

THE EVOLUTION OF THE HIGH PERFORMANCE TECHNOLOGY AND MOTORSPORT CLUSTER

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SUMMARY

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SUMMARY

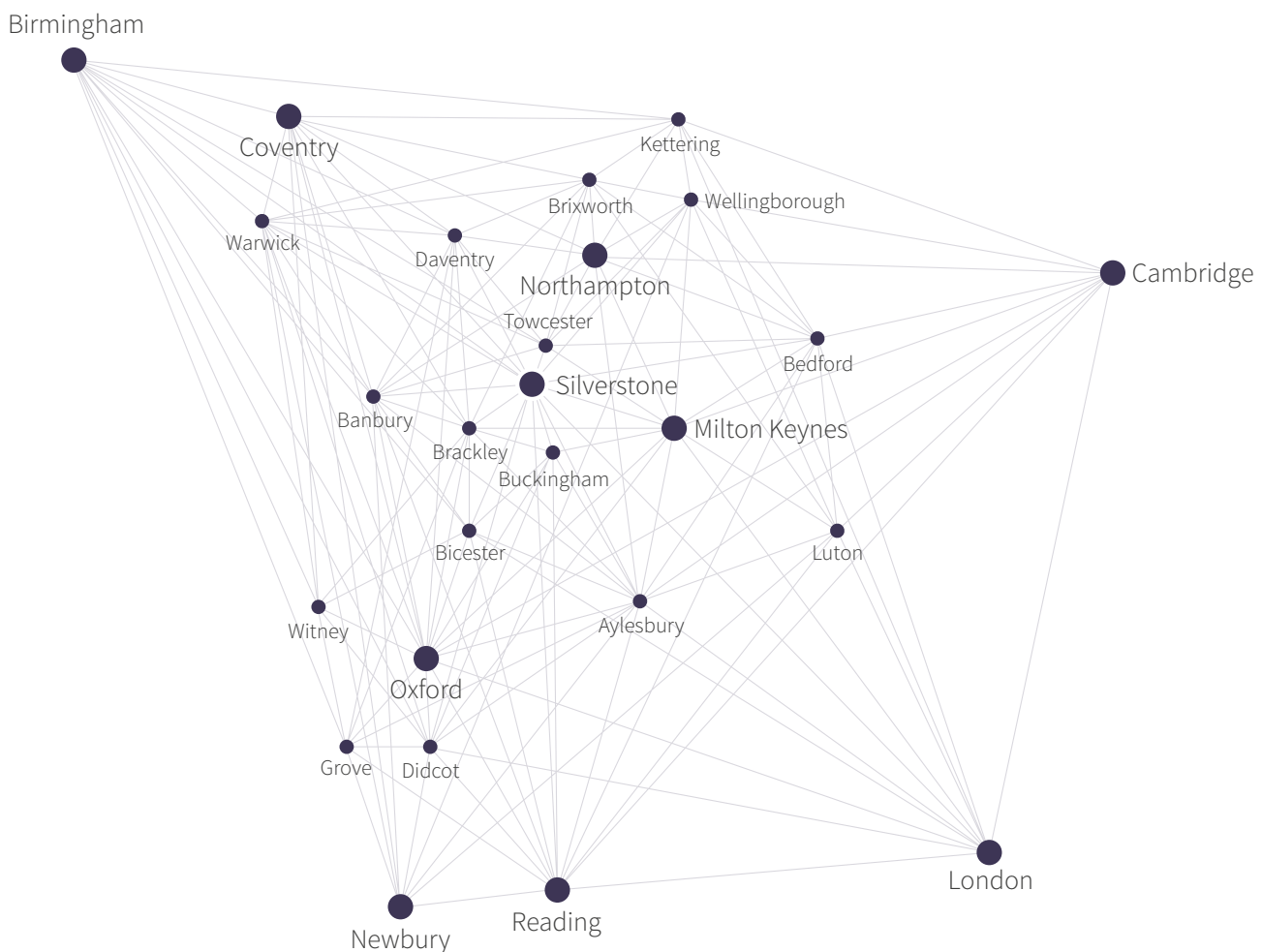
The area around Silverstone is home to significant business activity across the field of high performance technology and motorsport (HPTM). This displays many of the attributes of an adaptive and knowledge rich cluster¹.

