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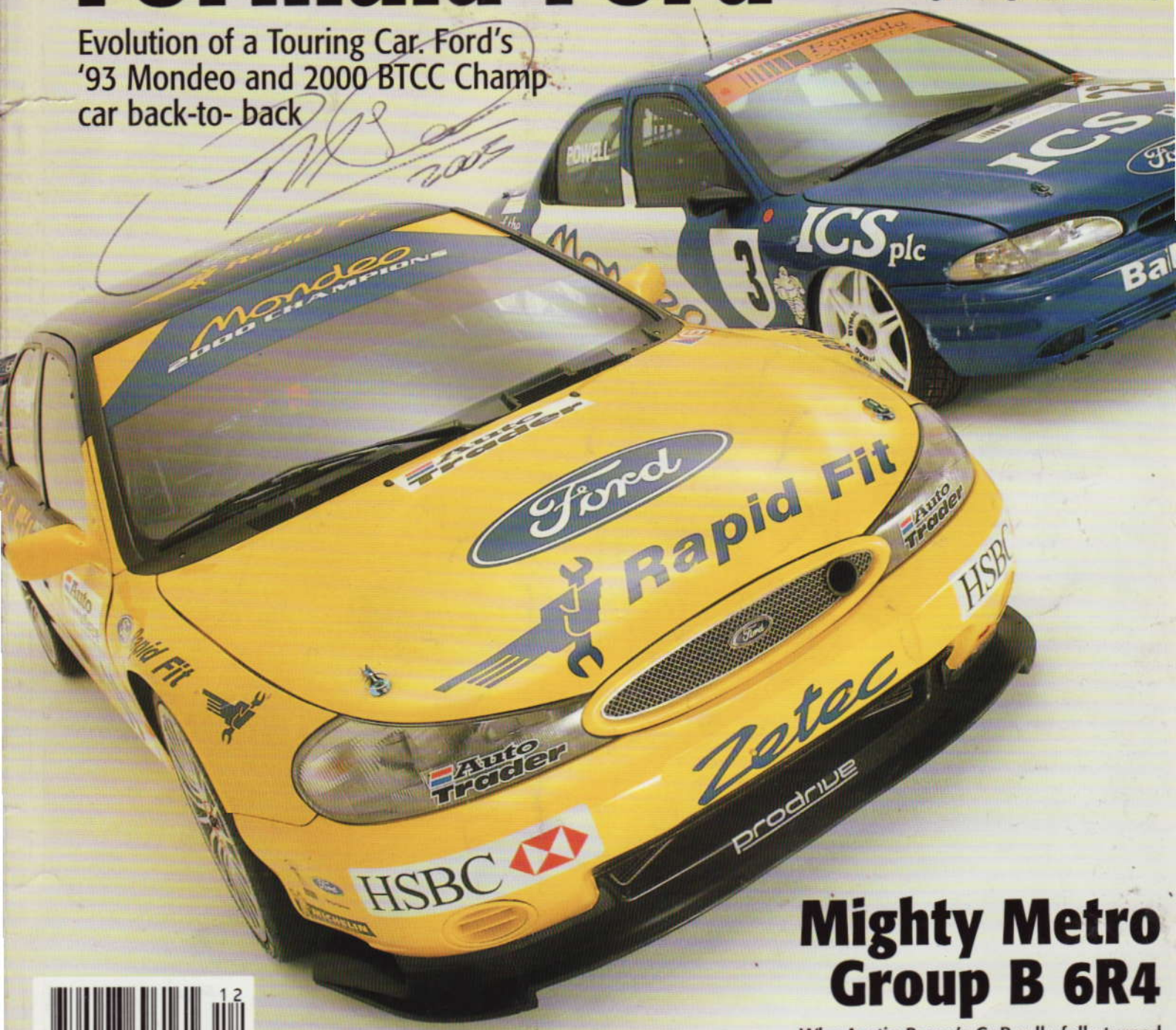

