WORDS: ROOTSY IMAGES: GARETH HARFORD

MOTO MK

Honda isn't the only manufacturer making a MotoGP bike that you can buy. Using MotoGP regs as a guideline, a precision engineering company based in Milton Keynes has made its very own racer for discerning customers with a few quid to spend. Well, it's made two actually...

With Red Bull's Formula 1 team based in the town, Silverstone just down the road, and all manner of high-tech race suppliers making bits hewn from unobtanium based in and around Milton Keynes, I wasn't surprised to learn of a MotoGP-based weapon being assembled in the Buckinghamshire new town. But instead of directing me to some lavish HQ with marble floors, shining worktops and frothy coffee on tap, the BMW S 1000 XR's sat nav pointed me towards a common or garden unit nestled between a car servicing unit and a steel fabricators just on the edge of town. Think Pagnell rather than Panigale...

After double-checking the Beemer's Garmin, I noted that above the door is a sign for Reynolds Engineering. Seeing as I was

here to see Dean Reynolds, the creator of the DR Moto machine I was here to drool over, I made a calculated guess and strode in to say hello.Turns out the sat-nav was right...

Alright, so the unit is absent of marble floors, shining worktops and Eritrean coffee, but in their place is a smiling welcome, impressive looking CNC machines and a kettle primed and ready for action. So after introductions, a cup of splosh and a choccy biscuit I started to learn what it takes to build a MotoGP bike from scratch, zilch, nothing.

This venture hasn't come from thin air, Reynolds has previous when it comes to precision parts. "We started the business initially to do repetition turning – big batches of parts. When we got into the milling side of things one particular customer was doing a lot of work for Stewart Grand Prix, what turned into Jaguar F1, and we ended up doing a few bits for them. Then that built up until we did

PIMP MY RIDE

Dean's relatively humble riding CV doesn't hint of the madness he's since created with the DR Moto machine.

"I did a bit of classic racing in the late Eighties and early Nineties, then after that I got into trackdays. I bought an early R6 and went out on that a lot, but I got to the stage where it was going to end in tears on track as it was my everyday bike too. So I decided to sell it and bought a race SP-1. Never got on with it. It felt like it was going to kill me because it had so much torque. The back came round on me a few times and it felt like it was really long. So I bought a 2000 model R1, a track bike, and I never felt comfortable on a litre bike either. I'd got used to the lean angle and corner speed you can run on a 600 – and this doesn't work on a bigger bike. I kept on running out of tyre. That's when I ended up with the GSX-R750. It's 600 sized with a nice bit of extra power. I've had that seven or eight years now, it's a fantastic bike with a bike of suspension work, I've got a Phil Seton head, so it pumps out 143bhp. Then I built this. I admit it's not the most obvious next step...

lots more work, then we got involved with BAR Honda in Brackley, and we were suddenly doing nearly all Formula 1 work."

In Motorsports Valley this isn't an uncommon tale, nor was the move into bikes, "I really wanted to work with motorbikes," says Reynolds, "so after a phone round we got hold of Chuck Aksland from Team Roberts when they were at Banbury, and we started doing some work for them. It was much more interesting than F1, but 80 per cent of our business was with Honda there. Then Honda decided to go home, and that left us in the shit. I'd just spent £100k on a new machine, and had to let seven out of the ten working here go." Not a happy time...

Reynolds managed to keep the business afloat, and continued to work with the Kenny Roberts team making, in Reynolds' words, "All the dangly bits." This meant things like rearsets, fuel fillers, yokes and spindles. But when Kenny Roberts packed it all in another wave of uncertainty followed. Fortunately, Roberts' chief designer, Barry Ward, was kept on to look after the fabricating side of the business, which mainly revolved around swingarms and a few frames for some 125cc teams. When Roberts pulled out completely, Ward filled the void with his GPMS Technology company – with Reynolds making the metal components.

"We do about 90 per cent of machining work for Barry. He produces anything from 8 to 15 billet swingarms a year for the likes of Ten Kate and Paul Bird. So I was machining these panels up, and loving it, and I thought that I'd really fancy one on my own bike." I bet you can guess where Reynolds is taking us. "So I got talking to Barry about how much he'd charge to design me a whole chassis. He put some figures together and we talked to a few suppliers, and I thought it was a good way to channel money back into the business, an investment. I'd get something out of it too."