Some HPTM firms are very high profile. However, many more are nested within motorsport supply chains and/or, increasingly, developing products, services and know-how across the spectrum of high performance technology. For some firms, there is little or no apparent link to motorsport. However there is a heritage and a specialist labour market that is shared.

There is a constant imperative to innovate, improve and solve complex technological problems, reflecting in part the intensely competitive nature of motorsport. This has helped to mould an industrial ecosystem which is full of paradoxes. It is restless and volatile, yet intensely conservative; secretive yet highly networked; global in ambition yet strongly localised and deeply embedded; and full of potential yet with an inconsistent track record in terms of the overall pace of growth.

The cluster has achieved global recognition through activities linked directly to motorsport. It is less well understood across high performance technology defined more broadly, and in this respect, the cluster must be recognised as “developing”. However, applications in high performance technology are increasingly important, and they bring growth potential.

A group of partners led by MEPC² therefore commissioned SQW³ to investigate the existence and character of the HPTM cluster in the area around Silverstone, and to help identify opportunities to support further growth of the cluster. The study was substantially completed between August 2015 and February 2016. It relied on a largely qualitative methodology involving interviews with over 70 individuals from HPTM firms and institutions.



¹ With reference to the academic literature, clusters may be understood as “concentrations of firms – and related institutions – that produce synergy because of their geographic proximity and interdependence”
² In addition to MEPC the study has been in partnership with Barclays and PwC and has been sponsored by: the Motorsport Industry Association (MIA); Buckinghamshire County Council; Northamptonshire County Council; Aylesbury Vale District Council; South Northants Council; Cherwell District Council; Buckinghamshire Thames Valley Local Enterprise Partnership (BTVLEP); Northamptonshire Enterprise Partnership (NEP); South East Midlands Local Enterprise Partnership (SEMLEP).
³ In completing this study, SQW was joined by Dr Nick Henry from Coventry University and Dr Tim Angus from Motorsport Research Associates.

THE ORIGINS OF THE CLUSTER

The origins of the HPTM cluster trace back to the period before and immediately after World War II. They reflect a combination of: government support for aircraft research and manufacture in the inter-war period; a changed emphasis in early professional motorsport to focus more on aerodynamics and weight reduction; and a shift to racing on designated circuits which were established on disused airfields (such as that at Silverstone).

HPTM businesses were formed in this context, sometimes by “racing entrepreneurs”. However, many early entrepreneurs had a strong background (and training) in aeronautical engineering. Many of these businesses have seen successive ownership changes and, over time, their competitive focus has evolved. Today, some have little or no connection to motorsport and are better understood in terms of their wider high performance and technology credentials.

Alongside the businesses, key institutions played a crucial formative role (e.g. Cranfield University). Like the population of firms, new institutions are still emerging today as the cluster evolves. These are playing particularly important roles in relation to research and testing; and training and workforce development.

Today, the evolving HPTM cluster has a particular character in the area around Silverstone, but boundaries are neither “hard” nor “fixed”. There are very important wider connections across the UK and also internationally.

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A flight of Vickers Wellington long range bombers, used by the Royal Air Force during World War II.

THE WIDER SPATIAL AND ECONOMIC CONTEXT: ADDING TO THE HPTM "MIX"

The HPTM cluster exists across several functional economic areas. It therefore draws on a number of quite distinctive local labour markets. In some respects, this explains both its character and strength – although the lack of a single city focus sets it apart from some other clusters.

The area in which the cluster is situated has grown – and is growing – quickly (in terms of population and employment). One consequence is that labour markets are deepening (as their scale increases and their skills mix grows). This “wider growth of the wider region” is very important in understanding how the cluster is evolving – including with regard to digital activities. Within this context, the changing role of Milton Keynes has been particularly significant (insofar as the origins of the cluster predate the existence of Milton Keynes⁴; and, in many respects, Milton Keynes is now, functionally, a city).

Looking ahead, substantial further growth in housing and jobs is planned through to the 2030s. In the area around Silverstone, this is likely to be focused on Milton Keynes, Northampton, Aylesbury and Bicester. This growth itself will shape the cluster’s future evolution.