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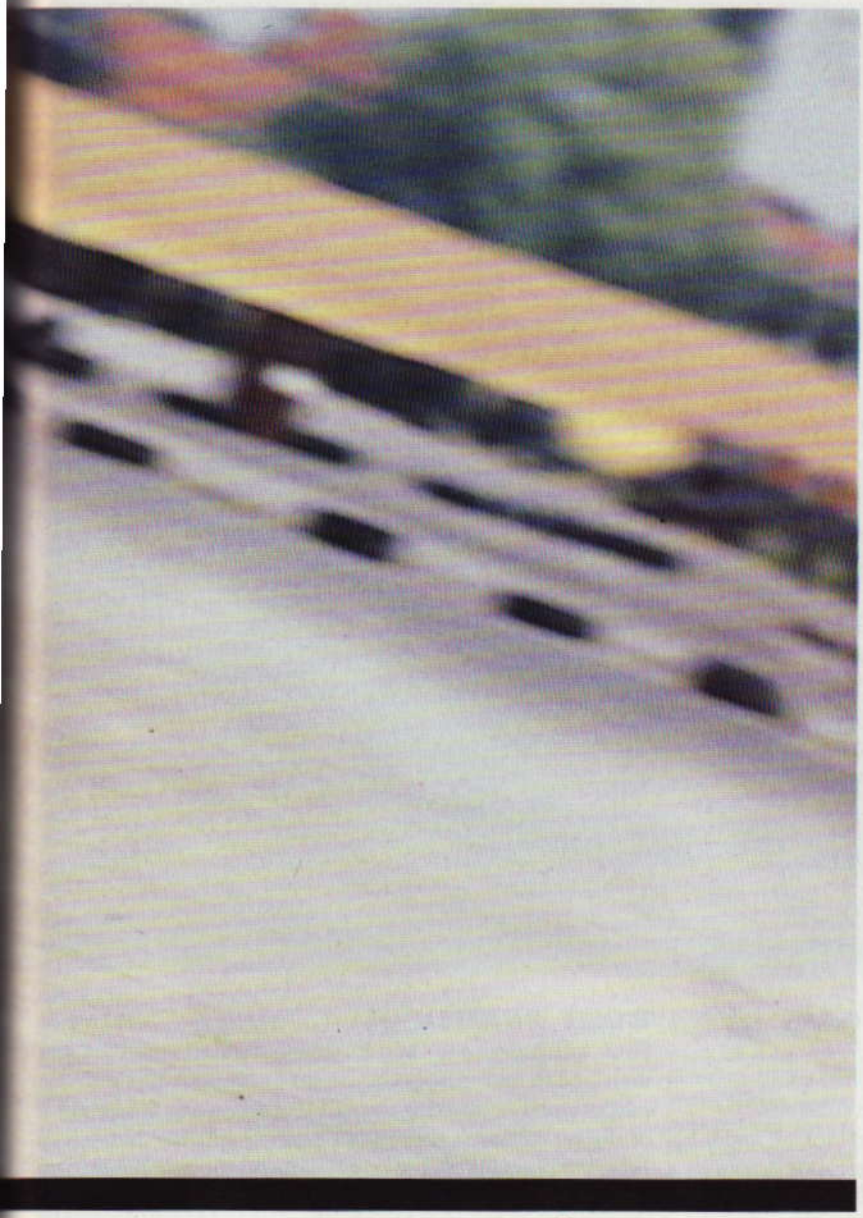
PHOTOGRAPHY - PAUL HARMER

KITTEN WITH ATTITUDE

CCC's **PETER KNIVETT** meets the best special we've seen in ages - a spaceframed Reliant Kitten tarmac rally car with a Kawasaki ZZR1100 bike engine in it. We kid you not...

When the Editor about this job, I had to catch my breath - a Reliant Kitten rally car? Had he got his wires crossed? Was it an early April Fool gag? No, it was no joke... Indeed, with the combined talents of David and Julie Plant of DJ Motorsport behind it, I realised that we were dealing with a serious one-off special. But why a Kitten? "We built it to prove a point when we're rallying" says the quiet vehicle engineer in a serious, but slightly mickey taking fashion, "to prove that it wasn't how much money you could spend



on a rally car but how well you engineered it."

Basically then, it comes from a desire to wind people up, those people who spend far too much money on rallycars and use them for single venue tarmac events that don't do the cars justice. The Plant master plan was simple - build a high performance tarmac car that relied on sound engineering and light weight rather than gobs of horsepower and four wheel drive. Oh, and do it in the most unlikely vehicle possible - a bike-engined Reliant Kitten sounded a good bet then.