So with the decision made to begin the project, another big choice had to be made; the engine. "We had to choose an engine before we started, and the frame obviously only fits this motor. We chose the Yamaha R1 motor for the big bang aspect of the M1 GP bike. We bought one, got it laser scanned to produce a solid (CAD) model of the engine and airbox and exhaust. We were into several thousand pounds just to get the scanning done. Barry then got on with wrapping the frame round the engine." Dean wanted to use the Yamaha M1 as the inspiration of the style of the bike too, and you can clearly see the influence of that machine in the DR Moto bike. It's a very handsome weapon.

As you'd expect, designing a bike isn't a back of the fag paper project. "Barry does a lot of FEA testing, and the design side is really time consuming because the software has to crunch lots of numbers," says Reynolds. "It takes hours to run an analysis for a chassis, and if anything doesn't stack up then you have to tweak the design and run it again."

With regards to the chassis numbers, this was Ward's meat and drink. "Barry had made hundreds of swinging arms, so he knew all about stiffness characteristics. For the frame, once you've wrapped it round the engine you've got to make the stiffness figures work and that's a long process. Regarding the chassis, the geometry is multi-adjustable. There are insets for the yokes and headstock so you can move the effective headstock back and forwards, and you can change the angle of it both ways. It's plus or minus 3mm everywhere. The swinging arm pivot goes up and down and is also adjustable for stiffness via inserts that can stiffen it laterally and torsionally, independent of each other."

The choice of motor, however, presented some problems. "It's quite a wide engine, and it's lopsided too. One problem was we wanted a symmetrical frame, which gave us an advantage because we didn't want any air exits in the fairing, and one side has got a good flow, so there are no overheating problems. The engine hangers come out from the main spars a long way and that gave us problems on the FEA, so we had to fit a cross tube to strengthen it. It's only quite thin, and in stainless, but it was enough to give us the

The flow to the airbox can even be altered...

The fuel tank mostly resides under the seat

Top spec electronics and dash – as standard!

Utterly jaw dropping

A RACER'S VIEW

Joe Burns – Currently running in British superstock, Joe (Chris's brother) was one of the first to sample the DR Moto machine

"Before even leaving Valencia's pit lane I could feel the smoothness of the motor. I wound the power on and there were no hesitations like some high powered engines I've tested, but then the first time coming onto the start/finish straight I gave it full throttle - and JESUS! I've never felt anything like it, absolutely phenomenal acceleration. I'm well used to 200bhp-plus superbikes, but the power of the DR Moto still shocked me!

"Over the three days, as I got more used to the bike, Dean (Reynolds) removed the swingarm flex adjusters to see what difference could be felt. Instantly, there was a less harsh feel through the rear, and what I felt was more edge grip and corner exit grip which worked well at Valencia, but obviously could be adjusted depending on the circuit.

"The DR Moto, by a million miles has smoothest and most positive chassis, the strongest engine, the best electronics package, and the nicest riding position of any bike I've ever swung my leg over."

right figures and stiffness."

But when Barry and Dean got the gig to make Paul Bird's MotoGP chassis in just three months at the end of 2012 it comes as no surprise to learn that Dean's project was put on the back burner for a while. "A lot of midnight oil was spent on Paul Bird's bikes, but it was worth it because it was a beautiful chassis. Because of the slim engine (the Aprilia V4 motor) it could be designed without compromise, it was very neat. Once that was over, we started up again. We got the bodywork designed with another guy that used to work at Roberts, but who now works at PES Performance, an engineering design company in Sheffield. While that was being done we were busy machining all the parts."

Once all machined and made, the onerous task of fitting it all together laid in wait. The build, however, was a breeze according to Reynolds. "When it came to building the bike, it just fitted. An idiot could put it together, really. Everything has a drawing and a model. The headnut, for example, Barry designed the nut, but then also the tool to do it up with. There were so many little things like that. Every edge is radiused, there are no burrs, it just comes out of the machine ready to go on the bike. Even the bolts, Barry did a complete bolt list for us, to the extent where the magnesium yokes have M7 bolts in. We weren't happy with the strength of M6 bolts and M8 ones are too bulky, so we had to find M7 bolts and helicoils for it. Everything has been thought of."