The wider sub-national setting is also formatively important. There are very significant connections to and interactions with: the Midlands, particularly Birmingham, Coventry and Warwickshire (in terms of its very strong automotive sector); Oxford and Cambridge (as international powerhouses with pre-eminent universities and very strong knowledge economies⁵); London (as a global city which itself is growing quickly); and key international gateways, especially Heathrow Airport and also Birmingham Airport.

The area in which the cluster is situated is growing quickly.



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MEASURING THE HPTM CLUSTER

By definition, clusters are fluid, evolving and fundamentally based on relationships. Measurement – which requires clear boundaries – is intrinsically difficult.

Informed by previous studies and discussions with firms, a proxy definition of HPTM was developed. This leads to an overestimate of scale as not all of the activities captured by it are “actively clustering”. However, distinguishing between the HPTM cluster and activities which are similar in sectoral terms is impossible with available data. In any case, the wider local economy is providing significant resources – particularly in relation to the labour market – on which the cluster can draw.

On a very broad definition, we estimate that there are around 36,000 employee jobs within a core geography⁶. However, estimates of scale – on whatever basis – are fraught with difficulty. Moreover, scale alone (measured by job numbers) says little about the strength of a cluster, or its performance or prospects.

4 The New Town of Milton Keynes was designated in 1967.

5 It is important also to note that the National Infrastructure Commission was tasked – in Budget 2016 – with examining infrastructure priorities across the Cambridge-Milton Keynes-Oxford corridor. This could be significant in relation to the long term future growth of the HPTM cluster.

6 Defined in relation to seven local authority district/unitary areas.

UNDERSTANDING CLUSTER DYNAMICS TODAY

Discussions with firms and related institutions pointed to the processes which are defining the cluster today. Specifically, the study identified four main aspects of the cluster's contemporary make-up and dynamics, and the nature and consequences of beneficial interactions across it. These relate fundamentally to the specialist labour market which is at the cluster's core.

(I) KNOWLEDGE "IN THE AIR"

Throughout the cluster's history, tacit knowledge has been developed principally through people; knowledge therefore has strong social and cultural dimensions. The turbulence of the cluster's history and entrepreneurial zeal have compelled individuals to move from one firm to another. This has created a shared culture/mindset which was described by the managing director of one business as "an obsessive madness about making things better in zero time". As individuals have moved, knowledge has been disseminated and built. This process of knowledge transfer and circulation has been – and is – crucial in understanding how the cluster works. Individuals moving between firms are creating the knowledge-based glue that gives the cluster coherence and form.

For individual firms, this process of churn is double-edged given wider recruitment challenges. However, firms are investing in the skills and knowledge base of the cluster, particularly through the recruitment and training of young people. This has long been a feature of the cluster through the likes of Cosworth, Reynard and Prodrive. Today, among both small and larger firms, apprenticeship and/or graduate programmes are often in place. Specialist institutions have also emerged; important recent examples include the National College of Motorsport and Silverstone University Technical College. Again, this is a characteristic of a well-functioning cluster.

For the cluster as a whole, churn has led to new businesses being formed and this process is central to the growth narrative. Strong relationships between individuals who have grown up within the cluster explain the origins and growth of many companies.

(II) INNOVATION AND ADAPTATION

Innovation is a crucial driver of economic growth. The HPTM cluster has long been a prolific innovator, and today, firms within the cluster are innovating in many different ways. Some of these are organisational (e.g. taking the disciplines from competitive motorsport into different spheres). Many others are based on the development, adoption and then dissemination of different technologies: examples include additive manufacturing, satellite-based navigational tools and systems, and advanced materials. These products/services are increasingly being applied in sectors such as automotive, aerospace, marine, defence, medical devices, sensors, etc.

The process of innovation sometimes involves individual firms, but often it is based on more collaborative approaches. These may involve other companies and/or other research-based institutions. Sometimes these are contained within the core geography of the cluster, but wider relationships are also very important.

Regulatory frameworks are having a substantial influence on patterns of innovation. Of particular importance are international regulations linked to carbon emissions and big data. At the level of individual businesses, these are prompting innovative responses that could be transformational. At a macro level, the changing regulatory framework is starting to define a new industrial paradigm and this will shape economic growth into the mid-21st Century.

