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Le Mans

With new rules and new cars, who's on top?

Ferrari 360

Privateer racecar that challenges Porsche

Renewable race fuel

Showing the way by racing on enthanol

Tyre theory

Why race rubber doesn't always obey the rules

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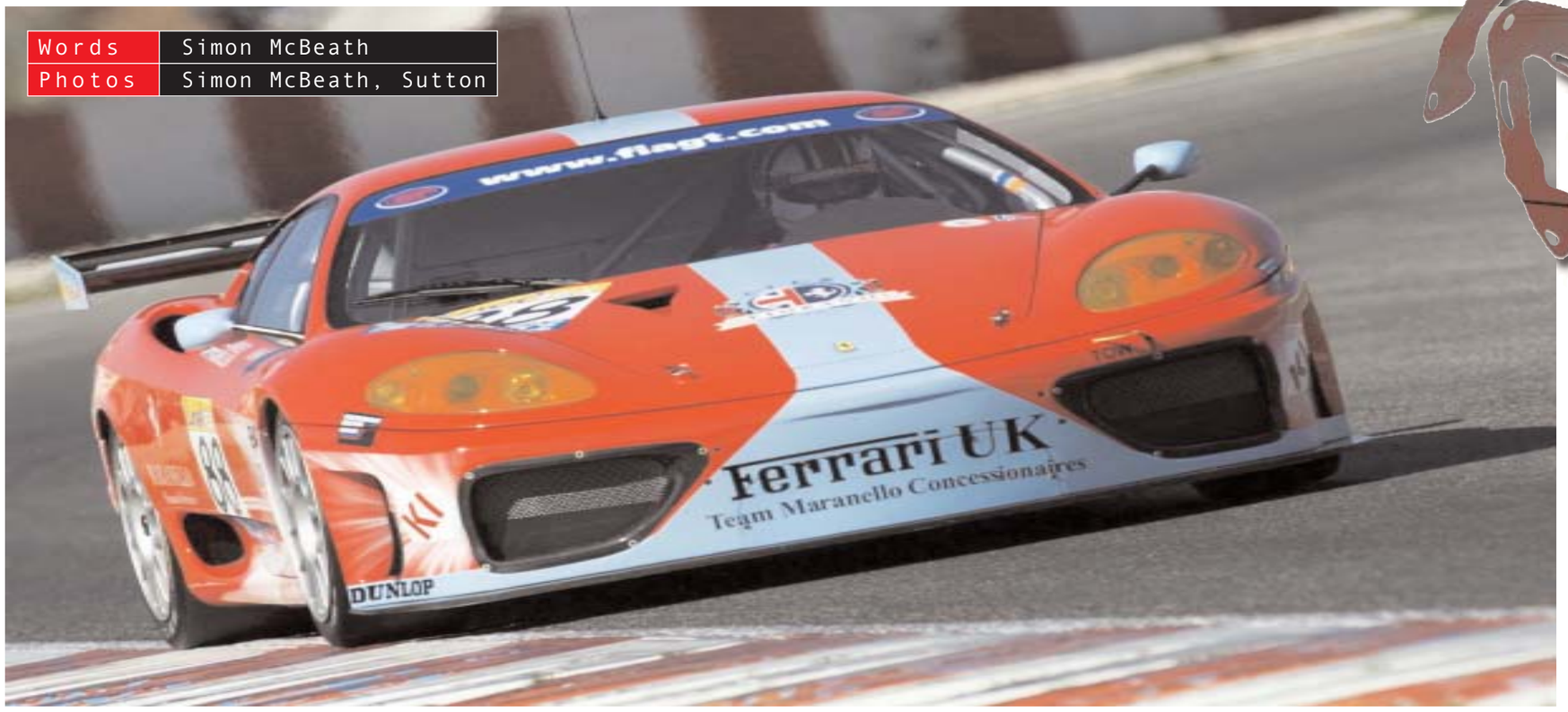
Ferrari 360

Stallion job

Words Simon McBeath
Photos Simon McBeath, Sutton



Is the Ferrari 360 Modena really a credible alternative to the ubiquitous Porsche 911 Carrera on the GT3/N-GT stage? Team Maranello Concessionaires certainly thinks so

The increasing competitiveness of Ferrari's 360 Modena in GT racing around the world is evidence that it's not just the mystique of the marque that is appealing.