It's a credit to the bike that it comes together as a whole, you don't just focus on the beautiful frame. Only when you study it closely, or see the component parts, do you start to appreciate that this was once a lump of metal – and a big bit, too. "An 80 kilo billet of aluminium is used for one part of one side of the frame. So it's 160 kilos for one frame spar. Now one of the parts weighs around three quarters of a kilo – and some more weight has to come out of it through post weld machining. An 80 kilo block of billet is around £250 a block, so you're looking at £1,000 for the chassis in raw materials for, just the spars. From the swarf we recycle you could probably buy a meal out. Anyway, they slot together easily and the weld is run down it. We have a bloke called Pete Brown welding it up, he used to do all of Barry's stuff at the

The BSB lump is good for well over 200bhp

One hell of a stunning swingarm

The best combo in the business...

MOUTHING OFF
The bell mouths we've had rapid prototyped from the factory carbon units.

WEIGHING IT UP
We've weighed at 160kg, with the carbon discs and a gallon of fuel in. There's now a kilo of paint on it, it's surprising how heavy paint is.

INSERT HERE
I'll admit to being a bit sceptical about the swinging arm inserts, but you can tell the difference. They're only on or off, and I could feel the difference when we took them off. And I was surprised at that.

BOUGHT IN
"The only parts we haven't designed and made are the front and rear hugger and the bars and levers from Renthal. The front hugger is from Paul Bird's MotoGP project and the rear one we got off MSS Kawasaki. They're not perfect, but it would cost me £1,500 to make a mould to get a few produced, and that was a step too far."

EXHAUSTING WORK
The headers are factory Yamaha, so Akropovic I think. But we had to get a link pipe altered because the R1 was an underseat design, so we redesigned it. CoBuilt is Jeff Kane, he was in F1 before, but now works out of the same unit as Barry, so he does a lot of work for the likes of Paul Bird. It's all in titanium. The new one is from one of FTRs Moto2 bikes after I saw one and fancied it. It's properly loud, but in a nice way. I've addressed the noise situation, and we've got an exhaust that gets us down to 105Db. It doesn't look as pretty, but it does the job.

FUEL FOR THOUGHT
The tank holds 17.5 litres, which was a discussion point. At the time the ruling in MotoGP was higher, but we didn't want to spend masses of money making it MotoGP compliant unless someone was there giving us money to take one racing. So it ended up being a simple shape, rather than filling in space everywhere. Originally we had to take the seat unit off the fuel it, but we've changed that now with a hole cut in the seat unit to fill it.

time. The swingarm is 5.2 kilos. The cross hatched finish is there so it doesn't scratch up. It's a bit of a talking point, and that's once instance where we disagreed because Barry didn't like it because it's not necessary!"

At some point, you have to get your credit card out and make a few expensive phone calls to people in Sweden and Italy. "The ancillary decisions were made early. We went with what they were using in CRT at the time, so the forks and shock were direct from Öhlins in Sweden, built by the race department. The first set were £11,500 for the forks and shock, then a bit less for the second bike because the exchange rate was better. The shock was a challenge to package it neatly. With Öhlins you get a choice of different head styles, so we chose one to suit out of their range. The Brembo calipers are billet machined, not the forged ones, also Moto GP spec. We tried Freno Carbon brakes early. They were ceramic coated carbon discs, beautifully light, the steel discs are a kilo heavier, but they just didn't work. They juddered when they got hot so we had to send them back. Wheels are Marchesini, 16.5" on the first bike, but we'll move to 17" on the second because I've exhausted all the 16.5" BSB tyres going."

Not everything is from abroad, however, and the DR Moto aptly demonstrates the skills on offer in this country. "The radiator comes from Pace Products in Suffolk, all to Barry's design. There's nothing you can do, you can't find something to fit a unique bike. We designed the chassis, so we've got to supply radiator designs that are millimetre perfect to the fairing. So we sent Pace the models and drawings and they came up with this. The carbon was done by a company called KS Composites. I paid over £20k for the patterns and moulds, which was cheap as it happens. They did a great job. They did the moulds and made the fairings under the same roof. To keep costs down some of the patterns were made out of MDF instead of the usual epoxy resin. Usually a mould would be made out of carbon, then you mould the mould over the pattern. But that's expensive, so we've got a carbon mould for the tank/seat unit as it has to fit so closely, then the others are fibreglass moulds off MDF patterns, there is no compromise in the quality of panel but you can't produce as many panels before the mould wears out. A set of carbon fibre bodywork for the bikes is about £3,200."