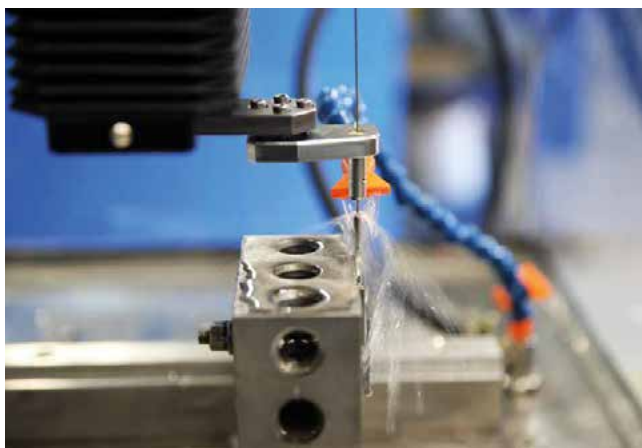
Innovation is a crucial driver of economic growth. The HPTM cluster has long been a prolific innovator, and today, firms within the cluster are innovating in many different ways.



Software engineers collaborating together – Racelogic



Inspection of shot peening on a racing exhaust system – Sandwell



EDM Hole drilling - EDM Precision Engineering

(III) FINANCING, NETWORKS AND GROWTH

The overall pattern of financing for growth across the HPTM cluster is – in parts – very distinctive. Some elements of the cluster (notably the Formula One teams) are well resourced through sponsorship arrangements. Some other larger firms have also secured investment. However, many smaller, specialist firms within the wider supply chain have struggled to secure external finance for growth.

Small HPTM firms have typically financed their own growth – relying on the personal savings of founders and then financing growth through cashflow. Individual firms perceive that securing bank finance can be difficult while equity investors can be unrealistic in terms of the expected scale of financial returns. Some firms are now actively exploring alternative possibilities, linked for example to crowdfunding. However, within the cluster, there are relatively few examples of serial investors/entrepreneurs who have successfully built businesses, exited from them and then reinvested cash (as well as commitment) to grow the next generation; other well-functioning clusters have a stronger endowment in this regard.

The lack of external finance could be a market failure. But it could also be a market signal. HPTM firms may need to evolve and adapt to become more “investible”. This is not a reflection of their technological abilities or potential, or the commitment of business leaders; it may though say something about the precise nature and focus of “ambition”.

There are some signs that financing solutions may be changing and that new approaches may unlock growth. The source of these seems to be largely external to the cluster and their emergence is a reflection of the potential of high performance technology, particularly in the context of global demand for low carbon, green/clean and energy efficient solutions.

Another important aspect of the cluster’s global footprint relates to skills and recruitment.

(IV) LINKS BETWEEN LOCAL AND GLOBAL

Although firms within the HPTM cluster are frequently small, many have a global footprint. Within the cluster there are some outstanding businesses in terms of export performance.

Another important aspect of the cluster’s global footprint relates to skills and recruitment. With significant national skills shortages (linked particularly to engineering and IT), international recruitment through visas is important. However, the cluster is also a global “magnet” for ambitious people who are looking to build their own careers in activities linked to HPTM. There have been some specialist responses from within the cluster and the role of Cranfield University is especially important in this regard.

LOOKING AHEAD

The HPTM cluster is continuing to evolve. Currently, it embraces two elements that overlap significantly but are at different stages of maturity:

- The cluster is “mature” in relation to motorsport and it continues to adapt and to demonstrate global competitive advantage as global motorsport evolves spatially (e.g. into China and South America) and in response to regulatory change
- The cluster is “developing” in relation to mainstream high performance technology. This has growth potential in the context of a fast-emerging industrial paradigm, driven by regulatory changes in the ambit of carbon emissions and big data, and focused around cleaner/greener, low carbon and energy efficient products and solutions. In taking this fully into the mainstream – of automotive, aerospace, marine, defence, medical devices, sensors, etc. – the potential is vast.

