Motorsport

- High-performance engineering
- Niche manufacture and assembly
Motorsport

Total supplier capability for two- and four-wheel, on- and off-track motorsport vehicles.

Our mission of delivering excellence through innovation and technology has always been borne out across our extensive motorsport portfolio. We strive to give our clients a winning, competitive edge through outstanding engineering delivery.

Not content with the multiple land-speed records under our belt, or the contributions made to some of the world’s great racing moments, our people are driven by helping clients to reach the greatest heights within their field.

Our expertise and legacy are extensive, resulting in a tried-and-tested offering that includes:

- Component, system and powertrain design, from feasibility analysis and conceptualization to sign-off
- Research, simulation and analysis
- Strategic and technical consulting
- Component, system and powertrain engineering and testing
- Niche-to-volume manufacture

In addition, we believe that truly collaborative partnership, communication and project management are as key to the success of a project as the engineering, technical and production expertise that goes into it.

Our client teams can draw on the experience and input of a diverse range of over 2,700 experts across the business, giving us valuable insight, new ideas and the perfect sounding board.

We put Ricardo inside, and our full weight behind, every vehicle we work on.

“Proven pedigree in the development, testing, prototyping and supply of engines, transmissions and driveline systems.”
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Who we help
Ricardo supports some of motorsport’s leading players.

**OEM motorsport constructors**
- Formula 1
- GP Masters
- GT3 Super Cars
- IndyCar
- Indy Lights
- Le Mans LMP1
- Le Mans LMP2
- Moto-GP
- NASCAR
- Rally Raid
- RS Rally
- Super Formula
- WRC Rally

**Single-make series**
- Porsche Super Cup
- World Series by Renault

“In working with Ricardo, we have engaged with a supplier that has the same passion for engineering excellence and a total focus on delivering winning results.”
Who we are

Ricardo’s extensive history in motorsport is matched only by the breadth of technologies it leverages.

Whether advanced software simulation of a combustion process or precision machining and assembly, our ethos has always been to create winning solutions through innovative technology.

At the heart of our winning technology is our people – a team that has been driving performance and innovation since Ricardo’s earliest days. The majority of our engineers and technicians have joined us from the motorsport sector and have a personal as well as professional passion for motorsport. They bring with them considerable expertise and knowledge in their respective fields, but also nurture close working relationships with the world’s governing bodies, ensuring Ricardo remains at the very cutting edge of the sport.

Ricardo is committed to perpetuating its position as a world leader in this field, and our flexibility and reactivity to clients’ needs has made us a partner of choice for many of the most successful teams. We continue to invest regularly in developing our capability, through schemes such as apprenticeships and graduate placements, to ensure success and innovation in the motorsport market for years to come.

“Offering the support, stability and resources of a large company, but with the flexibility and reactiveness of a small motorsport engineering specialist.”
Where we are

With offices and technical centres located across the world, we can support clients wherever they are based.
The history of Ricardo’s involvement in motorsport is rich and varied, spanning eight decades and involving varied racing disciplines and technologies.

As early as the 1920s, our founder, Sir Harry Ricardo, was involved in the application of internal combustion engine technology for motorsport. Sir Harry designed the three-litre engines used by Vauxhall racing cars in the Isle of Man Tourist Trophy in 1922. The first major accolade came in 1936, when Ricardo developed a diesel variant of the Rolls Royce V12 kestrel engine and helped ‘Flying Spray’ set a new diesel speed record at Bonneville Salt Flats – 159 mph – a record that would stand until 1950. Half a century later, Ricardo would return to Bonneville with another car – the JCB Dieselmax – to snatch the diesel record back once more, at over 350 mph.

We also undertook pioneering work with Wifredo Ricart (Alfa Corse, under the leadership of Enzo Ferrari) in the 1930s, collaborating on the design of the Alfa Romeo Tipo 162 three-litre V16 supercharged engine. The engine was designed to challenge the all-conquering German racing teams of Mercedes-Benz and Auto Union.

In the early 1960s, one of the original founders of what would become our renowned driveline and transmissions capability, Harry Ferguson, developed a Formula-1 car to prove the feasible high-performance application of four-wheel-drive technology. The resulting P99 was driven to a single Formula-1 win in 1961 by Stirling Moss. The principles went into further development and were later applied to an innovative luxury coupé – the 1966 Jensen FF – the first-ever four-wheel-drive road car, and the first to feature ABS.

In the 1970s, we continued to pioneer the advancement of high-performance four-wheel-drive applications, with the invention of the viscous coupling. This was widely used on a range of production and motorsport applications, most notably in several Group-B rally cars in the 1980s.