And that should not come as too much of a surprise. After all, the 360 appears to have a highly suitable layout for racing purposes and teams that have invested in the development of these Ferraris presumably recognised a sound basis for that effort. In other words, they must have thought them capable of winning against Porsche's highly developed product right from the very start.

One such team is up-and-coming Brackley UK-based race team Veloqx Motorsport, or as it is now known in deference to its commercial arrangement with the famous Ferrari UK importer, Team Maranello Concessionaires. *Racecar* paid the team a visit to discuss the engineering that went into its 2002 British GT Championship GTO class-winner, and how the team was preparing for a full FIA GT Championship N-GT class campaign this year.

The 360 Modena was unveiled at the 1999 Geneva Motor Show. The car boasted significant weight reduction over the previous F355 model, in part through the use of aluminium for the entire chassis frame and most of the bodywork, and a new V8 engine 'for the 21st century.'

The car also offered effective underbody aerodynamic treatment, which, it was claimed, generated 1765N (396lb) of downforce at 290km/h (180mph) with an equal front to rear split. And perhaps most invitingly the fundamental layout was classic mid-engined with a rear transaxle offering a 43 per cent front, 57 per cent rear weight distribution. A further innovation that initially seemed to have some potential was the option of a 'Formula 1 type electro-hydraulic' gearshift system on the road car.

Team Maranello Concessionaires principal Sam Li and chief race engineer Steve Ridgers are in no doubt about the 360's good points as the basis of an N-GT car, and Sam Li made the observation that, 'based on the technical excellence of Ferrari's Formula 1 and road car technology, when everything is in place for a GT programme it could be unbeatable.' It will indeed be fascinating to watch how Ferrari tackles Porsche in particular, the renowned German manufacturer having a big head start in the business of developing its road-going cars into fast and reliable racecars.

"THE FASTER SHIFT ALONE FOUND US A SECOND PER LAP"

Steve Ridgers goes on to list the key areas that he believes make the 360 into a good racecar: 'The engine is superb. It has a low centre of gravity; good throttle response and reasonable power. And for 2003 Ferrari is working on torque and power delivery, although peak power tends to be restricted by the twin 30.8mm (1.2in) induction system restrictors.' Interestingly it seems the Porsche (911 Carrera GT3) was a little quicker down the straights than the Ferrari in 2002.

'The car does have a good weight balance and low centre of gravity too, and its basic layout is classic. The suspension is very good, and →

drivers who have driven both the Porsche and the F360 [in GT racecar specification] say the Ferrari handles really well. The drivers also love the brakes. So the Ferrari is very good into and through the corners but not quite so fast on the straights, which gives an interesting mix of performance between the cars,' says Ridgers.

Contributing to the Ferrari's cornering performance is its aerodynamics (5400 hours of wind tunnel time went into the road car design) not least the standard full-length twin tunnel underbody. For racing purposes a splitter is added at the front and a single element wing at the rear. However, Steve Ridgers remarked that the small but significant speed disadvantage compared to the Porsche is down to extra drag incurred by the Ferrari's bigger frontal area, and although the 360 is lower than the Porsche it is also considerably wider.

The Ferrari's all-aluminium chassis is another of the car's advantages, Sam Li stating that it is 'better than most competitors, and although the stiffness is not on a par with an LMP prototype it is nevertheless quite amazing for an N-GT class racecar.' Steve Ridgers added that, 'the chassis is also very strong, as is the suspension, the driveline and so on. Things very rarely break.'

"WHEN EVERYTHING IS IN PLACE FOR A GT PROGRAMME IT COULD BE UNBEATABLE"