The social and cultural aspects of clusters are what sets them apart. In this context, the “shared rules and conventions” of motorsport are powerful. However, mainstream high performance technology applications have rules and conventions of their own. The differences are important. These are seen most clearly in relation to growth finance. A failure to adapt to the emerging opportunity will mean that the cluster may struggle to achieve its full future growth potential.

The cluster is “developing” in relation to mainstream high performance technology applications; these have real growth potential...

The importance of HPTM is recognised through local enterprise partnerships’ Strategic Economic Plans. This reflects both the opportunities linked to it, and its local significance against a backdrop of planned housing and jobs growth.

NEXT STEPS

An adaptive and knowledge-rich cluster with the opportunities, challenges and momentum of a fast growing region ought to be a cocktail for future success. In order to realise this potential, an Agenda for Action is proposed, structured around five main strands:

- access to appropriate forms of growth finance – recognising that established approaches will need to evolve further
- building leadership capability – acknowledging that the calibre of engineering excellence needs to be matched by strong business leadership skills
- routes to market – and building visibility – recognising that the know-how linked to HPTM is technically complicated and its potential needs to be communicated effectively, particularly to the investment community
- increasing the supply of skilled people – acknowledging that despite significant investment from within the cluster, there is a national shortage of engineers
- appropriate infrastructure provision – recognising the on-going need for a broad range of premises, all with high quality broadband connectivity.

CASE STUDIES

The full report provides case studies of HPTM companies operating within the wider cluster. Two examples are provided below. GE Precision Engineering has a deep cluster pedigree. This is seen particularly in terms of the backgrounds of its founders and the processes through which the business is growing today. The business is located in Northampton, very close to both Cosworth and MAHLE Powertrain. Flybrid Automotive – which was also formed in 2007 – has similarly deep roots in the cluster. Subsequently, Flybrid was acquired by Torotrak plc, leading to investment in the further development and testing of its mechanical Kinetic Energy Recovery System (Flybrid KERS), working with global partners.

GE PRECISION ENGINEERING



New headquarters on St James Mill Road within the Enterprise Zone

EARLY DAYS

In May 2007, Garry Edwards formed GE Precision Engineering: a manufacturing company offering precision engineering services to the motorsport and automotive industry. The business was based in Towcester, and soon after its inception, Garry was joined by fellow work colleague Andy Spencer.

In November of the same year, Scott Bredda joined Garry and a sister company (GE Design & Technology) was formed. Design Engineer Richard Beetham joined shortly afterwards. Subsequently, the companies merged and Garry and Scott became partners in the business.

Both Garry and Scott have spent their entire working careers within the engineering environment:

- Garry carried out a toolmaker apprenticeship working for TRW Aylesbury and Mall Moulds before working in the motorsport industry for Jordan GP and Ilmor Engineering
- Scott's engineering background started with an apprenticeship at Ford, followed by an engineering degree at Portsmouth University and employment at Knorr-Bremse, Cosworth and Ilmor Engineering.

Business funding was entirely from Garry and Scott's personal savings, both re-mortgaging their homes. Profit was reinvested into new equipment which enabled GE Precision Engineering to offer a wider range of services with the intention of attracting larger contracts.

The recession impacted on GE and a number of customers took work back in-house.

However, as the company's skills are transferrable, they undertook design and manufacturing contracts from alternative markets including Optical Systems, Radar and Nuclear.

Growth slowed slightly during this period but soon picked up and by 2009, there were 11 employees. New business included a number of engineering contracts for Mercedes AMG HPP (formerly part of Ilmor), based at Brixworth. Business links and personal relationships gained during the course of Garry and Scott's careers have been very important.



Fully equipped temperature controlled inspection environment – GE Precision Engineering

GROWTH FROM 2010

In 2010, GE Precision Engineering moved from a 3,000 sq ft unit in Towcester to a 6,000 sq ft industrial unit on St James Mill Road in Northampton which was (and is) very close to both Cosworth and MAHLE Powertrain; subsequently this area was designated as part of the Northampton Waterside Enterprise Zone. This proved to be a very positive move for GE, operating within a hub of similar companies.