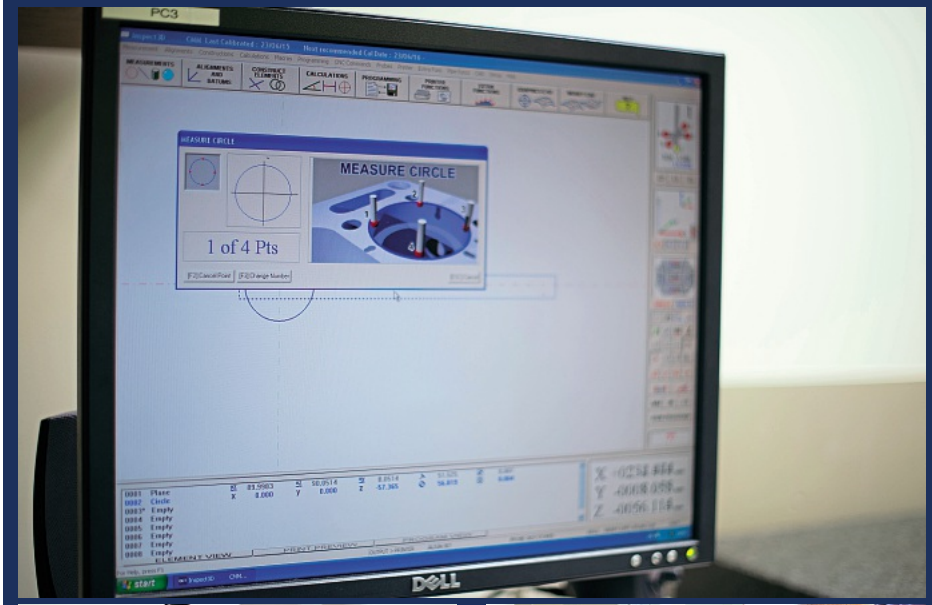
As for the engine, it's not as simple as phoning up Yamaha for a motor. "We found out that you can't buy new Yamaha engines. Rob Mac finished up his team just as the BSB

WINGING IT
There's a wing in the headstock that can be changed to suit air flow characteristics.

AIRING DEBATE
We spent hours debating the shape of the air intake. You don't realise the amount of time that goes into it. When we got what we wanted from the front it didn't look right form the side. Barry and I are very like-minded, we like clean lines, we don't like anything unnecessary.

Evo rules came in. He had factory support, and we got an engine from him. It was a full FIM spec motor, so titanium rods, two ring pistons, factory cams, factory bell mouths, lots of money spent on a Cosworth lightened crank and balance shaft. Everything is special on the motor. The loom is from the same bike, so it was a BSB loom so a fully enabled Motec M800 system with TC, launch control, wheelie control, pitlane limiter, all of that."

These spec engines don't grow on trees, but Reynolds has still sourced something pretty special for his second bike that is close to being finished. "New rules came in, so the special parts stopped. So for the first customer bike we've got a fully refreshed engine from Sean Muir out of last year's BSB bike. That's got everything done to it to current Evo rules, which makes it a bit more user friendly. I'm told there was £3,500 worth of head work on



CLOCKWISE FROM TOP: Barry Ward, Kenny Roberts' ex-designer, supplied all the CAD work for Reynolds to then manufacture using his weapons-grade CNC machines. The precision of the parts is a thing of wonder, no surprise it all fitted like a glove. Before being machined, you would have been looking at 160kg of aluminium that went into making the frame spars. It's a bit less now! The bits for the third bike knocked up already The fuel tank and swingarm are both true works of art, it's a shame the tank has to hidden, but the swingarm can be shown off to all!