In the early 1990s, Ricardo provided key analytical support to Formula-1 and sportscar engine manufacturers on advanced valve-train and crank-train dynamics.

In the mid 1990s, the company was a key supplier to Ford during their dominance with the Ford Escort of the rallying world, whilst also developing transmissions for the Jaguar XJ220 and McLaren Formula-1 road car.

Ricardo’s presence at Le Mans and World Endurance Cars came to the fore in the late 1990s and early 2000s, by supplying the
dominant Audi R8 during its multiple wins. Our presence continued into the diesel era, with the design, development and supply of a truly unique transaxle to the Peugeot 908HDi FAP.

During the early 2000s, Formula-1 teams, including Benetton and Renault, were actively using Ricardo’s transmission modelling and dynamic simulation software to develop launch strategies and gearshift simulations. Ricardo also worked in conjunction with EEMS on pioneering fuel-flow meters (FFMs) for the British Touring Car Championship, the output of which influences today’s Formula-1 FFMs.

In the mid 2000s, Ricardo’s presence in Japan was cemented with the Japanese GT series mandating the use of a Ricardo transmission due to significant improvement in performance and reliability, reducing cost per mile for the teams. Substantial R&D work was also undertaken with helium trace technology, to understand and model air and fuel flow for the development of V10 engines for Formula 1.

From 2003 to 2006, Ricardo designed, developed and delivered the highly innovative Petronas World Superbike engine, dramatically increasing performance and reliability, while in 2006 it contributed to the development of the world’s fastest diesel engine for JCB, the Dieselmek.

Between 2007 and 2010, Ricardo supplied technical consulting and advice to various regulating bodies regarding the future direction of motorsport technical regulations, culminating in the Global Race Engine concept.

Ricardo continues its legacy today with the supply of transmissions for the Porsche Cup Series, the longest-running, largest and most successful series in motorsport. Our teams remain actively involved in GT3, single-seater, rally and endurance racing, furnishing Formula 1 with over 40,000 components since 2002.

“Our own history is the precedent for delivering engineering excellence in motorsport for decades to come.”
High-performance engineering and production

Motorsport performance that’s in a league of its own.

Just as our clients aspire not only to get to the top, but to stay there, Ricardo continues to evolve its expertise and skills in the design, development and production of high-performance powertrains, laying the foundations for motorsport performance that’s in a league of its own.

Calling upon our wide base of in-house capabilities – covering strategic and technical consulting, engineering, manufacturing and analytical software development – we can offer each of our clients the individual level of support they are looking for.

We design, engineer and manufacture drivelines and transmissions, engines, and electric and mechanical hybrid systems for use across a range of high-performance vehicles. Much of the work we do is carried out in our own facilities, allowing us to quality control every stage of the process, and select and apply the best technologies and physical components.

In addition to our core powertrain capabilities, we also deliver a range of vehicle engineering activities covering electrical and mechanical system integration, chassis, ride and handling, NVH and lightweight material application.

Our clients are seeking seamless access to the best knowledge and the best solutions, and we wouldn’t be Ricardo if we didn’t rise to the challenge on every occasion.

“We wouldn’t be where we are, 100 years on, if we didn’t commit the best people, technologies and processes to every project we deliver.”
Driveline and transmissions

Designing and developing race-winning transmissions for our clients.

Within the transmissions team, Ricardo engineers design, develop and test new transmissions and differentials specifically for client applications, understanding and interpreting the requirements and creating bespoke solutions.

Ricardo works closely with clients to ensure that packaging constraints, layouts and other unique features are developed in line with the rest of the vehicle – and the relevant regulations – to ensure seamless integration and provide race-winning transmissions.

Ricardo’s high-performance transmissions team operates from a single 5,000m² manufacturing facility that features extensive in-house machining, heat-treatment, assembly and inspection facilities, enabling the manufacture of a wide range of geared, splined and prismatic components, primarily for the motorsport sector.

The capability to produce parts wholly in-house enables Ricardo to ensure high product quality and short lead times. Combining this with our policy of continual investment in new machinery, we meet or surpass the requirements of our clients.

Our transmissions team, consisting of more than 150 experts, is highly experienced in a wide range of alloy, steel, titanium and magnesium materials.
Ricardo is accredited to ISO 9001 and ISO 14001, and our fully equipped QA department operates to the requirements of these standards. All results are fully supported by complete documentation and certification.

