

Ahead of the curve

How UK Motorsport technology and innovation
can benefit your company



Withdrawn on 4 December 2020

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In association with



Motorsport Industry Association (MIA) - The Global Motorsport Business Network

With nearly 400 global corporate members, who transact over £5bn of international motorsport business, the MIA is the world's leading trade association for the motorsport and high-performance engineering sector. The organisation represents the specialised needs of this highly successful industry as it undergoes rapid global development.

www.the-mia.com

Working actively with governments and industries around the world, the MIA identifies and engages opportunities for members to grow their motorsport business, and exploit their innovative capability within automotive, defence, marine, aerospace and beyond.

UK Motorsport - a global leader

The UK is the undisputed world leader in global motorsport. Dominant in Formula 1, it is the home of Formula E and the leading international supplier to racing series from China to the USA. The cutting-edge technology developed in the UK's Motorsport Valley® is increasingly finding applications in other industries. Organisations in sectors as varied as defence and healthcare are taking advantage of UK motorsport's unique ability to find rapid solutions to complex challenges.

UK Motorsport offers:

1

The ideal location for product development

The most precious commodity in motorsport is time. The key to Motorsport Valley's® success is that it is the world's biggest cluster of competition-oriented engineering organisations. Their close proximity to each other allows ideas, components and people to move around quicker than anywhere else globally. Teams in every leading motorsport series in the world rely on UK suppliers for success.

2

Groundbreaking technology

For over 50 years, the UK has been responsible for more motorsport innovations than any other country. In 2014, the British-based Mercedes AMG Petronas team designed the F1 W05 Hybrid with its revolutionary turbocharger design; achieving 16 race victories in a single season, this car is the most dominant in the history of Formula 1. UK Motorsport innovations are increasingly being used in road vehicles - for example, London buses are now being fitted with a hybrid energy-recovery system developed by Williams F1.

3

Solutions for every sector

Capabilities from Motorsport Valley® are being used by an ever-growing number of industries, from aerospace and defence to marine and healthcare. The principles of using world-leading technology to solve engineering challenges are universally applicable and UK motorsport companies have already solved many problems currently being faced by industry. Even pit-stop techniques are being employed to dramatically increase efficiency on production lines and hospital emergency wards.

For more information on how to invest in UK Motorsport, please contact UK Trade & Investment and the Automotive Investment Organisation.

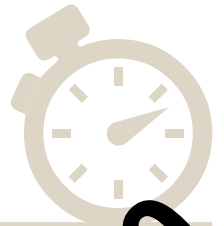
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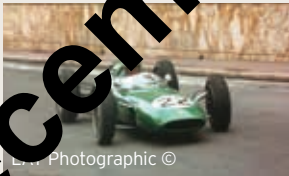



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Timeline



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 <p>LAT Photographic ©</p>	 <p>LAT Photographic ©</p>
<p>1957</p> <p>Cooper pioneers mid-engined Formula 1 design (Cooper T43)</p>	<p>1953</p> <p>First use of disc brakes in motorsport by Jaguar at Le Mans</p>
<p>1963</p> <p>Mini proves superior grip of front-wheel drive on Monte Carlo Rally</p>	 <p>LAT Photographic ©</p>
<p>1963</p> <p>Lotus 78 pioneers 'ground effect' aerodynamics</p>	<p>1962</p> <p>Lotus creates first aluminium monocoque chassis (Lotus 25)</p>
 <p>LAT Photographic ©</p>	<p>1967</p> <p>Cosworth DFV demonstrates the superiority of four valves per cylinder</p>
<p>1995</p> <p>McLaren F1 GTR wins Le Mans - first road car ever to beat Le Mans Prototypes</p>	<p>1981</p> <p>McLaren first Formula 1 car with carbon-fibre composite monocoque chassis</p>
 <p>Mercedes AMG Petronas ©</p>	 <p>LAT Photographic ©</p>
<p>2014</p> <p>1.6 litre Formula 1 powertrains are one-third smaller, one-third more economical, but the same power as the previous year's 2.4-litre engines</p>	<p>2008</p> <p>First use of KERS (Kinetic Energy Recovery System) in Formula 1</p>

A history of innovation

The most striking aspect of UK Motorsport over the last 50 years is how it has successfully surfed each new technology wave.

