

# FAST GROUP, PLEASE

This MotoGP-inspired R1 is, without doubt, the last word in trackday excess



Powered by a Yamaha R1 engine, but that's where the similarities with a road bike end



By Gary Inman

**Y**ou've read about ultimate this and extreme that as many times as I have, the superlatives now used to a point of becoming meaningless, but I'm struggling for a more apt description when it comes to the DR-Moto. This track bike is surely the last word in 20-minute session excess. It is truly decadent. This is true MotoGP manufacturing technology without the need for one of those tricky-to-negotiate factory contracts. The only thing is, it will cost you £89,500.

Virtually every piece of frame and swingarm has been machined from solid. Ten breezeblock-sized billets of 5083 'O-condition' aluminium alloy are the raw material for the frame and swingarm. Four of the heaviest blocks weigh a hernia-inducing 80kg each before they meet the ball-ended cutter of the five-axis Hardinge Bridgeport 500XP3 – a machine as big as a starter flat in London. When the blocks are transformed to an inner or outer frame

## WHAT'S THE STORY?

■ The chassis of this track weapon was machined from solid billets by a UK specialist. The engine is a WSB-spec R1. It weighs 160kg, makes 198bhp and could be yours for £89,500. Say hello to DR-Moto, the ultimate trackday bike.

spar section, and emerge from beneath an avalanche of 79kg of swarf, they are just 2mm thick and weigh the same as a flip-flop.

There are a couple of pieces of flat plate that the builder is embarrassed about, but that's it. There aren't any cast parts or fabricated-from-sheet sections. One piece – one swingarm inner wall that is the length of your forearm, from fingertip-to-crook of your elbow – requires 155,962 lines of CNC programming to be cut. Add the rest of the pieces and it's well over one million cutting lines to create the frame



## 'One swingarm inner wall requires 155,962 lines of CNC programming to be cut and well over one million to create the frame and swingarm'

and swingarm, before the individual parts are assembled in jigs and sent to be welded.

The DR-Moto (www.dr-moto.co.uk) is the brainchild of Dean Reynolds, the boss of Reynolds Engineering, in Buckinghamshire. Reynolds supplies precision-machined components to clients including the F1 industry, and used to be a contractor for Kenny

Roberts' Team KR squad, when KR's privateers were hounding factory bikes and scoring podiums with the Honda-powered, Roberts Jr-piloted MotoGP bike.

"I think we were the first to make full billet swingarms," says Reynolds, whose small firm, comprising seven staff including himself, manufactures swingarms and components for chassis specialists GPMS, of Oxford. As well as finishing first and second in the 2013 British Superbike Championship, GPMS swingarms can currently also be found in MotoGP's Open Class and also on the grid in World Superbikes.

It was Barry Ward of GPMS, a former Team KR and Reynard Indy Car chassis designer, who was the architect behind the DR-Moto's chassis. "I think Barry designs components that he thinks we can't machine, but we find some common ground," reckons Reynolds. They share a philosophy. "We like things to be simple and clean and if it's not needed, don't do it."

Clearly, they believe machining from solid is needed; Reynolds explains why. "When you make something out of sheet metal it is one thickness. With

machining you can alter the thickness and control the rigidity."

"Also," adds Ward, "the process of pressing sheet metal into three-dimensional, complex shapes just isn't as accurate or repeatable as CNC machining them from solid."

Casting, the process most mainstream manufacturers employ to create the majority of their road-going superbike chassis sections, isn't accurate or thin, and therefore isn't light enough for the likes of Reynolds and his customers.

The DR-Moto is the result of an obsession and is the preserve of wealthy obsessives. For the £89,500 price tag, you could buy a six-bike group test's worth of performance litre bikes, and still have enough money left for a van to take a couple of them to a trackday, but Reynolds insists it has to be this price if he has the slightest chance of breaking even. It's also similar to saying you could buy six Audis for the price of a Ferrari. And while this is the first completely finished DR-Moto, another is close to completion and the major parts have already been machined for another two.

*Continued over*

## Machined perfection

When it comes to MotoGP-level chassis design, every millimetre matters

Every machined part of the DR-Moto's frame and swingarm is made to a tolerance of +/-0.1mm (the rearsets don't have to be that accurate). Barry Ward, the chassis designer, says he would expect a top-level motorsport fabricator to be able to hand-fabricate frame spars from sheet alloy to a tolerance of +/-1mm, 0.5mm on smaller parts – still up to ten times as much as the CNC machine. "While 1mm doesn't sound a lot, it adds up," says Ward.

The incredibly accurate components must be welded together and that inevitably changes them, but Ward explains. "Because the CNC'd parts fit together so perfectly and accurately in the jig, there is less distortion when they are welded

'Because the CNC'd parts fit together so perfectly and accurately in the jig, there is less distortion when they are welded'

**BARRY WARD, GPMS**

and the distortion we see is more repeatable so we can design for it and account for it in the jiggling."

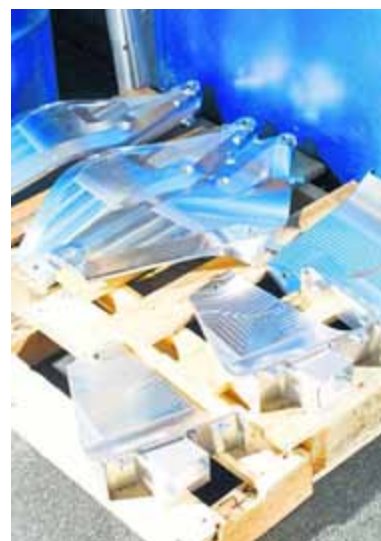
The DR-Moto is a bike for people who can feel the difference of riding a bike built to this level of accuracy, or those who want to know they have a machine with the chassis build quality of a bike on the 2014 MotoGP grid.



