



THE FIRST 40 YEARS



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Cutting edge

From the back of a Chinese takeaway to a 500-employee business, UK transmission specialist, Xtrac, has come a long way in 40 years

By DANIEL LLOYD

The company's factory site at Thatcham, UK, puts Xtrac right amongst the British motorsport industry's key players



Xtrac

Each day, employees entering Xtrac's design office pass a wall-mounted layout drawing for the company's first racecar transmission. The G4 gearbox was developed by former Hewland engineer, Mike Endean, for rallycross star, Martin Schanche's four-wheel-drive Ford Escort. The plan serves as a reminder of where Xtrac started, and how much it has grown in the 40 years since.

Now entering its fifth decade, the British transmission manufacturer has an increasing staff count of almost 500 employees, two regional outposts in the United States and several long-term supply deals for major series. It currently builds the transmissions for IndyCar, NASCAR, Supercars, RX1e rallycross, all LMDh cars, most LMH cars, several in Formula E and more.

In recent years, the company has diversified into the high-performance automotive sector with several electrification projects and boasts an impressive factory in the UK. And it all started with that hand-drafted design for the G4, which enabled the spectacular Schanche to win multiple European Rallycross rounds in the 1980s.

The first Xtrac headquarters were a small workshop around the back of a Chinese takeaway in Wokingham, a town outside London. Its first gear-making equipment came from a company called MEH in nearby Staines, which was closing down and selling off assets after one of its directors died.

That machinery enabled Endean to build components in small quantities, mostly for off-road motorsport.

The name Xtrac only emerged after the G4 gearbox had started racing in 1983. The story goes that Endean lightheartedly told the revered British motorsport commentator, Murray Walker, that his as-yet-unnamed firm was called 'Mr X's Traction Company'.

Walker then ran with it, going onto the broadcast and spurting out 'Xtrac' for short. The impromptu, catchy moniker stuck and Endean, together with his wife, Shirley, established Xtrac Ltd on June 15, 1984.

Early doors

One of the company's earliest employees was Peter Digby, who became its managing director and is now its president. At the time, Digby was factory manager with Williams and assistant managing director at Haas Lola. Both teams ran Hewland gearboxes, giving Endean and Digby a connection. When Carl Haas shuttered his short-lived F1 operation in 1986, Endean reached out to Digby with an offer.

'Mike called me,' Digby recalls. 'He said, "I know you've been running a factory with 100 people. How do you fancy working in a factory with four?"

'I came and joined Mike behind the Chinese takeaway. By then, he already had this amazing vision and had found a site near Finchampstead [Hogwood Lane] where he had reserved a plot of land and started

looking at building work to put up our first factory, which was about 9000ft.sq.'

That was quite large premises for such a small company, so Xtrac initially rented out a quarter of the floor space to a sub-contractor to help with cashflow. But then, as it adopted more projects, it steadily filled the new facility, leaving the workshop behind the Chinese takeaway for good in 1987 and officially moving to Hogwood Lane.

Off-road racing gave Xtrac most of its early business, and the popular Group A rally category of the 1980s was an important source of income. According to Digby, road car gearboxes at that time were totally unsuitable for rallying applications.

So, building on the international success of the G4, Xtrac entered partnerships with the likes of Mazda, Toyota, Opel and Mitsubishi, with which it also collaborated for the Dakar Rally. As manufacturers noticed the reliability gains from a specialist racing product, Xtrac found itself with plenty of welcome work.

'We were bringing in one new person every two to three weeks,' recalls Digby. 'We couldn't afford to buy machines because we were so small, so we would go to these [car manufacturer] customers and say, if you want to have that gearbox, we need this much up front for design, tooling etc.

'We would then take that money and go to a machine tool supplier, quite often having to wait until they brought out the right CNC machine for the job.'

Gearboxes were coming out of the Hogwood Lane site left, right and centre. However, one limiting factor was the lack of in-house heat treatment capabilities.

So, in 1988, Xtrac purchased a heat treatment plant, cutting out an area in which it relied on sub-contractors and increasing its production efficiency.

