Automotive

- Design and manufacture
- Technical consulting
- Research and development
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Pioneering technology for tomorrow’s automotive markets

Our mission at Ricardo is to support the evolution of the automotive sector towards an efficient, sustainable low-carbon future.

As the industry responds to seismic changes in the automotive market – and across society as a whole – we remain one of its most trusted and innovative partners, leading the way in high-calibre research across engines, drivelines and hybrid systems, as well as supporting the development of emerging technologies such as autonomous and connected vehicles.

Deep technical knowledge, complemented by an expansive strategic consultancy offering, uniquely positions us to support clients across every stage of the product development process, from clean-sheet design to manufacture, testing and product launch.

**Key services include:**
- Market research and strategic planning
- Powertrain and component design and integration
- Efficiency optimisation
- Emissions reduction
- On-board system software
- Calibration and independent testing
- Niche manufacture
- Whole-product-lifecycle support
- Vehicle chassis and attribute engineering
- Tailored research and development solutions

In a sector under more scrutiny than ever, and on the cusp of a new technological era, choosing Ricardo as your technical partner sends a clear message to the market that your business is committed to delivering innovative, high-quality products to its customers.
Who we are

The cornerstone of our business is the quality of our professionals and the diversity of experience, disciplines and outlooks that they represent.

Across our global teams are experts committed to pushing the boundaries of vehicle design and technology. They are engineers, scientists and support staff renowned for delivering innovation in areas including engines, transmissions, electric and hybrid vehicles, fuel technologies and vehicle testing.

Alongside them are those we have attracted to the industry from other walks of life – including government, academia and science – who bring skills and insight from a broad range of industry sectors, such as environmental regulation, mass transit operations, smart cities and clean energy.

Binding us together is a shared value of being free to offer trusted expertise. We're a natural home for professionals who want to see things done properly; who believe it is their responsibility to anticipate problems and deliver tangible results.
How we help

We provide a global, multi-sector pool of expertise that combines local industry knowledge with international viewpoints, coupled with world-leading engineering facilities.

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We were commissioned to design a minimum-change upgrade to the Ford Focus RS Ecoboost 2.3L engine. We optimised engine performance, supported the client’s vehicle calibration team and provided systems engineering. The engine was launched successfully with good press feedback, and various territory performance certifications were achieved.

Ford Focus RS Ecoboost 2.3L
350PS engine upgrade

Bugatti Veyron and Chiron
Dual-clutch transmission

Our experts designed, developed – and continue to manufacture – the highly demanding seven-speed, four-wheel drive, dual-clutch transmission for the Bugatti Veyron. The transmission has been upgraded and is being manufactured by Ricardo for the Bugatti Chiron.
Anhui Jianghuai Automobile Group (JAC)
48V mild hybrid ‘HyBoost’ – concept to production

Ricardo and JAC are collaborating on a 48V mild hybrid engineering programme for a downsized TGDI engine, from concept to start of production. Ricardo is responsible for Mule vehicle build, test and procurement, noise, vibration and harshness (NVH) optimisation, DVP management, key hybrid system development and integration, functional safety, and extensive software and calibration development.

Changhe
N Series direct injection turbocharged engine family

Changhe required a new engine family to meet future customer and legislative requirements. We supported concept to prototype design and analysis of each engine variant and provided services for component procurement and engine build. The 1.0L I3 TGDI variant was developed from clean sheet to first fire in under 11 months, and met client performance targets.

Ford Ranger
Product calibration for global markets

Our team was responsible for all base-engine and aftertreatment calibration for the Ford Ranger I4 and I5 diesel engines. To meet 27 world market target emission levels, 46 unique calibrations with varying engine hardware options (turbocharger, EGR, AT) were delivered on time. This was the largest certification event by Ricardo, Ford or the authorities, to date.
The factors that influence the development and application of passenger car powertrain technologies today are more complex than at any time in the history of the automotive industry. Regulatory frameworks in the major international markets are pushing the automotive industry towards a more energy efficient, cleaner and more environmentally sustainable model of transportation.

Ricardo Integrated Electrification

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**Electrification**

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The role of electrification

The increasing electrification of passenger car powertrains – whether through hybridisation or substitution with pure battery electric architectures – is essential if US 2025 CAFE and EU targets for 2021 and beyond are to be met.