Prior to the move (in late 2009), GE Precision Engineering was invited to participate in a substantial 3-year R&D project. This collaborative project was led by Jaguar Land Rover (JLR) and part funded by the Technology Strategy Board (now Innovate UK). It also involved partners including Shell, Bath University, Lotus, Imperial College and CD Adapco. The project required a significant investment by GE Precision Engineering but both Scott and Garry recognised that it represented a major opportunity. The project was delivered on time and to budget and GE has since undertaken further contracts with JLR.

GE Precision Engineering has developed work-streams with local companies including Mercedes AMG HPP (Brixworth), MAHLE Powertrain (Northampton), Cosworth (Northampton), Prodrive (Banbury) and Formula One teams. Evident throughout the growth of the company has been the network of personal relationships established from working within the cluster. This “small world” – in which key personal relationships survive both individual job changes and corporate ownership changes – has been very significant for business growth.

GE PRECISION ENGINEERING TODAY AND ITS PLANS FOR THE FUTURE

Currently, GE Precision Engineering employs 42 people. By the end of 2016, it anticipates that its headcount will increase to nearly 50. Over the next three years, turnover is expected to rise significantly. Overall, it anticipates that 50% of its business will be with automotive firms and 40% will derive from motorsport; it will have a particular focus on low volume production for niche vehicles. It will continue to undertake design engineering work for other sectors (e.g. nuclear), but this will be a small part of the business (perhaps 10% overall).

In realisation of its plans, GE Precision Engineering recently moved into a new, larger, building (still on St James Mill Road and within the Enterprise Zone).

Recruitment can be challenging, and in order to grow its team of engineers, GE Precision Engineering has so far employed four apprentices. This has proved to be very successful. The company is also supporting an undergraduate student through an engineering degree.



Moto3 engine testing on GE Precision Engineering's motorcycle chassis dynamometer



Low volume automotive production cell: major casting machining – GE Precision Engineering

FLYBRID/TOROTRAK GROUP

EARLY DAYS

Flybrid Automotive was formed in 2007 by Jon Hilton and Doug Cross.

The two founders had previously worked together at the Renault Formula One team, based in Oxfordshire. Prior to this, Jon – a graduate of the University of Hertfordshire – had senior engineering roles at Cosworth (in Northamptonshire) and TWR Arrows F1 (Oxfordshire), while Doug’s experience derived from spells at both Ricardo and Toyota.

Whilst working for the Renault Formula One team, Jon and Doug alighted on the idea of mechanical Kinetic Energy Recovery Systems (KERS). Essentially, this is a process through which energy is stored as vehicles are slowing down and then recovered in order to help vehicles accelerate. The consequence is that much less energy is wasted and levels of fuel efficiency are significantly enhanced.

At the time, the Renault Formula One team took the view that this new system was not a priority. Subsequently, following a change in the Formula One rules, Renault decided to downsize its technical team and both Jon and Doug were made redundant. The announcement came five days after Renault won the Formula One Drivers’ and Constructors’ Championships in 2006.

In the context of redundancy, Jon and Doug decided to back their own ideas and “give it a go”. The new start-up was formed with funding from two redundancy packages; personal savings; and what would have been the deposit on a house. Flybrid was located at the Silverstone Innovation Centre, for two main reasons: it was mid-way between the homes of the two founders; and it was seen as the “home of British motor racing” (which Jon and Doug considered would be helpful in opening doors to mainstream vehicle manufacturers).

By May 2007 – through an order which came from one of Jon’s ex-Cosworth colleagues – Flybrid was supplying the Honda Formula One team. Over the years that followed, Flybrid grew to the point at which it employed 22 people. However, it had significant outgoings (in terms of the monthly salary bill) and was exposed to substantial risk. The financing of the business at this stage was challenging and the two founders of Flybrid recognised that they “*had to sell it to let it grow*”.