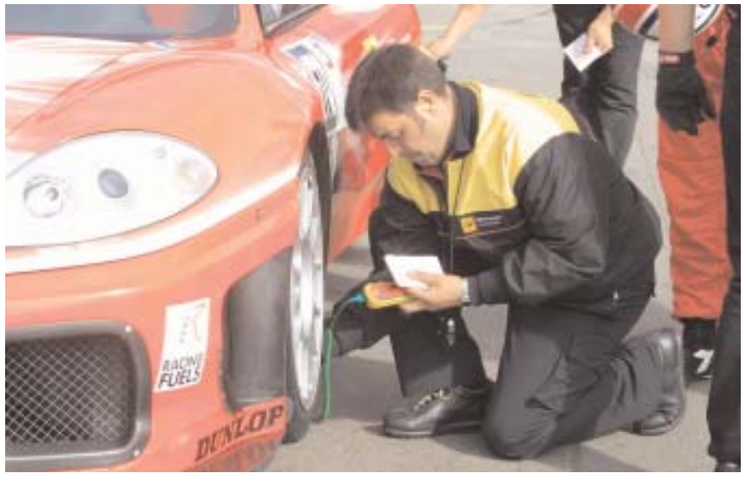
Clearly part of the attraction of running a Ferrari is *the image*, which engenders zeal rarely linked to any other marque. Steve Ridgers: 'this is partly why the mechanics love working on these cars, though they are not all that easy to work on.' So in spite of one or two points against the 360 Steve Ridgers concludes that 'there are very few real problems.'

The 360 GT cars were originally developed and prepared for Ferrari by Michelotto Automobili in Padua, Italy, and although Ferrari Corse Clienti (the customer racing department) now officially runs the project and builds the cars, Michelotto is still heavily involved in liaison with clients and preparing cars. Sam Li is full of praise in particular for Michelotto's Luigi Dindo. 'He has vast experience of GT racing and is a very smart man. He is a great asset to Michelotto and Ferrari, and he certainly knows what it takes to be competitive and win races within the limited resources and investment given to any project.'

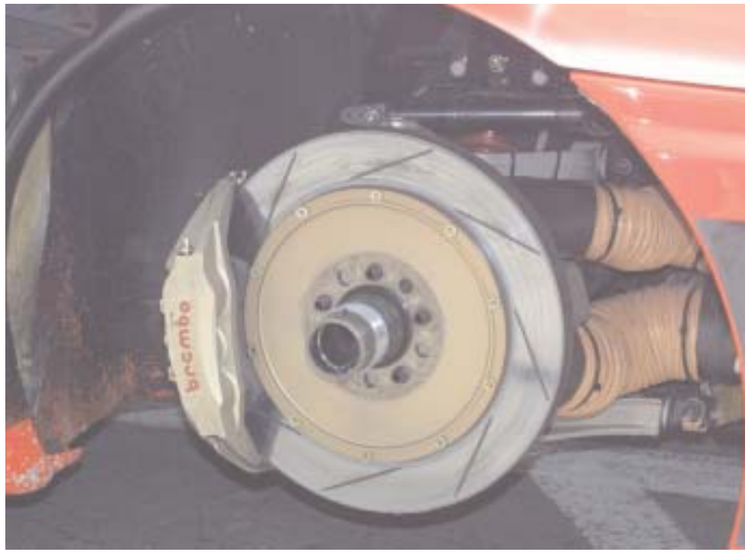
The 360 GT was actually a development of the car built for the one-make Ferrari Challenge

The all alloy Ferrari V8 nestles deep in the 360's engine bay – it produces 430bhp at 8500rpm and 275lb.ft at 4750rpm

A driver change during testing – Veloqx Motorsport now races under the evocative Team Maranello Concessionaires name



Veloqx has developed the relationship it forged with Dunlop in British GTs and now tyres are developed for the team



Front and rear brakes are racing spec courtesy of Brembo while the suspension is standard Ferrari 360 Modena

The rear end is now built around the Hewland NLT transmission – which has replaced the original modified Ferrari gearbox

It's not just the magic of the name and that prancing horse – the rear of the road car is also blessed with twin diffuser tunnels

Pirelli Trophy, for which the 360 became the only eligible model in 2002 having run alongside the F355 since 2000. Then the success of the JMB Competition squad in taking the 2001 FIA N-GT championship persuaded Ferrari to build a limited run of 360 GTs to enable private teams to contest not just the FIA GT series, but also Le Mans and the similarly regulated ALMS – principal differences between FIA and Le Mans/ALMS spec cars are in the underbody and gear change mechanism.

The Ferrari's heart

Long ago Enzo Ferrari remarked that the engine was the heart of his cars, although the level of competition in any current racing arena means that all areas of a racecar have to be optimised nowadays. But if the all-alloy, 90-degree V8 nestling under the transparent cover of the 360 would have made 'The Old Man' proud, it seems unlikely that he would have approved of mandatory restrictors to limit horsepower. Yet that is what N-GT runners have to contend with, a pair of 30.8mm (1.2in) restrictors being the option selected for the 360 GT. These fit ahead of the standard variable intake geometry

"CRUCIALLY VELOQX HAS BEEN WORKING WITH DUNLOP SINCE LATE 2002"

induction system, which incidentally also incorporates a fly-by-wire throttle mechanism.