As the company grew, it branched out from rallying and set its sights on Formula 1. It had made a few F1 and IndyCar parts in the early days, for the likes of Haas and Penske, but not an entire transmission. That changed in 1989 when Onyx contracted Xtrac to develop a transverse gearbox for its F1 car. The connection was designer, Alan Jenkins, who switched to Onyx from Penske where he had liaised with Xtrac on producing parts in the mid-1980s.

'Then we were approached, almost at the same time, by McLaren,' remembers Digby. 'Pete Weismann had designed them a new, revolutionary gearbox and they were making gears, but having some issues. McLaren decided to do a back-to-back test. Allegedly, ours lasted longer.'

'So, overnight, we had a massive order in from McLaren, which was a real challenge. Then, within a couple of years, we had six Formula 1 teams that came to us.'



IndyCar is Xtrac's longest single-supply customer. This year, the P1359 gearbox will replace the outgoing P1011 to coincide with the arrival of hybrid power



Xtrac supplies components to most of the Le Mans grid, including all Hypercar transmissions, except Peugeot



The last Xtrac F1 gearbox was the P1044, a seven-speed sequential with 340Nm of maximum continuous input torque capacity used by Lotus, Hispania and Marussia

'Overnight, we had to build 100 [IndyCar] gearboxes very quickly with all our own money, before we sold one. We were bursting at the seams'

Peter Digby, president

'Nearly all of the work was bespoke at that point. We had Benetton, McLaren, Tyrrell, BAR, Williams and Jordan on the books. That was probably our peak of Formula 1.'

Xtrac is still involved in F1 today, supplying torque-carrying steel internal gearbox components to 'a number of successful teams.'

The company pushed in the past for F1 to adopt a single gearbox supplier, as other series have done, but that didn't materialise.

'We've spent big, six-figure sums trying to convince the teams of the benefits,' admits Digby. 'Outside of F1, the whole one-make gearbox has grasped most of the motorsport industry. Why wouldn't you do it? It just benefits so many areas.'

Sole supplier

Nevertheless, single-supply contracts are where Xtrac really accelerated its growth heading into the 21st century. In 1999, IndyCar enquired about a standardised gearbox to try and prevent development wars and reduce costs for teams.

'Gearboxes in those times coming from Lola and Reynard were about US\$150,000 for a spare,' says Digby. 'If you bought it with a car, it was a bit cheaper, but the organisers wanted to get on top of this.'

'We basically put together a package that said, if you allow us to have a five-year contract, overhauling the gearboxes and supplying them exclusively, we can do it for under \$50,000 [per unit].'

Xtrac built some test parts and convinced IndyCar to start the contract. This was a huge scoop for the British company and helped further its worldwide reputation in motorsport.

'Overnight, we had to go and build 100 gearboxes very quickly with all our own money, before we sold one,' Digby recalls. 'We were bursting at the seams.'

The huge increase in workload that came with the IndyCar deal had Digby out every Sunday morning on his motorbike looking for a potential new factory location.

He eventually came across a 13-acre industrial site in Thatcham, Berkshire, and decided it was suitable for the next stage of the company's expansion. Ridge & Partners, the architect for most F1 team headquarters in the UK, put the 88,000ft.sq factory in place for staff to move in by the summer of 2000.

Three years later, Xtrac opened its first American outpost in Indianapolis to service the IndyCar transmissions. However, this rapid expansion came with a financial cost.

'We needed to finance all these IndyCar gearboxes,' says Digby. 'We also needed the machinery that was going to come into this factory... so we took on board our first private equity partner, which was HSBC Private Equity [later called Montagu]. They came on board and took a 25 per cent shareholding and helped us finance the growth and obtain the security we needed.'

The IndyCar deal came after Xtrac had already expanded into other areas of motorsport. The company made its first complete 24 Hours of Le Mans transmission for the Peugeot 905, developing a six-speed sequential manual for the first time.