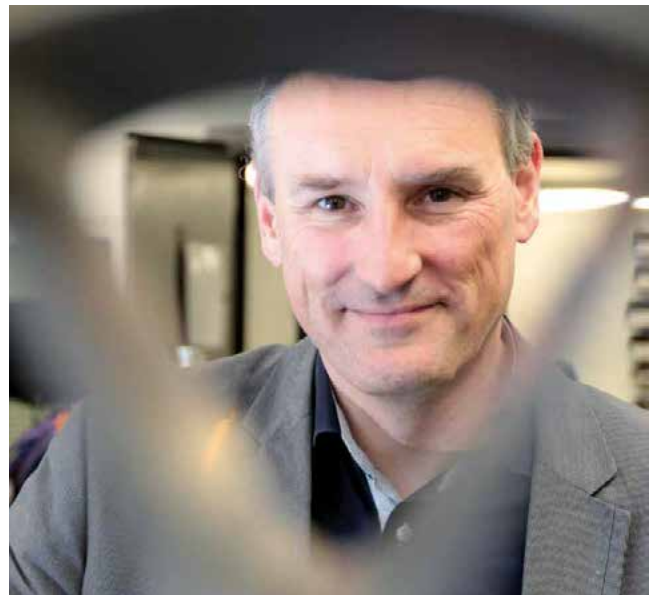
THE SALE OF FLYBRID AUTOMOTIVE TO TOROTRAK PLC

Flybrid was acquired by Torotrak in two stages: 20% was acquired in March 2013 and the balance of the business was acquired in January 2014.

Torotrak – based in Leyland, Lancashire – is a listed company which floated on the London Stock Exchange in 1998. At about that time, it identified itself as a “*technology development and transfer company with operations “sharply focused on the promotion of the Infinitely Variable Transmission (IVT) technology, to the point of launch on the market, initially in the passenger car segment”* (Torotrak Annual Report, 2001).

In early 2014, Torotrak raised around £16m through a placing and open offer to finance the full acquisition of Flybrid, but also to “*finance the investment required for the commercialisation of Flybrid’s first manufactured product for the commercial vehicle market and to finance the on-going design, development and testing of Torotrak’s V-charge technology and Flybrid’s M-KERS technology for the passenger car markets, as well as enhancing Torotrak’s testing and engineering capabilities*” (Torotrak Annual Report, 2014, and Torotrak Prospectus, 2014).

For the founders of Flybrid, the acquisition created possibilities in helping to “*get the product to market*” in a way that had not previously been possible for a small, privately-owned, business (given the scale of resources available within Flybrid). Commenting at the time, one of the founders noted that “*the conclusion of this acquisition will enable us to race to market faster and with more resources, to expand our profitable business and provide engineering and manufacturing jobs in the UK*”.



Flybrid Automotive founder, Jon Hilton

TOROTRAK TODAY

With the acquisition of Flybrid, Torotrak essentially brought together three fuel-efficiency technologies. It considers each of these to be capable of bringing significant change to the future of automotive engineering. These are: Torotrak commercial IVT (infinitely variable transmission); V-Charge (variable boosting); and Flybrid KERS units. All three are being developed as distinct products for the passenger car and commercial vehicle markets.

For Flybrid KERS, major opportunities include mainstream automotive (e.g. Jaguar Land Rover and Volvo); buses (through, for example, Wrightbus); and off-road applications (e.g. JCB). Substantial development work has been undertaken and is on-going. KERS-enabled vehicles have, for example, undergone extensive testing at Millbrook (Torotrak Annual Report, 2015).

Operationally, Torotrak’s site in Leyland has changed from having predominantly a design and development focus to now include development for manufacture including long-term testing, component manufacture and lower-volume assembly for high-value products. Its Silverstone site, previously the base for Flybrid, remains focussed on product design and development (Torotrak Annual Report, 2014).

LINKS BETWEEN LOCAL AND GLOBAL

Flybrid – now part of Torotrak – retains very strong local links, but it is also (increasingly) a global business:

- In terms of recruitment, Flybrid has relied heavily on strong links with Cranfield University. Roughly a third of the workforce has completed the MSc in Advanced Motorsport Engineering at Cranfield, and Doug and Jon are both on various steering groups within the University. Links to the University of Hertfordshire and to Oxford Brookes University are also important
- Increasingly Flybrid “*does quite a lot of business with people on the Silverstone Circuit*”. Jon comments that enquiries are referred between businesses; and that they “*help each other out*” if there is a need
- Much of Flybrid’s business is international – as well as the UK, Flybrid/Torotrak’s major clients are in North America, Sweden, Germany, France, Italy, Switzerland and, increasingly, the Far East.

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