In spite of the induction system restrictors, development of the race engine has seen an increase in peak power over standard of around 30bhp and a more modest increase in peak torque of 5Nm (3.6lb.ft). These gains have been achieved with a number of modifications, including a modified combustion chamber design enabling a raised compression ratio; higher lift camshafts; a straight through exhaust system unencumbered by silencers; modifications to the dry sump oil system to reduce frictional losses and power drain from the oil pump itself; and the expected lightening and balancing work to the major reciprocating masses.

Engine cooling has been uprated from standard, with a pair of larger connected water radiator matrices at the front supplemented by an oil/water heat exchanger instead of the production car's rear mounted air cooled oil radiator. Steve Ridgers remarked that the engines are simply supplied by Ferrari and installed in the cars, normally running reliably for an entire season, although unusually the team did have one blow-up in 2002 –

which is still under investigation.

The Bosch engine management system enables different fuel maps to be run with a driver-selectable switch in the cockpit. This was said to be instrumental in JMB's 2001 championship success, enabling reduced fuel consumption and shorter pit stops. But for its British GT Championship campaign, which involved much shorter races, the Veloqx cars ran on full rich for maximum power.

Gearbox change

Originally fitted with the modified Ferrari gearbox used in the Challenge cars, in mid-2002 the Veloqx 360 GTs were switched to the Hewland NLT six-speed sequential transmission, a move within the regulations – which state that the original location and orientation of the transmission shall be retained. Although the FIA GT regulations allowed the use of the F1-style paddle operated gearshift option from the road car, it seems the electro-hydraulic change was actually somewhat slow in operation. The rules allow either an H-pattern shift with synchromesh engagement or a sequential shift with dog engagement, and the Ferrari gearbox used synchro, which meant that in spite of the 'hi-tech' paddle operation, the shifts themselves were slow. Steve Ridgers said: 'there were also fewer options on ratios with the Ferrari transmission. So the Hewland offered dog engagement, a faster shift, more ratio choices and less power loss. The faster shift alone found us a second per lap at Pembrey [a 2.35km circuit in Wales that the Veloqx team occasionally uses for testing].'

Interestingly, although Veloqx funded this transmission switch, Michelotto now supplies the NLT as standard on the 360 GT. New for 2003 is a 'flat shift' facility that will enable even more rapid shifts and the saving of more lap time increments.

Suspension

FIA N-GT rules require the use of standard suspension components fitted in more or less the original locations. The 2002 regulations permitted relocation of up to 20mm (12.6in) of the inboard suspension mounts from the original positions, but it seems that the 2003 rules have reduced this leeway to just 5mm (0.2in). That the 360 already had effective double wishbone suspension – and a geometry that was less compromised by the reduction to racing ride height than it might have been – was a further justification for its selection as a good base racecar. And although the aluminium suspension is suitably heavy duty, Veloqx also lifes the key components.

The standard hubs have to be retained, but the front track has been widened by 70mm (2.7in) by altering the offset of the front wheels, while the rear track has been kept the same as standard. Steve Ridgers confirmed that 'the front of the car is quite dominant.' The front anti-roll bar is stiffer than the production one, and the rear bar has been made adjustable, the bars being used for coarse tuning at the track.

Sachs four-way dampers are used along with what Ridgers described as fairly stiff, linear rate springs. He said: 'The dampers allow us to fine tune the car very nicely, and after that it's about paying attention to the tyres. We found a "sweet spot" in the set-up so we tend not to change it very much. We visited the Lola seven post rig during the season, and although that did generate some useful set-ups it only really confirmed that the track-derived set-up was good.'

The aluminium chassis with the engine removed

The front wheel arch. Note suspension mountings on cast bulkhead and Kevlar inner arch

"THE CAR IS VERY RIDE HEIGHT SENSITIVE"

Barnstorming Veloqx

Team Maranello Concessionaires, née Veloqx Motorsport, might be the new kid on the block, but its senior personnel has extensive racing experience at top level. Team principal Sam Li brings an unusual combination of a mechanical engineering and vehicle dynamics education together with commercial acumen and experience gained in his UK and Far East businesses that should stand the team in good stead. Add in a policy to bring on young race engineers and a recently acquired modern, spacious raceshop and this looks like a team set to go places.