The Plants tested their concepts on a road car at first, buying a 1980 Reliant Kitten before putting Spax suspension on it, new brakes and tyres and then installing a 165bhp Kawasaki ZZR1100 bike engine! Er, aside from being a completely mad thing to do, wasn't that a touch difficult to engineer?

Not so, says David. "It was just a case of making enough room to fit the motor and then making some form of drive to the back of the car to make sure it was legal with speedo's and those things on it. We also adapted a reverse gear set up as well. All the real hard R&D was done on that car, because if it was going to break on the heavier road car, it'd be okay on the rally version."

Kitten soft? Hardly, it may not look a bit silly but there's some serious engineering behind this pocket rocket.

Kawasaki didn't intend this sort of application for its engine, so for car use the engine is turned 90 degrees so that the gearbox sprocket faces the rear. From there David machined a sprocket to fit an output flange and mated it to suit a universal joint propshaft. Because of the confines of the car the propshaft couldn't run straight and low through a low transmission tunnel, so it had to run between the seats. Close proximity to a failed propshaft could be very dangerous, so David used a BTCC spec item with the biggest joints possible, to build in a large safety margin.

On the road car the power went through the original Reliant diff, because "I still had in my head that 'it's only a motorbike engine, it isn't going to be anything special' and of course you couldn't even set off in it, it'd just spin its wheels..." So the next step was to crudely weld the diff up, which did the trick! In this state the Plants began to realise the potential of the car as a serious rally weapon and also began to experience the benefits of bike power. "I realised how well balanced the car was, with the size of it, and nature of it, although the brakes were appaling!"

One unexpected side effect of the transplant was a weight gain, from 520 to 560 kilos. Even so, with 165bhp up front, the car was a fearsome device as David recalls - "Our friend has a Group N Sapphire Cosworth rally car and we picked a really awful day when it was streaming wet. He's got 380ftlb and 300bhp in a 1430 - 1450kg car and we wanted to compare the traction and the performance in a straight line - and the Kitten destroyed it!" The proof was in the pudding and so the next stage of the Plant budget flyer rally car design process began.

Initially this involved a rethink. "I always had it in my head that it would need to be sub-500 kilos in weight, because 350bhp per ton is what we wanted and that's basically what a really nice (Metro) 6R4 would show. So we sat down and planned exactly what we could take out of the car, which is where the idea for a spaceframe car came in, because it's the lightest, strongest way of producing a one-off design."

SPACED OUT

David is no stranger to the art of spaceframing, he's been designing partial spaceframes for about 5-6 years. But no rally car had ever been totally spaceframed to his knowledge, so before any metal was committed he got in touch with the MSA to see what its reaction would be.

"It doesn't actually mention spaceframing in the rally car section of the Blue Book," says David. "I wanted to work with the MSA and they said get it SVA'd (which is why it's on a V-registration) scruntineered and MOT'd. The only criteria that the car had to have was a reverse

Cat's whiskers: the Kitten proved solid and stable into corners, turning in on a sixpence.

gear which was obvious, and covers over the propshaft. So then we started building it."

David wanted to keep the look of the road going Reliant Kitten, rather than opting for the cut-down 'sprintline' effect. "I wanted it to be awful looking and in your face - obnoxious I suppose!" However, this design caused a problem that hadn't shown itself on the road car. "The biggest problem was that I couldn't fit the engine into the engine bay and get it behind the front wheels. The MSA stipulated that we had to sit in the cockpit between the A and the B pillar, whereas in the standard Kitten your feet stick out, like in an F1 car, but they wouldn't let me do that." Clearly a major rethink on the seating arrangement would be in order.

"The first thing we had to do was build a basic spaceframe with suspension on it, made from MSA approved CDS tube with a 50mm main hoop and 42mm lateral bars and everything else in 42mm steel." Leaving the engine mounts off the spaceframe so they could juggle the engine positioning about, they began on the glassfibre bodywork, which was a combination of the centre section of the Reliant shell and lightened doors, with Julie making all the mouldings on the front for the engine hump. David worked out an engine position within the restrictions.

