NO COMPROMISE

Built in Britain as a showcase for Reynolds Engineering, their DR Moto R1 is the closest thing to an off-the-shelf GP bike you can buy. It takes money, talent, skill, experience... but most of all a refusal to accept second best

Words Jon Urry / Photography: Paul Bryant

I WANTED TO make something that is totally cutting edge, something that could compete in MotoGP.' And the bike Dean Reynolds has created, the DR Moto, really would not look out of place on a MotoGP grid. This is no shed-built R1 special, this one-off R1-powered prototype is designed and built based on years of experience in MotoGP and F1.

As you walk round the DR Moto, your eye is drawn to glorious detail after detail. There are top-line MotoGP-spec parts from the usual suspects – Ohlins, Brembo and Marchesini – but it's what they hang off that's the star of the show. Painstakingly designed and lovingly crafted, the chassis is a stunning piece of engineering. Each section has been meticulously machined before being expertly fabricated into the finished chassis parts. The attention to detail even extends to the milled finish on the otherwise flat surface of the machined alloy parts. The deep beam frame wraps itself round a gasflowed and blueprinted ex-British Superbike R1 crossplane motor. Draped around the chassis and engine is a one-off Moto2-styled and deeply lacquered carbon fibre fairing with an aggressive snout and sharp-edged blue, red and white stripes leaving you in no doubt where this bike has been created (no, not France).

'We've been working on high-end bike stuff for years now, building parts as well as complete items for Kenny Roberts' MotoGP team when they were based in the UK. Then, about five years ago, we started machining the panels for entire swingarms from solid aluminium, which got me thinking. I'm a machinist, I love creating parts, and building my own bike seemed like a good idea for no other reason than I could and it would be an interesting project.'

Reynolds Engineering's base is a fairly nondescript unit on an industrial park in Milton Keynes. And when you open the shutter door you are presented with an array of state-of-the-art CNC machines, all gently whirring as they turn blocks of solid aluminium into precisely hewn components. This is F1-standard craftsmanship – Reynolds include several F1 teams among their clientele. It's a big money game, though.

'I commissioned Barry Ward [ex-Kenny Roberts] to design the chassis for me and it isn't just sketched out on a sheet of paper, it is based around all the knowledge that Kenny's team learned from their years in MotoGP,' explains Dean. Before Dean got too far into the project, he had to decide what engine he wanted to use, which didn't take long. 'I wanted to use an R1 engine as the crossplane is the closest relation to a MotoGP engine you can buy. After getting the motor we got it laser scanned so that we could create a computer-generated model, which Barry used to model the frame.'

They then used finite element analysis to ensure the chassis would perform on track. This is a rigorous and bloody clever computer program that can replicate the stresses and forces that act upon a chassis. 'It involves a lot of trial and error,' says Dean. 'We spent nearly £40,000 on the design alone, before we'd machined a single piece of alloy. But MotoGP costs...'

REYNOLDS ENGINEERING...

The company was set up by Dean Reynolds in 1993. It specialises in high-end precision machining and has done prototype work for most of the UK-based F1 teams. Reynolds has also machined parts for the Ilmor MotoGP project as well as Paul Bird Motorsport in MotoGP and BSB and Ten Kate Honda in WSB.
www.dr-moto.co.uk

➤ Underneath the black finish is a magnesium top yoke, machined by Dean himself. Ohlins forks are MotoGP CRT spec

▼ MotoGP-spec Brembo four-pad monoblocks are £3000 pair (but there's still a higher-spec lithium alloy caliper available)

▼ With an exit hole the size of that, it is no surprise the Co-Built can trips noise meters. Dean does have a quieter can for trackdays, though

◄ Dean's company Reynolds Engineering take computer-generated models and machine them into alloy works of art

▼ Having been retired from BSB duties, the heavily tuned crossplane R1 engine finds a new lease of life in the DR Moto

▼ Carbon seat unit is modelled on a Moto2 bike design and sits on a machined alloy subframe

➤ The carbon tank cover is a dummy and literally keeps the lid on a huge airbox

➤ Tank is located between the rider's legs and drops down to sit alongside the rear shock

▼ On the left is a solid lump of alloy, on the right is what it looks like after Dean's been at it, a finished top yoke