It also went on to supply the GT1-class McLaren F1 GTR, and then many LMP entries towards the end of the 1990s, including ones from BMW and Toyota.

In parallel, Xtrac was building front and rear sequential transmissions for several BTCC cars, and eventually moved to a single-supply contract for the series that it still holds today.

'We then decided to take sequential to rallying,' says Digby. 'Most of the drivers said they didn't want that, but we built a gearbox mock-up to show them that you could go from sixth to second as quickly as you could on an H-pattern, but without blipping the engine. It was transformational at that point. Nobody looked back after that.'

Covering various categories and adapting the gearbox technology to suit different vehicles' demands helped increase Xtrac's reputation across motorsport. Its products were often not the cheapest option, but its selling point has always been reliability, which makes it cost effective in the long run.

Automotive expansion

Despite hailing from motorsport, Xtrac has ramped up its high-performance automotive (HPA) business in the last two decades. According to company CEO, Adrian Moore, years of working on hard and fast motorsport deadlines enabled Xtrac to be agile in reacting to road car projects which tend to be more fluid from a timing perspective.

'The core of the business is still motorsport,' he says. 'It gives us the customer focus, the reaction time and the ethos.'

However, the automotive side is growing.

'Today, we're about 60 per cent motorsport and 40 per cent HPA,' adds Moore. 'That HPA percentage is growing, but not at the expense of motorsport shrinking. It will be more like 50 / 50 in a couple of years.'

Since its first electrified powertrain project for a Tesla prototype in 2006, Xtrac has also increased its EV and hybrid workload, and this will soon overtake internal combustion.

‘As legislation changes, we’re still small and agile enough to react... We’re ambivalent as to which way regulations go, it just depends what the customer wants’

Adrian Moore, CEO

According to Moore, the split last year was about 65 / 35 in favour of IC, but now they are on equal terms. Top-level motorsport series adopting hybrids, such as LMDh for IMSA and Le Mans, has been a big part of that swing.

Hydrogen has also recently emerged as an option and Xtrac has started developing transmissions for hydrogen combustion engine prototypes, such as the Alpine Alpenglow HY4 that is covered in this issue.

‘As legislation changes, we’re still small and agile enough to react to that,’ says Moore. ‘As well as IC, our capability is transmissions for those three [hybrid, electric and hydrogen propulsion systems]. We’re ambivalent as to which way the regulations go, it just depends on what the customers want.’

Mechatronic age

Nowadays, Xtrac doesn’t just sell transmissions. Last year, it formalised a dedicated mechatronics department for its automotive customers, who were increasingly requesting turnkey solutions such as control systems, gearshift mechanisms and clutch actuators.

‘HPM [high-performance mechatronics] has two focuses: one is motorsport, which is really actuators, and the other is automotive, which is the turnkey package,’ Moore explains. ‘That moves towards a gearbox having an electric machine that’s part of the supply.’

‘On our HPA gearboxes, for example, one of the products we build has a hydraulic gear change system. That leaves here with the clutch in place, the clutch bite point set, and every parameter set on the gearbox. Our end-of-line testing sets all of those, and we just plug it in the road car, and it works.’

‘That’s a different requirement compared to motorsport and is where a lot of our development has gone, in terms of bringing capability in-house. We have software engineers, electronic designers and control system engineers. In the last couple of years, that has been quite a big growth for us.’

Currently, Xtrac produces a quarter of a million components annually – that’s almost 5000 weekly, or 685 daily.

Before any part is manufactured, it is conceptualised in the design office. There are 90 engineers working in this department,



This Kapp Niles VX-series, 90-degree profile grinding machine allows for sequential roughing and finishing tool use



Heat treatment of parts is all done in-house, and is gradually moving towards the low pressure carburising solution

with about a third of them on motorsport projects and the rest on high-performance automotive. The gear design engineers, R&D, system engineers and analysts float between the two, depending on the project.

Downstairs from the design office sits the production office, where manufacturing plans and quality control are directed. Since each project contains sensitive customer information, Xtrac has high security data systems in place such as multi-layer authentication and encryption.