Architectures and OEMs of the future

A significant proliferation of the range of available powertrain technologies has occurred in a relatively short period, particularly when compared to typical automotive product development cycles. In addition, new players have emerged with a clear and exclusive focus on battery electric vehicles, while others have expressed the intention of entering the market at a later stage, with autonomous vehicle products. Ricardo is active across this area, with the full range of customers, and is supporting the electrification opportunity with research and development in all of the important systems, and in the development of its facilities, people, organisation and toolset.

Engineering the organisation

With the exception of BEVs, increasing electrification brings increasing complexity in packaging of the new electrified systems. This will sit alongside a future version of today’s combustion engine, which will itself be more complex. A further challenge is with the high-level control systems, which must be calibrated to enable these electrified architectures to deliver a seamless and fully blended experience for the customer.

To help deliver this, we are implementing an approach to electrified vehicle development that we are calling R-Intelect (Integrated Electrification). This combines a focus on functional system engineering with the application of an integrated model-based development (IMBD) toolset.
Functional systems engineering
The individual functions of a vehicle powertrain, such as acceleration and braking, are delivered by a combination of sub-system behaviours. For an electrified powertrain, many more sub systems are involved. The product development discipline that exists to optimise the combination of sub systems for overall powertrain or vehicle delivery of a given function, is functional system engineering.

Within our development organisation, the functional system engineering provides an additional layer over and above the traditional organisational delineations of engine, transmission, chassis and other sub-systems engineering teams.

Ricardo IMBD Toolset
Our IMBD toolset provides a framework for the exchange of data and information between analysis and simulation operations, with a hierarchy of tools that can be applied through the development V-cycle. As each new product programme is initiated, an experienced cross-business team is used to define the optimum modelling approach for each step of the process. Crucially, the IMBD environment enables the use and continual updating of sub-system modelling outputs in higher-level system models, and for these data to be replaced by test results as they become available later in the development cycle.
Our approach to product development is attribute-led, and delivers integrated designs in the context of the vehicle environment. Through a structured product development process, the Ricardo team works closely with customers to maximise delivery efficiency and ensure a robust and high-quality final vehicle.

Vehicle engineering

As a leading provider of turnkey vehicle programmes, our team is structured with both attribute and system engineering as core competencies.

Strategic consulting
Development of a successful product requires detailed engineering and business planning. Ricardo supports customers by creating a powerful combination of vehicle engineering and strategic consulting to develop:
- Assessment of market potential
- Overall business case
- New model development plans
- Engineering programme content
- Manufacturing strategy
- Launch strategy.

Vehicle benchmarking
Understanding competitor vehicle performance is critical to a manufacturer’s understanding of how its product will be received in the market. Ricardo works with product planning teams, vehicle line executives and system/attribute leaders to perform intelligent attribute benchmarking at vehicle level, with both subjective and objective metrics. Ricardo output is used to set targets for new products, guide system design direction and support the improvement of existing products.

Vehicle programme management
Extensive experience in delivering vehicle programmes allows the Ricardo team to manage the cross-discipline complexity of engineering development. Applying our in-house Product Development System (R-PDS) drives structure and quality in the engineering process ensures our customers’ products are successfully launched. R-PDS covers all stages of the product lifecycle through a structured set of phases and milestones, and is supported by up-front technology readiness evaluation.

Vehicle integration and attribute development
Ricardo practices attribute-led engineering throughout the product development lifecycle. This approach adds value to our customers’ products by creating a strong link between the driver experience and the specification of the vehicle systems and components. Structured CAE processes, virtual validation and model-based development reduces the development costs in prototyping and physical testing.

Ricardo is active in these areas:
- NVH
- Vehicle dynamics
- Thermal management
- Performance and driveability
- Energy efficiency
- Aerodynamics
- Architecture integration/package
- Safety
- Weight optimisation
- Cost reduction
Component and systems engineering
Ricardo employs a combination of systems engineering principles and sound engineering processes to develop vehicle systems and components across powertrain, chassis and electrical domains. Our engineers work as an integrated part of the customer team to ensure the requirements of service, manufacturing, quality and cost are respected throughout the design process – from product definition and concept development to production release and launch of series production. Ricardo’s in-house CAE and attribute teams support our system and component engineering with virtual development methods and a focus on achieving system targets, in the context of delivering whole-vehicle performance.