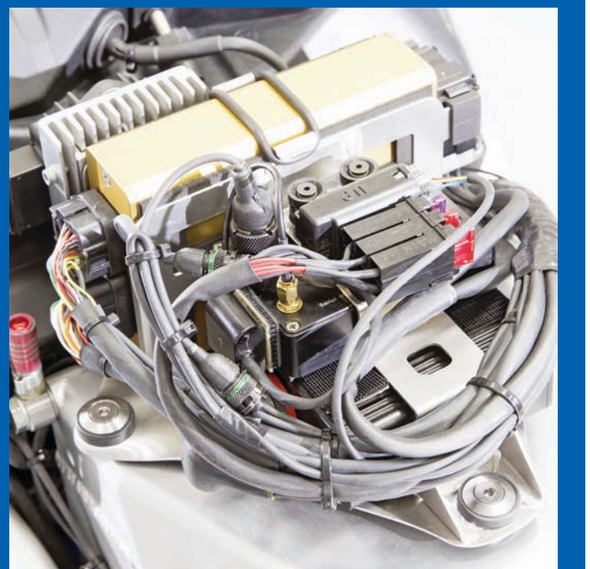
➤ MoTeC ADL2 dash works as datalogger and controller. It works in conjunction with the ECU and sensors to control traction, fly-by-wire, auto-blipping for clutchless downshifts. Big red button is fault warning light and shift light in one

▼ Each 175mm x 330mm x 530mm block of alloy weighs 82kg. It takes half a tonne of the stuff to create one single frame and swingarm weighing a mere 15kg

▼ If you're building an entire chassis from scratch, knocking out a pair of rearsets holds no fear

▲ Air is fed into the airbox through the headstock where air pressure is highest

▼ More advanced electronics than on current BSB bikes. Just swap this unit to be fully MotoGP legal



▲ Reynolds have done work for Ten Kate; this is one of Johnny Rea's old swingarms

➤ Fuel tank is a combination of cast and sheet aluminium

Thanks to the data Barry had gathered during his time with Team Roberts, Dean was confident the chassis design would work and potentially be able to compete in MotoGP. Time to get to work, then.

'The first components we built were, bizarrely, small items such as spindles, spacers and brackets,' says Dean. 'Then we started on the swingarms. We built three complete swingarms well before the chassis. Once you've got the finalised design programmed into the CNC machine, it is a relatively simple process for us to run off another the part. The chassis is built from four large blocks of 5083 type-0 aluminium alloy, which weigh 80kg each, plus extra for the headstock, uprights and cross tubes. So, from around 500kg of alloy we end up with 15kg of finished chassis and swingarm parts. There is a lot of recycling in our business.'

It takes over 65 hours to machine the pieces for the swingarm alone, and the frame takes even longer. Once all the parts are ready the chassis is put in a jig and welded together, a process that surprisingly only takes a single day. That said, fabricating parts by welding may very soon be obsolete. While welding is the current norm, F1 is starting to use glue rather than weld to avoid any chances of heat distortion in the metal, which would make the component less accurate and weaken it.

'Building the DR Moto was just an extension of what we were already doing,' says Dean. 'It is a showcase of our talents and takes us in a slightly different direction. The plan is to make five DR Motos, each one with a £89,500 price tag. There is easily over £120,000 of time, materials and development in the first complete bike. Any bike would be built from scratch and I'd say would take around six months to complete. We currently have a complete rolling chassis for bike number two and the chassis for number three is currently being machined.'

And what about Dean's dreams of MotoGP? 'I have always secretly hoped that a CRT, or Open Class, team would approach me and ask to use the bike. However, I have been doing a lot of trackdays recently and some of the kit people turn up on blows your mind – Moto2 bikes, race bikes, the works. People will go and buy a Panigale and then blow another £20,000 on top of that for bolt-on bits. So I see there being a potential market for high-end trackday bikes. If you go to a Ferrari trackday you see drivers belting around in a quarter of a million pound car. Those people get a kick out of owning something that is very technologically advanced and a proper race machine. If we can grab their attention, I could see the DR Moto being very appealing.'

With all the design and hours of work that have gone into creating the bike, wouldn't it be heartbreaking for Dean to see his bike on a trackday mixing it with road bikes rather than battling it out in MotoGP?