Our dedicated machine shop offers full prismatic facilities:

- Turning and milling
- Wire erosion
- Shaping
- Hobbing
- Spiral bevel-cutting
- Computerized heat treatment
- Grinding and gear grinding

We specialize in low-volume production and prototype-transmission-part assembly, but can deliver manufacturing volumes into the thousands if required.

“Our in-house capabilities ensure high product quality and short lead times.”
Engine engineering

Design at the heart of class-leading machines.

Ricardo has been involved in race engine design and development for most of its history, both for complete engine supply and client product improvements.

The heart of any engine is its combustion system, and our continual investment in technology keeps us relevant, especially in the modern era of highly boosted, direct-injection engines.

Our strength lies in our ability to harness the power of simulation and analysis early in the design and development process, utilizing the tools appropriate to the maturity of the design.

We help clients with concept design layouts through to complete engine design and development programmes, using our wide range of CAD and analysis tools:

- Engine performance simulation
- Computational fluid dynamics (CFD)
- Mechanical system analysis
- Structural finite element analysis
- Thermal management

Our engine development, calibration and validation capabilities cover steady state and transient testing for ultimate performance and fuel economy development, using the latest control software and hardware.

We utilize a number of rigs to enable parallel development and validation paths to shorten development timescales, as follows:

- High-speed single-cylinder engines for combustion system development
- Steady state and dynamic flow rigs
- Hydro pulse rig for accelerated durability assessment of cylinder heads and blocks
- Fatigue rigs
  - Torsional (crankshafts)
  - Axial (con-rods)

“Our strength lies in our ability to harness the power of simulation and analysis early in the design and development process.”
Hybrid powertrain systems engineering

Maximizing the power of hybrid technology for a greener future.

Electrification of powertrains is increasingly common in motorsport and is now utilized across Formula 1, FIA World Endurance and Formula E.

Developing and integrating these complex systems into a powertrain requires specialized support, as well as expertise to address challenges such as how to recover and deploy energy or which energy storage system to use.

Ricardo can help you from the outset, assisting firstly with the architecture selection through sophisticated and integrated system simulation. This helps you to understand both the technologies that are appropriate for the application, and how the technologies should be used together in order to maximize overall energy efficiency.

Ricardo can then help you select the best components from an existing supply chain, or design and develop bespoke units, with the appropriate functional safety requirements, such as:

- Electric machines
- Battery packs
- Battery management systems
- Power electronics

Ricardo has also developed an overall Vehicle Supervisory Controller, which combines the advantages and flexibility of a rapid-prototyping controller with a design intended for low-volume production. Based on the Ricardo generic rapid-prototyping controller, rCube2, we are able to provide the base software and all the necessary device drivers and configuration utilities to develop a high-level controller for the complete integrated system.

In addition to electrically based hybrids, Ricardo has developed expertise in mechanical hybrid systems and has a suite of patents to protect the IP. To eliminate the need for vacuum seals, a non-penetrative magnetic coupling system is used to transfer kinetic energy through the housing, and a variety of CVT/drive solutions can be used to connect the flywheel to the driveline.

So whether your application needs an electrical or a mechanical hybrid system, Ricardo is ideally placed to help you design, develop and integrate it into your vehicle powertrain.
High-performance manufacturing and assembly

Adding value through bespoke production management.

Our performance products group has an excellent reputation and is well known for designing and producing advanced transmissions for the iconic Ford GT and the Bugatti Veyron supercar, as well as numerous driveline systems and components used at the highest levels of competitive motorsport.

The addition of the new Ricardo high-performance assembly facility represents a completely new approach to the quality focused assembly of high-performance engines. This approach incorporates some of the very latest thinking and techniques in quality focused lean manufacturing, recreating these for an extremely complex and high-performance product in a low-volume context.

Ricardo is exceptionally well placed to provide the very latest in new product engineering skills and has long been able to take on the toughest challenges of performance product design and development. By extending this service to the simultaneous engineering of state-of-the-art assembly facilities, and the development, qualification and management of the supply chain, Ricardo can add significant value in a highly complementary manner to its clients’ premium-product aspirations.

“Ricardo has long been able to take on the toughest performance product design and development challenges.”
Software

Providing invaluable vehicle insight and analysis.

For more than 25 years, our software simulation products have helped motorsport engineers to develop winning designs.

Our products are specialized for engine, driveline and vehicle applications, with specific capabilities implemented for motorsport applications.

Clients apply our tools every day across a range of applications, including engine system layout, turbocharger matching and control; advanced combustion analysis and optimization of dynamic systems, including crank, piston and valve-trains.