Veloqx actually followed Ferrari and Tyrrell's example by initially running its operation from very modest premises, a converted farmhouse to be precise, near Hemel Hempstead in Hertforshire. Founder Sam Li says he is 'very proud of the fact that we won the first race and the first championship we entered with cars that were prepared in a barn.'

Even the team name is indicative of a thorough approach, as Li explains: 'Veloqx is a self-created word that I have used since running student research projects; the "velo" stands for velocity, speed, efficiency; the Q is there for quality; and the X symbolises the angles we look at any project from.'

The team's management style should appeal to engineers too as Sam Li believes in engineering led structures. 'We don't have a team manager as such, the race engineers are project managers for their respective teams of people and I personally lead the team of four engineers.' Steve Ridgers agrees that the management method is effective. 'I sometimes wish we had more people, but it works well because of the people involved. It helps us to manage Luigi Dindo's design better than most.'

Last year was always a stepping stone first year for Veloqx, and provided much learning and team building experience. Its last gasp British GT GTO class championship win was in reality an unexpected bonus, but the level of competitiveness of the team was certainly no accident. A two race toe in the water FIA GT campaign at the end of 2002 saw the Veloqx 360 GTs fastest in class at Donington Park in early October, but an unusual engine problem for one and loss of drive for the other saw both cars retire. Then at Estoril two weeks later one of the Veloqx cars finished third in class ahead of the 360 GT of regular FIA GT entrant and 2001 N-GT champions JMB Motorsport. Clearly the team can compete at this level, and its main aim for 2003 is a full FIA GT campaign. Le Mans is also firmly on the wish list, though plans had not been confirmed at writing time, and for 2004 the team hopes to step up a class both in the FIA series and for Le Mans.

With two highly experienced senior race engineers, Steve Ridgers (ex-Team Cadillac/TWR Jaguar/McLaren F1 GTR/Arrows F1 among others) and Eddie Hinckley (most recently ex-Bentley and Team Cadillac), two well qualified junior race engineers, Stuart Robertson and Oliver Knighton, and a small, dedicated crew in support, Veloqx Motorsport/Team Maranello Concessionaires certainly looks to have the resources to get the job done.

Veloqx chief engineer Sam Ridgers (left) consults with the team's principal and founder Sam Li

Team Maranello Concessionaires/ Veloqx has now moved from its former barn HQ to the ex Team Cadillac raceshop in Brackley, UK

Brake and tyre developments

Because of the increased demands of GT racing compared to the Ferrari Challenge the brakes on the 360 GT have been uprated with a Brembo kit comprising larger diameter discs, and six-piston calipers at the front and four-piston calipers at the rear. Furthermore, Steve Ridgers related that Performance Friction has produced some development carbon metallic brake pad materials for the team.

Perhaps crucially, Veloqx has been working with Dunlop since the latter part of 2002 to enable the supply of tyres suited to the Ferrari for the FIA GT series this year (Dunlop supplied control tyres for the British GT championship). Following the test programme a deal has now been secured with the Birmingham, UK-based tyre manufacturer. Steve Ridgers: 'we have developed a great relationship with Dunlop, and the deal to make a tyre that suits us will help us get our [lap] times.'

Aerodynamic surfaces

The regulations permit the replacement of original removable panels with alternative materials, and all bar the aluminium roof and outer rear wheel arches have been replaced with carbon panels, with the inner arches in Kevlar. Aerodynamically there are two obvious changes compared to the standard car: front airdam/splitter arrangement and rear aerofoil.

The original twin tunnel underbody is retained in its original form as required by the regulations for the FIA GT series, though regulations for Le Mans and the ALMS require a flat area between the front and rear axles and hence call for modifications to the original twin tunnel set-up, and a single wide and shallow diffuser at the rear of the car.

The twin ducts in the modified front airdam channel cooling air through the angled radiators and then sideways out through ducts ahead of the front wheels, with excess air bleeding through mesh grills into the wheel arches. The flat splitter protruding from the lower lip of the airdam varies between the FIA and Le Mans/ALMS rules too, the FIA version being somewhat longer.