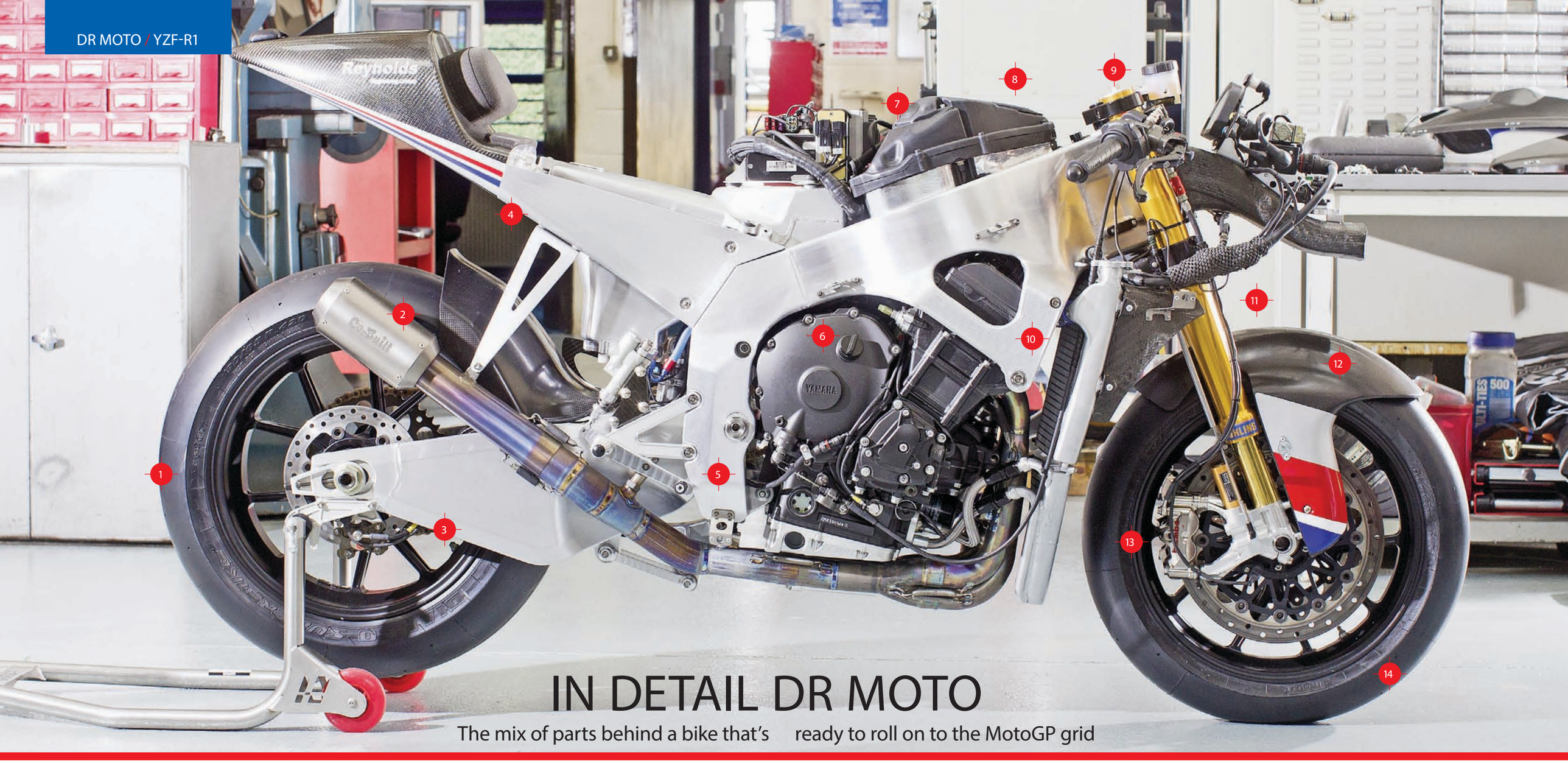
'While I'd love to see the DR Moto race as a wildcard in MotoGP, I am not going to supply it to a team for free and that probably means it won't ever be raced competitively. That said, if someone had the financial backing, all that would need to be altered to make it Open Class are its tyres and ECU.'

SO WHAT'S SO GOOD ABOUT A MACHINED ALLOY CHASSIS?

'THE R1 HAS a cast frame, which is made in sections before being welded together. Our frame is also welded together, but the sections are machined from solid alloy, rather than cast. The problem with casting is that you can't accurately control the thickness of sections. When we machine frame sections we can vary the thickness of panels by fractions of millimetres at any point, altering the rigidity based one our FEA testing. With such control we can optimise the torsional and lateral flex of the frame. At the very top level nowadays teams insist on swingarms that have lateral and torsional adjustability, allowing teams to vary their stiffness to suit rider and circuit demands.

'I've not worked with carbon fibre much, but the issue Ducati had with their monocoque MotoGP chassis was the fact you can't alter the carbon's stiffness, it's a fixed product. Also, carbon is rigid and I believe this internal resilience makes it far less predictable than aluminium alloy. That then creates a resonance through the frame, which in turn creates chatter. All of the MotoGP teams use machined aluminium chassis. Even Moto2 teams, who have free run with their chassis, also use the same design. Much of this is due to the fact that the majority of data collected by teams revolves around this design of chassis, which is why teams are unwilling to try something different. In racing you don't have the time or luxury to experiment as sponsors demand success, which is why Ducati abandoned their carbon monocoque and reverted to an aluminium alloy chassis.'