"VISUALLY THIS CAR IS A BIT OF A PISS-TAKE, BUT MY GOD, PERFORMANCE WISE IT'S NO JOKE WHATSOEVER..."

BODY BEAUTIFUL

Even with a desire to keep it looking standard, the Plants managed to make the body sit a lot lower, looking more purposeful, by removing the sills that run along the length of the car. "There's four inches of depth missing that if I hadn't chopped it off it'd be scraping on the ground. So people look at it and they think it's so low, but it's still got good ground clearance!".

The next headache was to assemble the body on the car in as light a way as possible while trying to achieve some solidity. David managed this by fixing all the hinges and door latches onto the spaceframe and not to the glassfibre shell. To keep to the twin goals of rigidity and lightness Julie made the floor from two layers of 250g woven kevlar, with the intention of making the passenger side as big as possible for comfort. "It's very strong and we could have left the floor like that, but when the scrutineer came around he wanted to see some support under it, so it's got a criss-cross of support tubes underneath it, which is why it's so stiff," says David. More rigidity came from making the front and rear bulkheads from carbon-fibre, once they were in place, the car was really starting to take shape.

GEARED FOR SUCCESS

With the engine position decided upon, the rally car used a similar two piece propshaft to the road car, but mated to a Sierra Cosworth front diff which uses a Quaife ATB unit. From there power passes through modified Sierra Cosworth output flanges to billet alloy hubs. A 2.5 KW starter motor sits on a six inch gear between the rear of the diff and the propshaft "which was the easiest solution

to a reverse gear requirement," explains David. For ease and reliability the Kawasaki hydraulic clutch has been retained and has proved totally fuss-free.

Naturally, the gearing on a bike engine that's designed to rev to 12,000rpm would be wrong for a car, but David discovered that his wasn't going to be the headache he'd envisaged. "We looked into it a bit further and found that Kawasaki had step off geared it with a 1.6:1 ratio so you've only got two-thirds of the output revs, or about 8000rpm, which is a really good road car. So then I got quite excited because I realised I could use standard road car parts in the gearing, and we went for the Cossie stuff because with 10 years of working with the Cosworths we had an abundance of bits available."

The car is geared to do 48mph in first, 62mph in second and 132mph flat out in sixth gear. Although it sounds like a really tall first gear it doesn't struggle to set off because it's got a powerband from 2000rpm to 12,000rpm and makes 95lb/ft or torque or about the same as a standard Peugeot 205 GTI 1.9, so it's not short on grunt.

Getting the gear linkage right was very important and David wanted a column mounted shift, as used on the Focus WRC car. Initially this was a problem, but then a contact mentioned the possibility of using control cables, and David took the advice on board, using them in his linkage. This linkage now runs through the front bulkhead and curls around the engine, where it picks up off the original bike gearbox gearshift. It now works superbly and, according to a grinning David, "This is now one of the best traits on the car, because you can change gear even when you're cornering".

Purple maze: the safety cell in the Kitten is beefy, but the seating position caused some problems. The bike dash gives clues to the engine's heritage.

ROCKING, NOT ROLLING

David was determined that cornering should be one of the car's strong points, but with such a narrow track, that meant getting the centre of gravity as low as possible, because the road car used to excessive body roll. As the suspension units on a car are one of the heaviest components, mounting them as low as possible led David up a radical path towards a cantilever suspension design.

Er, so how did you design that from scratch, then? "The front suspension was finalised first because we'd already decided the engine position so we had a little path between the engine and the radiator where we were going to fit the cantilever units." With a desire to use standard, off the shelf parts where possible, David began to sketch out the rocker suspension around the parameters of the bodywork and wheel position. The end result looks fantastic and works around modified Chevette upright, and a redesigned Escort alloy hub and a tubular double wishbone set-up. Using fully adjustable AVO 2.25in coilovers, the rocker suspension works at a two to one ratio - so that for three inches of spring travel the car has six inches of wheel travel - ideal for a rally car. David has also engineered the suspension to act on a slight rising rate, so that it stiffens the further it compresses.