Although there was a rich history of motorsport in the UK before the Second World War, the modern era can be dated from the first Formula 1 World Championship race in 1950. Held at Silverstone, the race course was marked out by straw bales and oil drums.

At the time, there seemed no significance in inaugurating the series in the UK: single-seater motor racing was then dominated by Italian teams such as Ferrari, Lancia and Maserati, and there seemed no particular reason why the UK should become the centre of the motorsport world.

In the 1950s, the focus in UK motorsport was sports car racing, with Jaguar winning Le Mans five times and Aston Martin once. It was not until 1959 that a British car took a driver to the Formula 1 Drivers' Championship: initially, UK success was met with a degree of condescension: Enzo Ferrari described the country's teams as 'gangsters' bolting together other people's components in their small garages. However, the tide turned: in the 1960s, UK-based cars and teams went from being enthusiastic amateurs to world leaders, winning seven Formula 1 Constructors' Championships and being victorious at Indianapolis, Le Mans and the Monte Carlo Rally.

The 'cottage industry' that had sprung up around motor racing was showing the benefit of its business model. Rather than the continental model of developing all the major parts of a racing car in-house, UK teams were happy to give suppliers a much freer hand in developing ideas and supplying complete sub-systems. From the outside, it may have looked ad hoc, but it meant a much better flow of innovative ideas, as each supplier knew its own field better than the customer team ever could.

Indeed, the logic was later accepted by mainstream car manufacturers who, since the 1980s, have moved a large proportion of R&D to specialist suppliers.

Pioneering with every passing year, UK companies have consolidated their position as specialists in all areas of motorsport - as the pace of technology has accelerated, the UK's lead has grown.



LAT Photographic ©



LAT Photographic ©

The world's motorsport technology hub

The UK's Motorsport Valley® is one of the world's leading examples of a successful business cluster, akin to Silicon Valley or Hollywood.

Motorsport Valley® is famous for dominating Formula 1; however, this is just one facet of the UK motorsport industry, which is also:

- home to Formula E, the new global series for electric racing cars;
- the major international supplier to the leading USA series of IndyCar, NASCAR and the United SportsCar Championship;
- the major international supplier and sole engine supplier to the emerging China Touring Car Championship;

- the transmission supplier to every Le Mans racing car;
- the world leader in motorsport engineering, for everything from precision machining to complete vehicle construction
- the global centre of motorsport aerodynamics, electronics and simulation.

Motorsport Valley® is also the place where other technology-based sports go to for help - powerboats, America's Cup yachts, superyachts, motorbikes, bicycles, air races - even bobsleighs.

“A mature economic business cluster, which is number one in the world... the jewel in the crown of British engineering.”

Professor Michael Porter
Harvard University Association.

Motorsport Valley® in numbers

7 out of 10

Formula 1 teams are based in the UK

87%

of UK motorsport businesses export overseas

Over £9bn

in worldwide sales turnover

4,300

businesses

41,000 staff

(including 25,000 highly skilled engineers)

Over 30%

of UK motorsport companies' turnover is re-invested in R&D – almost 10 times higher than road-car manufacturers.



Case studies

Xtrac: One of the UK's most successful motorsport companies, Xtrac is a world-wide leader in the design and manufacture of transmission systems. Xtrac is a long-established supplier of gearbox components to almost every Formula 1 team, and also supplies gearboxes, differentials and driveline components to a wide range of major international racing series. Combining engineering expertise, agile delivery and attention to detail, the company now boasts a wide client base including the transportation, defence and marine sectors.

www.xtrac.com

DC Electronics: In three years DC Electronics has grown from having no significant US export business to supplying virtually every major championship across US motorsport, including Global RallyCross, IndyCar, NASCAR, NHRA, Pirelli World Challenge, SCCA and United SportsCar. Over 50 per cent of the Essex-based firm's turnover is now generated from export sales and it has established a production facility in Mooresville, North Carolina. As a world-leader in manufacturing custom-built electrical systems, DC Electronics also supplies offshore powerboats, aerospace and military customers.