Our software tools are capable of accurately capturing the demanding physics of high-speed motorsport systems, with accuracy and predictive capability demonstrated in numerous programmes. Our client base is global and covers a broad spectrum of motorsport applications. We are proud sponsors of the US Formula and Baja SAE competitions and provide free software licences to nearly 200 student-led university teams across the world, enabling them to use our software products to optimize their designs.

Our motorsport clients include top Moto-GP, NASCAR, IndyCar and Formula-1 teams, along with several other teams in smaller motorcycle, endurance, track and off-road circuits.

The unique blend of specialized product capability, motorsport application knowledge and consulting has established Ricardo as a recognized leader in the industry.

“Our clients require an accelerated route to understanding and applying emerging technologies.”
Advanced technology support
Partnering our clients to interrogate and apply new technologies.

We provide advanced engineering services to many sectors within motorsport. Whether developed through our own research investments or from external sources, our clients require an accelerated route to understanding and applying emerging technologies, whilst in-house capability is established. Ricardo offers services in research and advanced engineering to assess new technologies and processes:

- Research in DI fuel systems at high engine speeds
- Application of advanced boosting systems
- KERS technology selection
- Cylinder-to-cylinder air/fuel ratio distribution measurement
- Waste-heat recovery systems

Our approach is to leverage our established processes, tools and techniques to understand, develop and apply new technologies through:

- System simulation of available technologies and architectures
- Development of advanced instrumentation and test rigs/methods
- Use of high-speed single-cylinder engines for combustion system development
- Application of specialist simulation techniques to gain understanding and provide development direction
- Provision of specialist skilled resource on an as-needed basis

This can offer benefits in terms of timescale, primarily driven by our activities being carried out in parallel with ongoing product development, thus avoiding the distraction of more immediate issue resolution.
Offering flexible services, stretching from single component reviews to whole-vehicle programmes.

Ricardo delivers high-quality prototype and low-volume manufacturing of complex products and assemblies, ranging from engines, transmissions, electric motors and generators, battery packs and fuel-cell systems to clean-sheet special-vehicle programmes.

With extensive in-house machining, heat treatment, assembly and inspection facilities, we also manufacture a wide range of powertrain systems for motorsport and high-performance production vehicles. In addition to its role in the internal operations, Ricardo’s manufacturing engineering team also provides a comprehensive and high-quality manufacturing consultancy service.

Capabilities spanning from concept development through to full-product and trackside support position Ricardo as a world-class partner and ensure seamless integration for its clients.
Ricardo niche manufacture and assembly services

- Design for manufacture and assembly (DFMA) with components, assemblies and systems optimized to improve key client requirements without sacrificing functionality
- Reducing cost, complexity, assembly time and warranty risk, while improving utilization of materials
- Product purchasing specification, including technical requirements, measurement, inspection and testing procedures, and logistics
- Process development, including value-stream mapping and flow definition, process layouts utilizing lean, six-sigma and 5S principles, and load-balancing
- Work-station specification, including fixture design, tooling, measurement systems, ergonomics and quality techniques
- Supplier qualification, selection and management, including auditing and technical and quality improvement initiatives
- Warranty optimization
- Component- and system-level cost estimating and product benchmarking
- Complete lifecycle support via a dedicated programme manager
Converting an existing GT3 engine for racing

For a leading OEM looking to promote its brand by developing a racing version of an existing car, we took its original Ricardo-designed GT3 engine and enhanced its capabilities and features.

The client was looking for a turn-key engine development and production programme to mate with the Ricardo six-speed semi-automatic transmission commissioned for the race series. There was the additional challenge of converting the engine to operate with a new ECU, adapting to new sensors and actuators.

Development and calibration of the engine was conducted against engineering targets for performance, fuel economy and driveability, in a balance-of-performance category. The calibration work with the new ECU supported the development of new control strategies for the unit.

Successful completion led to the manufacture of engines for the racing team and customer cars, with 25 cars being entered for the first racing season, securing multiple podium finishes and championship victories.

Development of high-profile GT3 transaxles

GT3 has expanded over recent years to become one of the most popular race series in the national and international calendar. Based around grand-tourer racing cars, and regulated by the Fédération Internationale de l’Automobile (FIA), it has attracted many of the world’s leading OEMs. The rules allow for a wide variety of production car types to be homologated with little restriction around the general configuration, including engine and chassis. In terms of transmissions, this led to specific demands for performance, weight and packaging to achieve the requirements many of the OEMs laid out.