Technology demonstrator vehicles
Demonstration of new technology is most successful when it can show the benefit brought to the end user. Ricardo works with both Tier 1s and vehicle manufacturers to develop demonstrator vehicles displaying the benefits of single or multiple technologies at vehicle level. The combination of attribute and systems engineering across vehicle systems at Ricardo helps to show new technology at its best, and encourage early adoption.

Product launch and through-life engineering
As part of the many vehicle development programmes completed at Ricardo, we have taken responsibility for delivering the engineering product through the launch phase into series production. A combination of quality process, manufacturing experience, broad engineering capability and global reach allows Ricardo to deploy launch teams across the world to support our customers’ growth. Further into the product lifecycle, Ricardo supports customers’ continual improvement actions in areas of field issue investigation, quality improvement, and cost- and complexity reduction. Specific engineering teams drawn from around the Ricardo organisation give focus and enable rapid results.
Engine efficiency was the expertise upon which the Ricardo group was founded. Today, we remain pioneers in engine technology, with a global reputation for capabilities ranging from design through to manufacture – across petroleum, diesel and emerging biofuel and gas engines.

**Design**
We have a global community of over 800 specialist engineers providing designs for full engines and individual components. The projects we support range from performance upgrades through to multi-phase design programmes for new high-volume-production engine families.

**Fuels, lubricants and aftertreatment**
We offer world-class analytical facilities for fuels, lubricants, catalysts and aftertreatment systems. We help clients develop fuels and lubricants for a variety of applications through the optimisation of performance, emissions and fuel consumption. We also provide analysis of catalyst activity to improve aftertreatment systems for all kinds of fuel, including biofuels.

**NVH**
We have been a leader in NVH development and optimisation for over 40 years, offering expertise in problem identification and resolution, optimisation and concept design simulation.

**Testing**
More than 60 independent test cells operating 24 hours a day across Europe and North America provide rigorous testing of complete engines. Our cells perform tests tailored to the requirements of each client, helping them to optimise the performance and durability of an engine throughout its development.

**Simulation and analysis**
Our software teams develop simulations and analysis specific to each project, from concept
layouts through to complete engine design and development programmes.

Using a wide range of CAD and CAE analysis tools, we can offer:

- Engine performance modelling
- Computational fluid dynamics
- Mechanical system analysis
- Structural finite element analysis
- Thermal management

**Calibration**

From initial design to full turnkey production calibrations, we prepare engines for international markets in full accordance with relevant legislation, with more than 100 different models proceeding to series production.

We calibrate engines that use conventional fuels and hybrid and biofuel. We also calibrate for other specifications, including turbochargers and EGR.

**Manufacture and assembly**

With an output of up to 4000 engines per year, our state-of-the-art production facility provides a near-clean-room production environment, where each and every process is carried out according to strict quality principles and within a comprehensive 'no faults forward' culture.
Ricardo engineers design, develop and test new transmissions and differentials specifically for client applications. Our expertise covers a wide range of modern transmission systems and technologies, from conventional transmissions to electric and hybrid solutions.

**Design**
Our engineers work closely with clients to create bespoke solutions, ranging from concept studies, upgrades, clean-sheet designs and demonstrator programmes through to fully developed and validated production products.

We have comprehensive engineering capabilities across all drivetrain applications and we can provide a full range of solutions, from cost-optimised systems to transmissions for premium performance applications.

**Control and electronics**
Modern transmissions require increasing levels of electronic control and calibration to boost performance and fuel economy. Ricardo assists clients by providing system architecture concept studies, transmission control unit hardware, and sensor and actuator selection, based on an objective selection tool.

We also develop high- and low-level control software for conventional and hybrid powertrains, ranging from basic function control to integrated vehicle systems.

**Simulation and analysis**
We focus on strategic use of CAE to optimise designs, investigate and resolve problems, and minimise time and cost to market. Our advanced geartrain modelling and analysis software package, SABR™, provides the foundation of concept and definitive design for all driveline and transmission projects that we undertake.

Ricardo also provides SABR™ under licence, enabling companies to optimise their own solutions, faster.

**Testing**
We offer fully supported test plans on our specialised in-house facilities, which include 2E, 3E and 5E rigs, hybrid/EV capability, battery simulation, functional spin rigs, tilt rigs and a hydraulics rig. We tailor each test plan to the requirements of the individual client. Whether it’s testing a current product or optimising product performance and durability during development, we can offer a comprehensive plan and a competitive timeframe.
**GSQA**
We have extensive capability in gear shift quality development for manual and automatic transmissions, with experience in market-specific requirements. We are also able to supply customers with our GSQA kit – one of the world’s ruling objective measurement systems for in-vehicle and on-rig use.

