCT

*MEXAcube* Gas Analyzer
- Multi-Gas Capability
- Accurate $NO_X$, CO, $CO_2$, $N_2O$, $NH_3$, HCHO, $CH_4$ and THC Detection
- Visible at our booth

## OUR SOLUTIONS

High-Precision Gas Analyzer Family for $H_2$ Engines:
- Fast Response
- High Stability
- Compact Design
- Lab. & Field Testing


*HyEVO* Hydrogen Gas Analyzer




*Complete HORIBA Testing Station for $H_2$ ICE:*
- *Fuel flow meter*
- *Engine dyno*
- *Particulate matter sampler*
- *Solid particle counting system*
- *Hydrogen gas analyzer*
- *Multicomponent analyzer including $NO_x$*


https://www.horiba.com/fra/mobility/