www.dcelectronics.co.uk

Key companies in Motorsport Valley®

Among the high-performance engineering organisations based in Motorsport Valley® are:

Aero Tec Laboratories (ATL)

Alcon

AP Racing

Bentley Motorsport

Bosch Motorsport

capricorn Automotive

Caterham F1

Caterham Technology and Innovation

Cosworth Group

DC Electronics

Dell Motorsport

Delta Motorsport

Donington Park

Formula E

GKN

Goodridge

Goodwood

Goodyear Dunlop

Grainger & Warrall

Group Lotus

Harland Engineering

Hytec Engineering

Jota Group

JRM Group

Lifeline Fire & Safety Systems

Lloyds of London

Lotus F1 Team

M-Sport

MAHLE Powertrain

McLaren Group

Mercedes AMG High Performance Powertrains

Mercedes AMG Petronas F1

MIRA

Moog

Morgan Motor Company

Motorsport Industry Association

Motortune

Multimatic

Performance Friction

Pirelli

Prodrive

Qt Services

Red Bull Racing

Red Bull Technology

Ricardo

Rimstock

RML Group

Safety Devices International

Sahara Force India F1

Santa Pod Raceway

Swindon Engines

Torotrak Group

TotalSim

Williams Advanced Engineering

Williams Grand Prix Engineering

Wirth Research

Xtrac

Zircotec

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Energy efficient solutions

Ever since the first car race in 1894, victory has gone to the vehicle which has used its energy most efficiently. This endless search for maximum energy efficiency now includes movable aerodynamics, lightweight structures, packaging and integration, energy recovery and storage, hybrid powertrains and turbocharged downsized engines. This expertise is at the heart of UK motorsport excellence.

Aerodynamics

Originally, it was assumed the less aerodynamic drag a racing car produced, the faster it would go - this created the popular 'streamlined' shape. However, in the 1960s, UK designers began to understand that by creating aerodynamic downforce from aerofoils and wings the cars could corner faster, even if the slight increase in drag reduced the straight-line top speed. In the 1970s, the UK continued to be a pioneer, with a particular highlight being the victorious Lotus 79 'ground effect' car.

Since then, the UK has cemented its position as the undisputed centre of innovative motorsport aerodynamics, with many overseas-based teams locating their aerodynamic facilities in Motorsport Valley®.

Lightweight design, materials and components

Lotus founder, Colin Chapman, famously stated: "Adding power makes you faster on the straights, subtracting weight makes you faster everywhere." If anything, this is even truer today than when he first said it. Nowadays, car companies are learning from their racing colleagues as increasingly stringent CO2 targets for road cars mean that weight is reduced while consumers demand additional safety and luxury equipment.

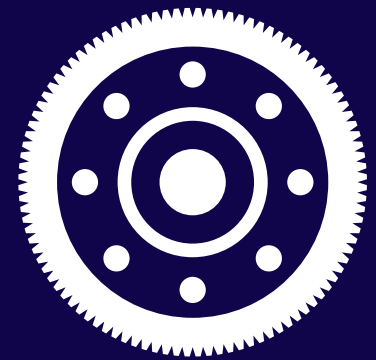


LAT Photographic ©

Motorsport Valley® has long been at the forefront of lightweight material development. One of the most significant examples is the use of carbon-fibre composites to create a driver's 'safety cell', first pioneered by McLaren in 1981. This material is now being used in high-performance road cars, and is steadily moving into volume car production.

Energy recovery and storage

In recent years, the regulations of Formula 1 have been designed to encourage the development of technology that can be applied to road vehicles, such as downsizing and the use of hybrid powertrains. Motorsport Valley® has been at the forefront of this process.