**Manufacturing**
Our facilities offer a range of niche manufacturing services, including extensive in-house machining, heat treatment, assembly and inspection facilities, enabling the manufacture of geared, splined and prismatic components. The ability to produce parts in house ensures high quality and short lead times.

Although we specialise in niche, low-volume production, we also deliver high volumes if required.

**NVH**
We offer specialist facilities and analysis techniques for problem identification and resolution. We also deliver optimisation and concept design simulation.

**Benchmarking**
We provide a broad range of benchmarking test and evaluation facilities. Our experts have access to the Ricardo benchmarking database and can advise customers on how to develop a more competitive future product strategy.

**Product development**
Our consultants help define product strategies for transmissions and drivelines, based upon a thorough analysis of the market, customers, technology, competition and legislation.
Hybrid and electric vehicles

In response to increasing demand for low-carbon technologies, we help clients meet their challenges in hybrid and full electric vehicle development.

We have helped to deliver more than 200 projects in this fast-growing sector, offering extensive prototype design and manufacturing capability, including complete prototype production and niche-volume production of hybrid components.

Safety critical design
Control systems in vehicles are increasingly used to provide active safety functions, which simultaneously introduces significant risks in the event of their failure.

Our engineers are skilled in the application of safety analysis techniques required by safety standards such as ISO 26262, IEC 61508 and MISRA, and provide control system software, training, leadership and guidance, and design reviews at all project stages.

Testing and validation
Our test cell facilities allow us to develop any propulsion system configuration for hybrid and electric vehicles. Electric machine testing includes characterisation, functionality and durability to validate systems for production. In-The-Loop facilities allow testing of embedded control systems in a virtual environment. High-voltage batteries can be tested at cell, module and pack level. Equipment for full-vehicle testing includes a 4WD chassis dynamometer, linked to a high-voltage battery simulator to prove out the functionality, performance and durability of hybrid and electric vehicles.
**Component development**
Ricardo has specialised skillsets to design and develop all the hardware necessary for hybrid and electric vehicles. Capabilities in battery packs, electric machines, inverters, DC-DC converters and electronic control units mean that Ricardo can deliver hardware and software solutions for integration into full-vehicle programmes.

**Software**
Proprietary and commercially available simulation software tools are used throughout the development process and can model and analyse any specification of hybrid and electric propulsion system. Ricardo’s expertise in software development for electronic control systems also includes the latest functional safety techniques, such as ISO 26262.

**Market analysis**
Typical assignments include market outlook studies, business case analyses and technology readiness assessments of increasingly electrified powertrains, i.e. hybrids, battery electric vehicles and fuel-cell electric vehicles.

We also have significant experience in developing services around a core product (e.g. charging solutions, energy contracts, battery second-life solutions) and helping to launch this ecosystem across market territories.
Technology driven trends such as autonomous driving, electrification and connected vehicles are transforming business models and supply chains across the automotive sector, with opportunities and implications for the entire market.

Ricardo is at the forefront of this new age, helping clients to develop proven, realistic responses without the hyperbole.

**Autonomous vehicles**
Ricardo demonstrated this technology in the SARTRE project, which was shown to offer a number of benefits to vehicles within the road train: Reduced fuel consumption, improved traffic flow and journey times, reduced accidents and increased driver convenience.

Ricardo is working on a number of new platooning projects in the EU and US to help drive the technology through the early TRL stages, and towards market adoption.

**Connected vehicles**
The use of advanced connectivity can help car makers increase fuel efficiency, by optimising the route and drive-cycle of the vehicle over the whole projected journey.

The Ricardo Sentience project achieved this by using telematics to look beyond the line of sight and adjust the vehicle speed to align with upcoming road topology and conditions. In addition to adjusting the vehicle speed, ancillaries such as air conditioning can be optimised in order to predict temporary stops, and manage the load accordingly.
Simulation and testing
Ricardo’s multi-disciplined team utilises sophisticated, custom vehicle-simulation tools to analyse proposed technologies and model how they would behave in different driving scenarios. If a concept stands up during simulation and analysis, the technology is physically constructed and tested to ensure it achieves the desired result(s). Experienced suppliers that could build and manufacture the technology are also investigated at this stage.