At the back David's designed a 'torsion box', which carries the differential plus acts as the suspension pick up point. David reckons that because the rear suspension has to work at a steeper angle it's actually a better design. And a deceptively simple one it is too, with a bottom arm, which is just a free moving arm, while the top wishbone is actually the cantilever arm, which links up to a 1.9 inch

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AVO adjustable coilover. This worked so well that the car has so much roll stiffness that it easily picks up a rear wheel in cornering, so a final modification was to fit a anti-roll bar, which cured the problem.

TWO WHEELED STOPPERS

Because the car was going to run 13in wheels, David wanted to use lightweight bike brake calipers, using

"WE'VE SEEN SOME SERIOUS ONE-OFF RALLY CARS THAT HAVE BEEN BEAUTIFULLY BUILT AND EXECUTED, BUT THIS CAR IS SOMETHING ELSE"

Escort discs on the Escort hubs. Fears of rapid wear meant that David wanted solid brake discs, but finding good quality items was a problem. "Eventually we managed to get Brembo to make some 240mm discs to suit the car - they hadn't made any like that for 20 years!" The calipers are Suzuki GSXR six pot alloy items, which generate so much stopping power that David designed the pedal box around a TAS bias pedal bar but with a brake pedal that runs a 4:1 leverage ratio. "Normally we'd run a 7:1 ratio on the leverage / pedal pressure, but if we did that on this car it'd lock up all the time." At the back of the car stopping power is provided by a set of four pot ZZR1100 bike calipers that clamp solid 235mm Mk1 fiesta front discs, while a homemade hydraulic handbrake that utilises a Girling master cylinder provides locking capability when it's needed.

Wheels proved a big problem. "What we didn't want on the car was 'Carlos Fandango' look wheels, because that gives it positive scrub. So Revolution Wheels made a special set of 13inch rims in a batch of 20 with an ET20 offset." On 621/13 Avon slicks and being steered through a MK2 Escort steering rack, the combination works perfectly.

PERFECT POSITIONING

With the MSA foot positioning rules the driving position was going to be difficult to sort. "And that probably took 15-20% of the total build time. But if it's not nice to drive then you won't drive it quickly, so it had to be right. So then came the headache of sorting my driving position, the gearshift, the pedals and the footrest." The car is beautifully finished with its bike-like carbon fibre instrument pod, Kevlar floor and, of course, standard Reliant steering wheel!

The back of the car houses a custom-made 6 gallon tank, and the car does 6mpg on a rally, so it's normally run half full. This

What's new pussycat? DJ's unique space-frame construction, David Plant says it's the lightest and strongest way of providing a one-off design.

was a compromise as David explains. "I went higher up with the tank than I'd like, but then I don't have to run a guard, which saves weight and it's still as low as the centre of gravity of the car."

The car has taken the Plants a year of ten hour weekends to build, so that's 500 hours work. And what they've ended up with is a car that weighs just 460kg, with 165bhp and a power to weight ratio of 350bhp per ton. It does 0-60mph in sub 4 seconds. It's also only cost them about £3500, including the £1000 on getting the wheels made, so it's a bit of a bargain. Okay, but how does it go?

INSIDE THE BUZZBOMB

Watching the little buzz-bomb screaming round Blyton showed how well it was working. Out of slow bends the traction was there, while over Blyton's bumps and kerbs the rocker suspension coped superbly with the worst that the surface could throw at it, allowing David to keep his foot nailed as the gears and the revs kept coming. Visually it's a piss-take, but my God, performance wise, it's no joke whatsoever. From inside it's even more impressive. Sitting low and cramped in the kevlar tub, there's a fair amount of heat soak from the big Kawasaki motor that sits up front. Then with a ring of the starter, a clunk into first and a burst of revs we're away in a flurry of gearchanges, endless revs, ferocious acceleration and virtually no wheelspin. Up to a corner the car feels solid and stable, and turns in on a sixpence, it's beautifully balanced. Through the fast chicane at Blyton (where even serious rallycars are lifting to scrabble through) the Plant foot remains planted as the tiny car shrugs off any direction change while no speed is scrubbed off whatsoever. Ye gods this thing is quick...