Unsurprisingly, the manufacturing area utilises the most space at Thatcham. It is constantly evolving, with new machines regularly being introduced or re-positioned for efficiency. A wide walkway runs along the length of the factory floor and serves as a gateway between the offices and machinery on the other side. Along the walkway, project timelines are laid out on whiteboards. With so many projects on the go, it’s important that schedules are communicated clearly so they are executed with minimal delay.

‘They give a day-by-day rundown of what is going on in the factory,’ explains principal engineer, Nick Upjohn. ‘It’s all trackable, and constantly monitored, and that feeds back to the operation control centre (OCC) office so, if there are any issues, we can solve them immediately, trying to cut down on time lost.’

Factory landscape

Xtrac has high-grade steel supplied to its own specifications, and holds stock of about 200 tonnes at any one time, ensuring it has enough to ride out any supply chain dramas.

On the manufacturing floor, gear-cutting machines stand like towers above a network of narrow walkways, through which technicians and engineers commute between the different stages of manufacture – turning, milling, gear cutting and heat treatment.

Once a part is designed in CAD, its first step towards manufacture takes place in the turning department. This consists of nine Okuma CNC lathe machines, which receive inputs from a turning program.



The cityscape of towering gear cutting and grinding machines dominates the factory floor at Xtrac's Thatcham manufacturing base



Mechatronics and control systems solutions mean Xtrac's business today is not only about supplying gearbox parts

'We've got multiple coordinate measuring machines, which are used to measure our parts,' says Upjohn. 'They validate that the program is machining the part how we want it. That way, if you've got an error in the program, you can correct it and account for any discrepancies in your next turning operation. It's a nice, closed-loop system. A lot of work will be done here before any issues present in our manufacturing support office.'

Next is the milling department, where over a dozen mills cut and remove material to define the part's shape, be it a bearing retainer or a gearbox casing.

'We have a huge array of mills,' says Upjohn. 'Anything from small, three-axis manual mills for simple parts, all the way up to five-axis machines that can accommodate a one metre cubed work piece.'

Cutting teeth

Once a blank part has been made, it is taken to the shaping, or hobbing, departments where teeth are cut into it by up and down movements. It takes about 15 minutes to produce a spline of 30mm diameter. Some gears can have as many as 150 teeth, and there are different cutting methods employed, including broaching and hobbing machines, which use rotary cutting tools.

'One of our most exciting machines is our bevel grinder,' adds Upjohn. 'In the very early '90s we invested in the latest technology Klingelnberg bevel cutting machine that could cut the bevels soft, and then finish the teeth very accurately after heat treatment. That was a really key step in enabling us to bring in house every manufacturing process.'

'Around 15 years ago we invested in a bevel grinding machine from Klingelnberg, and then a few years ago a second machine.'

That's not said lightly when you hear the bevel grinding machines cost in the region of a million pounds (approx. \$1.267m) each.



High-performance road car work has increased in recent years. Xtrac announced its 6012 transverse transaxle in 2006

‘Our Klingelnberg G30 CNC spiral bevel gear grinding machine was the first in the UK,’ says Upjohn. ‘We dress the form of the tooth we would like onto the wheel, and it then form grinds the material away. It’s an abrasive process, as opposed to a metal chipping one.

‘We then take it to our inspection department and a probe will measure where it’s incorrect vs the true perfect form. It will then send that information back to the first machine, which will administer corrections to make it the perfect shape. It’s a closed-loop system, right back to the original design data, which enables our engineers to refine the design for optimum strength, wear, efficiency and, for automotive applications, low noise.’

Heat treatment

Once the gear has been produced, heat treatment is employed to realise the intended material properties of hardness, ductility and strength. Xtrac uses two types of heat treatment furnace technology, both of which use electrical elements to heat to the correct temperature: a seal quench furnace (of which the company has three) and a low-pressure carburising furnace.