DEAN REYNOLDS FOUNDER OF REYNOLDS ENGINEERING



IN DETAIL DR MOTO

The mix of parts behind a bike that's ready to roll on to the MotoGP grid

1 WHEELS & TYRES

The Marchesini forged magnesium wheels cost £2400 a set and are 16.5in diameter and run Pirelli Supercorsa slicks. WSB and BSB now run 17in wheels, but the DR Moto uses pre-17in BSB tyres. This has also helped with the set-up of the electronics package. As the engine and electronics are old pre-Evo BSB-spec, traction control data exists for tracks in the UK. MotoGP teams also run 16.5in wheels, but you can't buy a pair of MotoGP-spec Bridgestone tyres off the shelf or gain access to their electronic data.

2 EXHAUST

Factory Yamaha titanium headers meet Dean's own design of link pipe with a Co-Built end can. Dean also has a quieter end can for trackdays that have particularly strict noise restrictions.

3 SWINGARM

Ten machined alloy sections make up the 5kg swingarm. There is no sheet metal, just CNC-machined 5083 type-0 aluminium alloy. The axle is S99 aircraft-grade stainless steel.

4 SUBFRAME

Self-supporting unit is machined from four pieces of aluminium alloy.

5 CHASSIS

The chassis is constructed from ten pieces of solid alloy that have been machined into individual sections, then welded together. The whole chassis weighs approximately 10kg.

6 ENGINE

The motor is taken from a 2010 BSB-spec YZF-R1 and was originally run by Rob McElnea's Yamaha team. The engine contains Pankl conrods that are 4mm longer than standard and two-ring pistons with a lower crown height. The crank and balance shaft are balanced by Cosworth to suit the new rods and pistons, while the entire engine is blueprinted and gasflowed with altered cams and valves. According to John Trigger Performance's dyno, the bike makes just shy of 200bhp at the rear wheel.

7 ELECTRONICS

The MoTeC M800 ECU come with a full electronics package that includes datalogging, traction control, anti-wheelie, variable fuel modes and race start. The whole throttle system is ride-by-wire and uses a modified Panigale twistgrip to eliminate the R1's cable feed. The Yamaha YCC-I variable intake funnel system is retained within the airbox, though the trumpets are now carbon. Customer bikes will be fitted with the latest MoTeC ECU that will be tailored to their individual requirements.

8 TANK

The tank is located under the rider's seat and is a separate unit to the subframe. It has a machined top and bottom with sheet metal sides.

9 YOKES

Machined by Dean, the top and bottom yokes are magnesium. You have to be very careful machining magnesium as it is volatile, but more irritatingly it turns the machining coolant fluid rancid!

10 MILLED FINISH

The frame and swingarm have a rippled milled finish to break up the flat look of the sides. It's purely cosmetic.

11 SUSPENSION

The Ohlins FG 386 CRT forks come direct from the factory and are Open Class MotoGP spec. They are a gas-pressurised damping fork and cost upwards of £8500 a set. The shock is an RSP 36 CRT, specially made so that the reservoir fits around the fuel tank. The preload adjuster has a pneumatic release.

12 FAIRING

Although the six-piece carbon fairing cost £2500 and is built by KS Composites, Dean had to invest £16,500 initially to have the moulds made. The shape is based around a Moto2 fairing, though increased in size and tested for aerodynamics using computer software by PES Performance. The front mudguard is taken from Paul Bird's MotoGP bike while the hugger is adapted from a WSB ZX-10R unit.

13 BRAKES

Brembo monoblock four-piston radial calipers are also MotoGP spec and cost £3000 a pair. They aren't the very top-spec lithium alloy caliper (Dean does have a set of these and is awaiting the invoice) and grip Brembo 320mm discs (Freno ceramic coated carbon are an optional extra). The radial master cylinder is a Brembo billet unit.

14 WEIGHT

At 160kg wet without fuel, the DR Moto is bang on the Open Class minimum limit.

15 FASTENERS

Over £1000 of titanium fasteners hold bike together.

16 IT COULD HAVE BEEN A 750

They considered using a Suzuki GSX-R750 engine to power the bike, but abandoned that idea as it wouldn't have been eligible for any current race series. Shame, though, it would have been a lovely bike to ride.