The room on board the DR Moto is impressive indeed

The business continues in the background...

it. Horsepower-wise, I'm told it's got 215bhp, but that all depends on what dyno you use. Electronics-wise, everything's been designed for that bike, so it uses a Motec M130 ECU, which is expandable to the number one bike spec and beyond. It's a lot lighter too, and all the functions are controlled by the one unit. But it's in basic form, but can be upgraded depending on what the customer wants. Andrew Brook at Mototronics, who does a lot of the BSB paddock, has done the loom and we've learned a lot on the first bike to make the electronics a more elegant package."

So that's how you go about building your own MotoGP bike. Dean completed the first one, razzed it round a select few European tracks, and satisfied a personal desire to see the bike finished. But the DR Moto is about more than building the one bike, it's about offering it to a discerning group of riders who want to have that GP experience on tap. Reynolds admits that the initial hope was that someone at the end of the phone would offer him the chance to take it to the MotoGP party, but soon discovered it's not as simple as that. "After speaking to a few people in the game, like Steve Bones who was at FTR, I got an idea of the politics in MotoGP. None of the teams want to pay anything and we'd have to give away frames to people, and we didn't want to get into that. But from the start we wanted to make something that the better off man in the street could buy and be ready to go on MotoGP grid. No-one else has done that. OK you can buy a second hand MotoGP bike, but they're either really well used or impossible to run." Whereas this is a bike with a proven engine, the chassis has real pedigree, plus there are neat options like starting it on the button, something your ex-racer MotoGP bikes can't do.

Time to fire her up. And what a noise it makes!

The first bike proved it could be done, the second one that's nearly finished proves that the first was no fluke. It's not been sold yet, but Reynolds is confident that there's a market out there, "The bike is underpriced at £90K (plus VAT) but the philosophy is to get one out there to show what it can do. Quite a few people have told me it's too cheap. I get all the comments that 'my R1 has 200bhp or my GSX-R cost me eight grand', but these people aren't my market, the DR-Moto is in a whole different league. More like what's on the current MotoGP grid than theirs."

What might speed up sales is an appearance at the 2016 TT. Gary Johnson was at the bike's debut trackday, and Reynolds approached the Lincs lad to have a shot on it. Johnson reckons that in its current state it's good for a 128mph lap before any tinkering prised more speed from it. That's some prospect, and another competitive outlet for the bike – other than MotoGP.

And the bikes need to be sold. "It's been a big investment. We have to sell a couple of bikes to break even and I'd like to do more than that. We didn't go into it with not selling any being an option. I've enjoyed doing it, and enjoyed riding it. It would be nice to get the money in to develop the project further. If we can get enough sponsorship to get it to the TT next year, we'll probably be struggling to keep up with demand."

But there's no mournful introspective thinking here, and as our snapper asks the bike to be moved, Reynolds catches the bike at another angle and an, "Oh, look at that," spills from his lips. When he fires it up, another schoolboy smile grows large on his face, as does the prospect of running it at Mugello in a few weeks time. "There's nothing I would change with it, it's my vision of what I wanted," when asked about the satisfaction he's gained from the project.

And this is a bike that has the potential to infect another with that enthusiasm and pride. Yes, there's a £90,000 barrier to get over first, but once you're over the not so inconsequential hurdle, you'll be all set to head to Silverstone for MotoGP next year. Not to watch, but to race…

"WANT ONE?

Head to www.dr-moto.co.uk where you can find out where to deposit the £89,500 (plus vat) asking price! Otherwise check out the site for more drool-worthy info!"

MY FIRST TIME: THE DR MOTO RIDDEN

Once you've built it, you've got to test it... Dean Reynolds talks about that magical moment.

"It was interesting in that it wasn't an anti-climax, but I was expecting us to be tinkering and setting up, but it wasn't like that. Other than the carbon brakes, that we changed, we didn't make a single adjustment. We started it and rode it.

"Nothing came loose, nothing needed adjusting, no click of preload, nothing. That's a testament to the design. It was fantastic. We were at Cartagena, which is nadgery at the best of times. The guy who did the electronics came out with us, he built the engine at Rob Mac's, and drove the laptop for us in Spain. He told me about the gearing I needed, and we had to go up three teeth on the rear sprocket. That pushed the spindle forward and it just reared up out of every corner. So after the second session I asked Ian about the wheelies because it was just ridiculous, so Ian looked at the numbers and I was nowhere near 100 per cent throttle. I'd only opened it up to 83 per cent..."