The heat treatment process creates a reaction in a gaseous environment that produces carbon, which infuses into the gear’s surface when the heat is raised up to around 1000degC. The latest technology, low-pressure carburising furnaces are newer to Xtrac, having only been introduced within the last six years, and can provide a more precise process than the older, but well proven, sealed quench furnaces through their gas quenching process, rather than the oil quench of the older equipment. There are currently two in operation, all feeding off a dedicated electricity substation.

Once heat treated, most parts, including gears, are processed through shot peening to improve their fatigue resistance and prolong their lifespan. This aerospace process involves firing tiny shot pellets at the gear surface and creating surface tension.

Off limits

Heading back out to the main walkway, greyed-out windows on the office side signify the R&D department. Of course, this most interesting of rooms is strictly off limits to outsiders, but we are told it contains testing apparatus, such as a four-square rig, a gimbal rig and a quasi-transient differential test rig (QT-DTR) that customers and Xtrac both use.

The factory also houses two fully loaded, transient powertrain test rigs, and multiple rigs used for end-of-line gearbox testing.

‘Having the R&D facility here in-house brings people in,’ indicates Upjohn. ‘You get them in the door and show them around, then maybe – hopefully – bring them on board as a customer.’



Around 15 per cent of Xtrac’s current employees started their careers on the company’s apprenticeship and undergraduate schemes

Next door is the Xtrac Academy: a practical training area for level two and three apprentices with manual and CNC machines for making non-production parts, and computer-aided engineering (CAE) training areas. Xtrac takes on around 10 apprentices per year, and a high proportion go on to stay with the company. As an example, Xtrac’s first apprentice from the 1990s, Simon Short, is now head of its Indianapolis build shop.

Upstairs from R&D and the academy is Xtrac’s motorsport build area, where gearboxes are put together. Five years ago, it was the assembly shop for all the company’s products, but the increased HPA workload has correlated with a significant investment into a dedicated automotive gearbox assembly line located in a different area.

At the time of our visit, sportscar gearboxes are being assembled for Le Mans. Also visible is a huge, 3D-printed casing built for the 932kW Czingier 21C electric hypercar (an industry first as most gearboxes use L169 aluminium). This makes a fitting bookend to the G4 layout encountered at the top of our tour. Gearbox technology has come a long way since Endean’s first innovative product and Xtrac has been a key part of furthering reliability and performance in many categories during that time.

As motorsport looks to other powertrain and fuel solutions for the future, Xtrac is well positioned to remain at the forefront of transmission design. **③**

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Evolving business

Xtrac’s growth has been stimulated through structural changes. The first major shift occurred in 1997 when Digby led a management buyout of the company whilst Endean stepped back. It involved Xtrac selling 49 per cent of its shares to the shop floor, while retaining 51 per cent for top management to maintain quick decision making.

‘Mike pledged us that we wouldn’t give ourselves any pay rises, and all the money would be spent on machinery,’ Digby recalls. ‘We needed his permission to buy a new machine. It set us on this path that is still going, and we are still taking on a new employee every two or three weeks.’

The employee share model continued after Montagu bought its 25 per cent stake in 2000. The private equity company was onboard for 13 years and, according to Digby, enabled Xtrac to ‘grow up’ and expand its manufacturing, commercial and financial departments. After Montagu’s exit, Digby became company chairman and then president, and in 2015 appointed Moore, previously technical director, as managing director to lead another management buy out and further re-structuring. In 2017, Inflexion Private Equity invested in Xtrac, facilitating an expansion of the manufacturing plant and a tripling of revenue from electrified powertrains.

‘We still were employee owned in that time, but we ended up wanting an investor in the business,’ explains Moore, who became chief executive in 2018. ‘The reason for that stems back to the early 2010s when we were still a motorsport business, but we could see the automotive and electrification leads coming at us and needed investment to fulfil those customer needs.’

Inflexion’s influence lasted six years and was shortly followed by MiddleGround Capital purchasing a majority stake in 2023. These outside investors have enabled Xtrac to maintain its spread into automotive and electrification, which is set to continue.