The single element rear wing has a maximum permitted span of 90 per cent of the overall width, which, Steve Ridgers said: 'Doesn't enable enough downforce to be produced really. And the car is very nose sensitive so we had to open up the front duct a little to lose some front downforce.' The car is also apparently very ride height sensitive, even at the increased ride height now mandated (60mm [2.4in] static or rest on wheels fitted with deflated tyres without grounding). 'This gives a narrow set-up range to work with' continued Ridgers 'and raising the nose a little can shed front downforce very easily. The front splitter is certainly the dominant feature, not the diffuser kick up as might be imagined.'

"THE TEAM WAS ABOUT TO EMBARK ON AN AERODYNAMIC DEVELOPMENT PROGRAMME"

At the time of our visit in late January the team was about to embark on an aerodynamic development programme involving the full scale wind tunnel at MIRA to investigate the top body surface and rear wing position, and track testing to optimise the underbody aerodynamics.

At the race track

Steve Ridgers explained the Veloqx approach to engineering the racecars at meetings:

The 360 has proved to be a competitive package in GTs

'we're very set-up conscious, and we check the cars as soon as we unload. We start free practice with our normal set-up and rarely divert much from that – small front or rear ride height or damper adjustments are usually all we make. We occasionally alter the springs, but the anti-roll bars are usually fixed. For the first session the track and the driver are usually green, so we look at the driver and his data, and also the damper data, and then carry out fuel measurements too.'

Ridgers adds: 'When we're running two cars we never run the same tyres at this point. There are soft, medium and hard tyres so each car does a longish distance on different tyres and then each engineer and driver pairing makes the tyre choice for the race. In FIA races you start on the tyres you qualify on so it's an important decision. Weather conditions can come into this decision too in order to stay in the tyre windows.

'Qualifying is only for a short period and we only do a few laps – as the tyres start to go off after three laps. If the car is okay then we do one run and leave it at that. If it's not okay then we do another run, after making the appropriate adjustments.

'After qualifying, and on race morning, the mechanics do pit stop practice to cover all possible scenarios. Then there's tyre selection, marking up, warming before the race – this is a big, important job. The pressures are set cold and then the tyres are put in the oven to pre-warm one hour before the race.

'We debrief after every session, and the drivers fill out sheets, look at their data and so on. It's both a social gathering and also a busy and important meeting. From these we decide on set-up and strategy, although with 70kg (154lb) of fuel in an 1100kg (2425lb) car the weight difference is not a big deal. After the race, once the cars come out of parc ferme, we do some checks before packing up including measuring brake pad wear and clutch wear.

'There's a lot of formality in how we do things,' Ridgers said, 'for example the mechanics check temperatures and pressures every time a car comes into the pits – and that helps you to spot many potential problems. The system works very well. If you divert from it, chaos can reign. I learned this from my McLaren F1 GTR days – there are few people with tight methods...' And, of course, the unspoken end to this sentence was 'and they're the ones doing the winning.' RE

Ferrari 360 GT Modena

Chassis: Aluminium frame/monocoque, welded multi-point rollcage
Bodywork: Aluminium roof and rear arches, carbon outer panels, Kevlar inner arches
Aerodynamics: Original twin tunnel underbody, front splitter, rear single element wing
Suspension: Front and rear unequal length wishbones, anti-roll bars front and rear, Sachs four-way dampers
Brakes: Brembo six-piston calipers front, four-piston rear, Brembo steel ventilated discs, Performance Friction carbon metallic pads
Wheels: BBS one-piece cast alloy
Tyres: Dunlop
Transmission: Hewland NLT six-speed sequential, Salisbury-type limited slip differential
Engine: Ferrari, 3586cc, 90-degree V8, five valve per cylinder, bore 85mm stroke 79mm, four camshafts, 13:1 compression ratio, Bosch EMS, power 430bhp at 8500rpm, torque 275lb.ft at 4750rpm
Data acquisition: Magneti Marelli
Dimensions:

Overall length	4447mm
Overall width	1925mm
Wheelbase	2600mm
Front track	1739mm
Rear track	1617mm
Weight	1100kg

"THERE'S A LOT OF FORMALITY IN HOW THE TEAM DOES THINGS"