The Reynolds workshop is home to the very latest cutting-edge milling machines



These blocks of marine-grade alloy are accurately nibbled to become...



...these stunning sections of swingarm and frame ready to be welded together



High accuracy means once in the jig there's minimal welding distortion



# DR-Moto: beneath the fairing



## 1 Yamaha R1 engine

"I chose the cross-plane R1 because it is the road bike engine most closely related to a MotoGP bike," says Dean Reynolds. Dating from 2010, this engine has Pistal pistons; Pankl titanium rods; a Nova gearbox; YEC kit generator; Suter slipper clutch and active bellmouths. Racing R1s often have deeper, YEC factory sumps. The only one Reynolds could find was so expensive he decided it would be easier to make his own. It is machined from a billet. Naturally.

## 2 Packaging

The DR-Moto has an under-seat fuel tank, as near to the centre of mass as possible. The battery, ECU, ride-by-wire hardware and GPS, normally under the seat or in front of the headstock, are positioned behind the airbox.

## 3 Electronics

The electronics package includes a Motec 'Advanced Dash Logger' ADL2 dash that collects data from sensors including: front and rear wheel speed; front and rear suspension travel; brake pressure; all the normal temperature and pressure readings plus airbox temperature and air pressure. Additionally, there are gyroscopes that monitor roll, pitch and yaw, data that can be overlaid with a track map, because the bike also has a GPS position logger. That means lean angle is recorded for every corner of every lap of the trackday. Such is the speed of technological advancement, there are apps that do something similar now, but you can't use them to programme fuelling and traction control for each corner of your favourite track, and they won't automatically blip the throttle for clutchless downshifts like this Motec does. Yet.

## 4 Ride-by-wire

ECU is a Motec M800 like those favoured by many BSB teams, and is a significant part of the £25,000 the engine cost. The bike runs a full ride-by-wire throttle. There is no throttle cable leading to a stepper motor, just an electrical wire, wrapped in Raychem heat-shrink, from the twistgrip.

## 5 Suspension

Öhlins front fork (£8500) in Reynolds-machined magnesium triple clamps. The shock was a measly £1500 in comparison. The whole underslung linkage is machined from billet. The linkage system was designed by GPMS and based on the gentle rising rates of a GP bike (linked with a higher-rated spring) compared to the more steeply rising rates of a road-going superbike with its comparatively soft spring.

## 6 Rolling chassis

Wheels are forged magnesium Marchesinis – 16.5in in diameter. Brakes are Brembo monoblocs, at £3000 a pair, with MotoGP Open Class-spec Brembo radial master cylinders. Reynolds says the brakes, wheels and suspension are all the same spec as front-running CRT bikes from the 2013 season. The front discs pictured are FrenoCarbon rotors, but Reynolds has also tested steel Brembo discs that perform at least as well as these prototype discs. There are even molybdenum-infused Nylon sliders for the chain to run on.

## 7 Weight

The all-up weight of bike (with fluids, but no fuel) is 160kg. Yamaha claim the wet weight of their 2014 R1 is 206kg, without fuel that would be 193kg

## 8 Adjustability

Like a racing prototype, the DR-Moto offers large amounts of adjustability...

■ In the headstock of the chassis – for both front wheel fore and aft adjustment and steering axis angle adjustment.

■ In the swingarm pivot of the chassis – to fine tune anti-squat characteristics under acceleration.

■ In the swingarm – for rear wheel fore and aft adjustment.

■ In the yokes – for steering axis offset adjustment.

■ Front and rear ride height adjustment.

■ Adjustable stiffness swingarm.



Turn up on a trackday with this and there's no excuse for not winning the fast group



It's all top-spec, from the £8500 Öhlins fork to the £3000 Brembo calipers



Dean Reynolds, master of the CNC machine and father of the DR-Moto



Adjustable steering offset is just the start of the DR-Moto's adjustability



## Riding the DR-Moto

Supersport TT winner Gary Johnson tested the DR-Moto earlier this year

"The motor is an unbelievable powerhouse! It pulls from zero and is as smooth and tractable as anything I've ridden," says Gary. "Then the first corner is thrown towards you and the braking force and stability is awesome. When you throw it into a bend, it just wants to drop on its side. I'd been on a Triumph 675 all weekend and the way this changes direction makes [the 675] feel a heavy lump."

Johnson rode the DR-Moto at its very first shakedown and was asked to give honest feedback. He pointed out what Reynolds knew, that the electronics need work to set them up and exploit the cross-plane R1, a motor well-known for needing the kind of high-end electronics to make it a race-winner. "On corner entry it didn't have enough engine braking to pull the bike up for the tall gear it could pull out the corner. Also, the first crack of the throttle was a little jerky, but it highlighted the huge torque available."

Reynolds says the bike has so much torque "it would be a pussycat to

ride on the road until you pulled the throttle." He quotes numbers from John Trigger's dyno (one he says is notoriously pessimistic with its figures) of 198.6bhp at the rear wheel and 112ftlb of torque.

"Rear grip was unreal," Gary Johnson continues. "In fact, I would sacrifice some steering and grip by lengthening the wheelbase to stop it wheeling so much. I'd love to dial it in and personalise the seating position and suspension on the bike to have a real go at showing its potential."

While the DR-Moto is most likely to find a market with wealthy trackday riders, the bike can race in open class racing such as MotoGP. It could also race in the Senior TT, though the tank isn't big enough and would need redesigning to allow it to be filled in a pit stop. "That's not an afternoon's work, but the bike was designed so it could be modified to carry more fuel if someone did want to race it," says the designer, Barry Ward.



TT winner Gary Johnson tested the DR-Moto in Spain and was blown away by the level of grip from the rear

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