To meet this challenge, Ricardo set about developing a range of novel longitudinal and transverse transaxles, which in turn have found their way into some of the most competitive and high-profile cars in the GT3 class. In developing these solutions, we were able to draw on our considerable experience and success in the GT1 and GT2 classes, as well as in the LMP1 and LMP2 classes, to ensure that the developed products delivered on performance, packaging, weight and reliability.

Transverse and longitudinal GT transaxles were designed featuring competition-proven internals housed in a bespoke aluminium or magnesium casing. This enabled our clients to adopt an optimized ‘no compromise’ approach when designing their car layout.

Ricardo’s credibility as a leading supplier of high-performance GT transaxles was reinforced by the fact that it supplied numerous GT3 manufacturers, including the entire Japanese Super GT grid.
Li-Ion battery application in Formula 1

The introduction of KERS to Formula 1 presented the challenge of assessing, developing and deploying completely new, race-ready technologies in a very short space of time.

Ricardo researched and assessed multiple potential technologies (including hydraulics, pneumatics and flywheel systems) before concluding that Li-Ion battery electrification was the most promising means to meet the KERS targets.

The team applied its in-depth knowledge of battery chemistry and management, power electronics and electric machine design to develop systems and deliver race-winning solutions to the track.

Our clients’ programmes were accelerated because of our ability to draw on cross-sector and cross-service expertise, engaging as many of the engineering brains at our disposal as we needed to. Ricardo pushed the boundaries of performance beyond even the expectations of the component suppliers, and the fundamentals of the systems we developed continue to be employed by many race teams.

Performance and reliability translated across multiple race applications

Ricardo has long been a key supplier of the global Le Mans Prototype (LMP) race series, and between 1990 and 2015 was instrumental in supporting its customers to 12 victories at the 24-hour Le Mans (‘24 Heures du Mans’), underlining its position as market leader in the world’s fastest closed-wheel formula.

In 2006, the first diesel-fuelled car won the historic 24-hour Le Mans, leading to other OEMs investigating this source of power. These, typically V12, power cars generated higher torque than their petrol equivalents, and in doing so placed higher strain on transmission during the race. OEMs approached us to develop new transmissions to meet these demands, resulting in a string of victories and underlining our ability to deliver class-leading transaxles in terms of weight, reliability and power transmission.

This mixture of performance and reliability naturally led Ricardo to be the supplier of choice in a multitude of other high-performance single-make race series, such as Indy Lights, World Series by Renault 3.5 and Super Formula Championships.

Class-leading R5 transmission development

Ricardo used its considerable rally and off-road experience, spanning from Group B to the current WRC category, to develop a robust, highly efficient, fully FIA-compliant R5 transmission system.

This transmission system was meticulously developed and rigorously tested, and featured novel design attributes to create a class-leading R5 package.

The driveline comprises a four-wheel-drive, five-speed transverse transmission assembly incorporating front and rear differentials plus a handbrake disconnect device.

Supplying drivelines for vehicles participating in the most demanding off-road competitions, such as Rally Raid and WRC, has helped our client to achieve prestigious wins at both Dakar and the World Rally Championship.
Ricardo is a global engineering and environmental consulting company, with a product and service portfolio extending from strategic consulting through to niche high-performance product assembly.

The company employs over 2,700 professional engineers, consultants, scientists and support staff who are committed to delivering outstanding projects focused on class-leading innovation in our core product areas of engine, transmission, vehicle, hybrid and electrical systems, and environmental forecasting and impact analysis.

Our activities have evolved over the past 100 years to cover a range of market sectors, including passenger cars, commercial vehicles, rail, defence, motorsport, off-highway, marine, clean energy and power generation, and government and environmental. Our client list includes the world’s major transportation original equipment manufacturers, supply chain organizations, energy companies, financial institutions and government agencies.

Our markets

- High Performance Vehicles & Motorsport
- Motorcycle & Personal Transportation
- Government & Environmental
- Commercial Vehicles
- Rail
“Our unique combination of capabilities is the reason why the world’s leading companies choose Ricardo as their trusted technical and strategic partner.”

Engineering capabilities
Through our in-house product engineering capabilities, we provide high-quality prototyping and low-volume manufacturing of complex products and assemblies, ranging from engines, transmissions, electric motors and generators, battery packs and fuel-cell systems, to clean sheet special vehicle programmes.

With extensive in-house machining, heat treatment, assembly and inspection facilities, we manufacture a range of powertrain systems for motorsport and high-performance production vehicles, and are a trusted manufacturing partner of top-tier aerospace suppliers, automotive OEMs and global defence organizations.
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