Motorsport technology transfer to automotive

In 2008, Williams F1 designed an electromechanical hybrid energy-recovery system using a flywheel instead of a battery. This was successfully adopted by Audi and Porsche in the World Endurance Championship, and the technology was then bought by the major UK automotive supplier, GKN Driveline. In 2014, the first production deal was announced for 500 London buses, and further production contracts are expected.

Product development

Every racing car is a prototype which is never 'finished' and yet must be delivered to a race on time, every time. A Formula 1 car moves from origination, through competition into the museum within just 24 months. It incorporates over 11,000 parts - 80 per cent of which will be redesigned during the course of a season.

A crucial success factor is to have the shortest possible supply chain. The unique advantages of the Motorsport Valley® business community are its proximity to the customer, its race-proven strength in depth and its 'community of knowledge' which is adept at resolving complex engineering challenges.

Original research

In every area of development, the UK has world-leading specialists and universities responsible for innovations such as the battery chemistry that enables the Formula 1 KERS (Kinetic Energy Recovery System) to fully drain and recharge its battery in less than a minute, and the aerodynamics and simulation that keeps racing cars glued to the track at over 300 km/h.

Engineering

From the invention of the modern mid-engine single-seater in the 1960s and the conquering Cosworth DFV engine of the 1970s, the UK has always been the engineering leader in global motorsport.

Prototyping - "We only race prototypes"

Motorsport Valley® is the world-leading engineering community for the development and testing of radical new ideas in the harshest environments. In just 24 hours at Le Mans, a car must cover over 5,200 km at more than 240 km/h average speed, with the engine running at full throttle for 85 per cent of the time.

A racing car is one of the most complex combinations of prototype parts it is possible to assemble - and UK Motorsport excels in all areas.

Production

Its unique expertise in taking designs from concept to low-volume production has made Motorsport Valley® a global leader in helping products bridge the divide between initial prototype and full-scale production. In engineering terms, that means moving from Technology Readiness Level (TRL) 4 to 7.





The Foundations of Success

No one wins a motorsport or championship by luck, and no country dominates a high-tech industry by chance. The UK has underlying advantages which enable the success of UK motorsport:

European leader in academic research

6 of the world's top 20 universities are in the UK



European leader in aerospace

(and world no. 2)



European leader in software

(48% of large software companies are in the UK)



Systems integration

In motorsport every square millimetre of space and every gram of weight matters.

Race vehicles must achieve the optimum balance between aerodynamic efficiency, reduced weight and dynamic performance – therefore systems integration and packaging is absolutely essential. This is another key strength of the UK motorsport industry.

Recently the task has become more complex by adding a complete hybrid power system. Today's hybrid system, developed in the UK, is no mere add-on – it produces similar power to the whole engine of a Formula 1 car from the early 1960s.

A result of this new technology is one of the most complex system-integration tasks in modern engineering. This knowledge is increasingly important for road cars, as their technology grows exponentially. Since the 1980s, the typical road car has added various features pioneered by the UK motorsport industry, including:

- turbocharging and intercooling
- four valves per cylinder with variable valve timing
- electronic fuel injection

Over the next 10 years there will be an increasing move to hybrid powertrains, which will draw on UK expertise gained from developments in world motorsport.



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Case study

Mercedes Formula 1 World Champions 2014 The domination of the 2014 season by the Brackley-based Mercedes AMG Petronas Formula 1 Team reinforced the UK's lead in the areas of packaging and systems integration. The team worked with Mercedes AMG High Performance Powertrains in sixworth to revolutionise the layout and packaging of Formula 1 engines. By splitting the two components of a turbocharger (the exhaust-driven turbine stays at the rear 'hot' end of the engine, and the compressor which forces the air into the cylinder moves to the front 'cold' end), the Mercedes F1 W05 Hybrid has three critical advantages. The more efficient compressor helps produce at least 40 brake horsepower more than its competitors; the engine is more compact, which enables better packaging; and the front-mounted compressor is fed by cooler air than conventional rear-mounted units, enabling smaller intercoolers and therefore better aerodynamics.