We offer concept specifications, lab and field demonstrations, and engineers that integrate prototypes into existing vehicle architectures.

Software
As a leading innovative automotive company, we are uniquely equipped to provide technology feasibility studies. We model various scenarios to offer our clients options to move designs forwards depending on their priorities for performance, emissions, cost and risks.
Testing

With comprehensive facilities in the UK, mainland Europe and North America, testing forms an integral part of Ricardo’s world-class engineering services.

Whether supporting a Ricardo project or working directly as part of a client team, Ricardo test engineers deliver advanced testing services. Testing is tailored to individual customer needs, ranging from the development of small powered hand tools to automotive engines and vehicles, marine and locomotive engines, and components and systems for large power-generation plants.

Key benefits of Ricardo testing services:
- Whether customers require a simple one-off component test or an advanced multi-bed project, Ricardo has the capability and capacity to provide a one-stop turnkey service.
- By partnering with Ricardo, customers have confidence that they are working with a world-class test-engineering team.
- Complete confidentiality, objectivity and independence enable our test-engineering specialists to help resolve any testing issue.
- Flexible approach tailored to customer needs, including technology transfer and training as required.
- A comprehensive range of rig systems is available to support development on components and sub-assemblies.

Ricardo’s £10 million Vehicle Emissions Research Centre (VERC) sets a new standard in vehicle-testing technology, providing a world-class facility that will enable the development of next-generation clean, low-carbon vehicles. The VERC was designed from the outset to accommodate the development requirements of the next generation of more environmentally friendly and fuel-efficient road-going vehicles.

The VERC is capable of carrying out climate-controlled vehicle tests, with a temperature range of -30 to +55 degrees Celsius, and humidity regulation. Configured for 4WD powertrains of up to 300 kW and capable of simulated road speeds of up to 250 km/hr, it can test vehicles from the smallest passenger cars to light trucks of up to three tonnes, including advanced technology hybrid electric vehicles and their associated energy regeneration systems and stop/start operation. For such electrified powertrain applications, the VERC is also able to measure battery state of charge in addition to vehicle emissions – an important consideration for increasingly popular plug-in hybrid vehicles.

The VERC’s exhaust emissions measurement systems are capable of supporting engineering projects to the regulatory standards applied in all parts of the world, up to and including the very highest Euro 6/7 and US SULEV standards. A novel feature in this respect is the triple Constant Volume Sampler (CVS) tunnels; typically facilities of this type have separate CVS tunnels for gasoline and diesel projects, but the VERC has a third tunnel, exclusively for the very lowest SULEV emissions.

The facility has been designed to meet all the demanding requirements for the measurement of regulated emissions and the development of advanced aftertreatment. State-of-the-art gas analysers enable the real-time measurement of CO, HC, O₂ and NOₓ, plus both EGR and exhaust CO₂ whilst specialist approaches for NOₓ speciation (FTIR) and detailed particle properties (mass, number, size) are included in the fully integrated emissions measurement capability.

Alongside this, Ricardo is an international leader in particle size and number measurement, and aftertreatment and fuels and lubricants testing. Ricardo’s chemistry laboratory provides gas chromatography, mass spectroscopy, fourier transform infra-red, and thermal gravimetric analysis.
Engine testing
Ricardo engine test facilities include steady state, semi-anechoic and highly dynamic test beds with road-load simulation and constant volume sampler systems. These test beds can be linked to the secure Ricardo web-based toolset for remote real-time interaction with ongoing tests.

Engine durability beds are configurable to client test processes – 24/7 availability typically provides 130 to 140 hours of testing per week, dependent on the robustness of the engine build level and service requirements.

Our base engine test beds can be adapted to address project requirements – facilities include specialist capabilities such as tilt, where engines may be subjected to both dynamic and static inclination in both loaded and unloaded conditions.

Vehicle testing
Ricardo vehicle test facilities support durability, noise, emissions and performance development activities across vehicle types, ranging from small scooters to performance motorcycles, passenger cars and light commercial vehicles, equipped with both conventionally fuelled or hybrid-electric powertrains. The vehicle test facilities consist of seven chassis dynamometers covering a range of services from emission and durability to NVH, addressing applications from motorcycles and scooters to small commercial vehicles.