Over the years on CCC we've seen some serious one-off rally cars that have been beautifully built and executed, but this car is something else. As a mobile advert for the undoubted engineering skills of David and Julie Plant this cannot be bettered. Few people could conceptualise and build a one-off car to this standard, finish it so well and set it up to work on the stages so easily, with so many untried concepts that are new to the sport of rallying. That David and Julie have done it so brilliantly, that they have exploited a loop-hole in the rules to embarrass a good few rallying egos on the way makes the story even sweeter. So much so that the MSA may introduce a minimum weight limit for rallycars, which may render the DJM Kitten 'Too light to rally', and that's no joke..." ■

DJM RELIANT KITTEN

Body: Spaceframe CDS chassis using 50mm main hoop and 42mm structural tubing. Woven Kevlar floor pan with under floor cross bracing, carbon fibre bulkheads, modified Reliant Kitten bodywork and lightened Reliant Robin doors, perspex windows

Engine: DOHC 1052cc Kawasaki ZZR-1100 motor, with rejetted CV carbs with bellmouths, custom made K&N air filters and DJM 4-2-1 exhaust, Honda RC45 carbon-fibre silencer

Power: 165bhp

Torque: 95lbft

Transmission: Standard Kawasaki six-speed sequential gearbox, u/j BTCC spec propshaft, Sierra Cosworth diff, Sierra Cosworth output flanges, XR4x4 driveshafts, 2.5KW starter motor for reverse gear, standard hydrualic clutch, home-made column-mounted gearshift using control cable operation

Suspension: Fully rose-jointed and adjustable cantilever suspension using a tubular double wishbone set-up front and rear. Front uses modified Chevette alloy hubs, Mk2 Escort uprights, adjustable AVO 2.25 in front coilover dampers, 1.9 inch rear dampers. Rear uses 'torsion box' set up with lower arm

Chassis: Mk2 Escort steering rack

Brakes: Brembo solid 240mm Mk2 Escort front discs, using Suzuki GSXR six-pot alloy calipers running carbon-metallic pads. 235 mm rear Mk1 Fiesta discs using ZZR 1100 rear 4 pot calipers, home made pedal box using TAS bias bar, hydraulic handbrake using Girling master cylinder

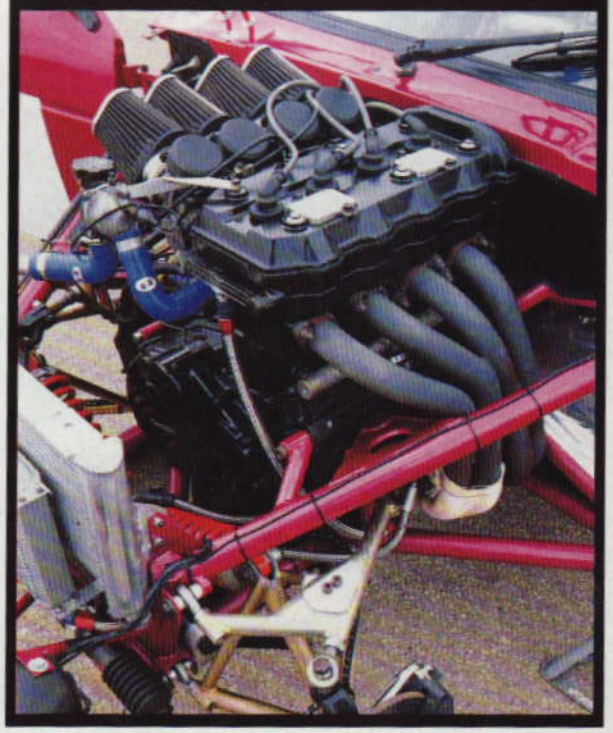
Wheels: One-off batch of 5 x 13inch Revolution rims using an ET20 offset.

Tyres: Avon slicks and wets 631 / 13

Interior: Carbon fibre dashboard binacle housing SPA tacho, plus oil pressure and temp, water temp and voltage gauges, lightweight wiring loom and aircraft fuses, Motordrive seats, Sabelt 4 point harnesses, upright handbrake lever, standard Reliant Kitten steering wheel!

Weight: 460kg

Performance: 0-60mph under 4 seconds, 132mph flat out



Atomic Kitten: 1052cc Kawasaki ZZR mated to an ultra-light body gives rocketship performance.