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Simulation, telemetry and telematics

The need for continuous dissemination and analysis of large amounts of complex data, before, during and after each race, has driven Motorsport Valley's® world-leading expertise in telemetry and telematic solutions. To streamline this continuous development process, and limit the amount of real-time testing, Motorsport Valley® firms frequently employ advanced simulation techniques.

These skills are vitally important to the road-car industry.

Simulation is the key to reducing the cost and time needed to develop new cars.

Already, many race and road cars are designed 'virtually', going straight from computer simulation to final testing. The physical development stage is sometimes missed out altogether.

Telematics is already coming to road cars. Examples include insurance companies which offer reduced premiums to young drivers in exchange for the fitment of a telematics box, and fleet operators tracking the usage, fuel consumption and driving characteristics of their users.

Telemetry is being increasingly taken up by other sports. Numerous America's Cup, Fastnet and record-attempt sailing challengers use Cosworth Electronics' (formerly Pi Research) data acquisition, logging and image-capture components and software.



Case studies

Cosworth: UK firm Cosworth has applied its motorsport-developed data acquisition and analysis equipment to environments ranging from America's Cup yachts to military vehicles in Afghanistan.

The Cosworth Performance Data Recorder (PDR) is available on the 2014 Chevrolet Corvette. This revolutionary system combines video, mapping and vehicle telemetry (cornering and braking forces, acceleration etc.) to provide the sort of data previously only available to professional racing teams. The driver can review their laps via the in-car infotainment screen or, when combined with the Cosworth Toolbox PC software (included in the package), compare their lap to an 'ideal' reference lap, showing exactly where they are losing time.

www.cosworth.com

Wirth Research: Founded in 2003, UK-based Wirth Research has pioneered advanced virtual engineering technologies, allowing complete simulated vehicle design, development and testing, thereby reducing the need for prototyping. Major clients include Andretti Autosport, Honda Performance Development, KSS, Lockheed Martin, Michelin and Porsche Motorsport, while Wirth's technology has contributed to victories in the American Le Mans Series, Formula 1, Formula E, IndyCar, United SportsCar and World Endurance Championships. The company is increasingly exploiting its capability in other sectors, including aerospace, architecture, defence and transport.

www.wirthresearch.com

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From aerospace to pharmaceuticals and beyond: providing solutions across the world

A century of innovation enables Motorsport Valley® companies to develop unique solutions for other sectors:



Aerospace

UK firms such as Forward Composites and Xtrac are currently involved in the design and development of the world's largest aircraft - the HAV 'Airlander'. Many UK motorsport companies have become suppliers to the aerospace sector, including Cosworth which supplies components for the Rolls-Royce Trent, currently the world's best-selling engine for wide-bodied airliners.

“The UK's world leading motorsport industry has helped create an environment which is at the forefront of innovation in engine technologies and ultra-low-emission vehicles.”

Joe Greenwell, CBE
CEO, Automotive Investment Organisation.



Automotive

Car manufacturers are increasingly using Motorsport Valley® companies to help develop new features and gain a competitive advantage. Other forms of transport, such as London buses, are also turning to motorsport solutions such as GKN Hybrid Power's 'Gyrodrive' technology to increase energy efficiency.

There are many examples of automotive companies working with the UK motorsport industry to develop high-performance limited editions. Car manufacturers turn to UK motorsport specialists to develop 'halo models' that will truly burnish their brand. Such co-operations include:

- Cosworth: Chevrolet and Aston Martin
- Delta Motorsport: Jaguar Land Rover
- M-Sport: Bentley
- Prodrive: Aston Martin and Alfa Romeo
- Ricardo: Bugatti and McLaren
- RML Group: Nissan
- Williams Advanced Engineering: Jaguar Land Rover



Defence

Many UK motorsport firms now supply defence projects working with companies such as BAE Systems, General Dynamics, Lockheed Martin and Thales. Motorsport engineering consultancy Ricardo, for example, led the design, development and manufacture of the UK Ministry of Defence's cutting-edge 'Foxhound' Light Protected Patrol Vehicle. Military commanders in Afghanistan described this as 'an enormous leap forward' in capability.