Vehicle testing services:
• Drive cycle emissions testing
• Aftertreatment performance characterisation and unregulated emission testing
• Noise characterisation and optimisation
• Performance and fuel economy development
• Conformity of Production (CoP) testing
• In-service testing
• Vehicle homologation

Vehicle testing facilities:
• Passenger car and medium-duty vehicle emissions facilities with up to 150kW continuous rating
• Climatic capability from -25 to +40°C
• Dedicated gasoline and diesel dilution tunnels for particle size and number investigations
• High-performance 140kW motorcycle emissions facility
• Semi-anechoic vehicle chamber for NVH development and measurement
• Drive-by noise certification track.

UK
Shoreham Technical Centre
• 33 engine test cells

Germany
Schechingen Technical Centre
• 13 engine test cells

USA
Chicago and Detroit Technical Centers
• 15 engine test cells
Santa Clara Technical Center
• 3 operational reactors for bench scale catalyst testing
Strategic consulting

Senior executive support for a complex and changing world.

Ricardo’s strategic consultancy practice offers an extensive portfolio of management and environmental consulting to help senior executive teams address high-impact issues and resolve operational problems, at every stage of the value chain.

The majority of our consultants are qualified engineers with executive-level experience within the transport sector. Our environmental and energy advisers are at the forefront of policy creation and programme delivery for a range of governments and multinational organisations.

Unlike ‘pure’ management consultancies, we offer advice and analysis informed by direct industry and regulatory experience.

Clients include transport operators, manufacturers and financial and government institutions, and our assignments range from acquisitions and post-merger integration support, through to designing business turnaround programmes, modelling of future transport trends and resource scarcity impact assessments.

In the automotive sector specifically, we have helped clients undertake local market audits, challenge supplier cost structures, reform procurement programmes and review internal safety processes.

Services include:

- Business strategy
- Market entry
- Corporate sustainability programmes
- Economic impact assessments
- Commercial due diligence
- Regulation and policy
- Quality and High Value Problem Resolution (HVPR)
- Integrated cost reduction and operations improvement
- Mergers and acquisitions
- Low-carbon technology assessments
- Regulatory compliance, planning and risk management
- Sale of non-core business units
- Modelling of future transport trends
- Resource scarcity impact assessments.
Maximise efficiency and eliminate waste.

The Ricardo group

A global engineering, consulting and performance products business that specialises in transportation, energy and scarce resources.

Our work extends across a range of market sectors – such as passenger cars, commercial vehicles, rail, defence, motorsport, power generation and government – and we are proud to possess a client list that includes transport operators, manufacturers, energy companies, financial institutions and government agencies.

Through our multi-industry knowledge and deep technical expertise, we are uniquely positioned to handle our clients’ toughest strategic and operational challenges, with assignments that have included strategy development, cost reduction, safety management, regulatory compliance and environmental impact assessments.

Meanwhile, our in-house engineering capabilities enable us to provide high-quality prototypes and low-volume manufacturing of complex products and assemblies, including engines, transmissions, electric motors and generators, battery packs and fuel cell systems.

Across everything we do, and in every assignment we undertake, we remain committed to the ethos of our founder, Sir Harry Ricardo – one of the most innovative mechanical engineers of his time – who, in 1915, set out on a mission to maximise efficiency and eliminate waste.
Hybrid test facilities
- Ricardo can engineer, develop, and test many hybrid configurations.

Driveline and transmissions testing
- Comprehensive engineering capabilities
- Conversion from conventional transmissions to solutions for electric and hybrid vehicles.

Driveline and transmissions
- Advanced geartrain modelling and analysis with Ricardo's own software package, SSRi, plus available under licence for customers.

Lightweighting
- Lightweight strategies
- Vehicle-weight-reduction studies
- Lightweight component engineering

Emissions
- An international leader in particle size and number measurement, aftertreatment and fuels and lubricants testing.

Engine test facilities
- Include steady-state and highly dynamic test beds with road load simulation and constant volume sample systems.

Engine test facilities
- Engine test facilities include battery simulation and control, electronic and machine testing.

Combustion research
- Spark ignition (SI)
- Turbogas
- Hydrogen, dual-fuel combustion

Engine durability beds
- Configurable to client test processes, typically provides 130–140 hours testing per week, dependent on robustness of the engine build level and service requirements.
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