Another notable example is UK prime defence contractor, Supacat, which utilises motorsport capability in a number of major defence projects, including its widely acclaimed 'Jackal' patrol vehicle. The firm now employs more than 15 Motorsport Valley® firms in its supply chain.

More recently, an entire UK vehicle, the 'Wildcat 500DKR' Rally Raid, was transformed from motorsport to a specialist military role. This achievement, by high-performance all-terrain vehicle constructor Wildcat Automotive, is a world first and embodies the synergy between UK Motorsport and defence.

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GKN Hybrid Power ©



Industrial and infrastructure

Williams Advanced Engineering is installing flywheel energy storage technology in two remote Scottish island communities to help stabilise their power grids, improve energy efficiency and reduce emissions from non-renewable power sources.



Rolls-Royce plc ©

Marine

Cosworth, Ilmor, Nissan and Xtrac collaborated to develop Caudwell Marine's revolutionary Axis Drive™ marine propulsion system - a radical new design boasting zero power-loss from engine to propeller. Cosworth, Prodrive and McLaren have also made technical contributions to current and previous America's Cup yacht-racing challenges.



Medical and pharmaceutical

McLaren Applied Technologies has used its expertise for projects ranging from the remote monitoring of patients to the application of pit-stop techniques to reduce times and increase operating-theatre efficiency at London's Great Ormond Street Hospital. The firm's recent collaboration with GlaxoSmithKline massively reduced changeover times on production lines, resulting in an increase in production of 6.7m tubes of toothpaste every year.



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A model of public and private-sector co-operation

Both central and local government in the UK support the Motorsport Valley® business community. UK motorsport companies are both technology leaders domestically as well as hugely successful exporters.

The government has worked with the Automotive Council and the Motorsport Industry Association to set up technology centres and partnerships to expedite the transfer of technology from motorsport to other sectors. For example, Innovate UK invested £7.6m in developing GKN Hybrid Power technology into a system that is now being fitted to buses.

Innovate UK's recent 'Motorsport Valley Launchpad' competition awarded £1.14m in funding to companies across the cluster to help accelerate the development of innovative energy-efficient technologies and their application into adjacent sectors.

The government's R&D Tax Credit scheme has significantly increased the global competitiveness of the UK motorsport industry. The initiative has a proven track record in helping Motorsport Valley small and medium-sized enterprises to maintain their high level of annual R&D spend, supporting innovation and developing competitive advantage in the sector.

Education and skills

The UK leads the way in motorsport education. The Motorsport Industry Association helped to create the world's first degree course in Motorsport Engineering Design in 1998, delivered by University of Wales Trinity Saint David.

Now some 30 UK universities, 140 further-education colleges and hundreds of schools offer specialised motorsport programmes. Combined with successful international competitions and educational initiatives such as the Bloodhound 1000mph World Land Speed Record attempt, F1 in Schools, Greenpower and the Institution of Mechanical Engineers' globally renowned Formula Student competition, UK Motorsport continues to inspire thousands of young people to pursue careers in engineering and technology. These programmes provide the future talent which will underpin the continued growth, success and global leadership of the UK's Motorsport Valley®.



Formula Student, Institution of Mechanical Engineers ©

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Oxford Brookes, Department of Mechanical Engineering ©

“I’m sure this will be the first of many government schemes which will utilise the world-leading capability of our highly innovative motorsport sector, support its ongoing development and encourage collaboration with other industrial sectors, so strengthening the UK’s position as a global centre for energy-efficient technology development.”

Chris Aylett
CEO, Motorsport Industry Association.

The Automotive Investment Organisation (AIO) - Unlocking your potential

Based within UKTI, the AIO helps firms access opportunities in UK automotive innovation and R&D by connecting potential customers, partner companies and academic institutions. It also helps companies access the full range of funding opportunities in the UK, using its unique combination of government staff and private-sector automotive experts. For more information, contact the AIO today:

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UKTI

UK Trade & Investment is the Government Department that helps UK-based companies succeed in the global economy. We also help overseas companies bring their high-quality investment to the UK's dynamic economy acknowledged as Europe's best place from which to succeed in global business.

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