



Empire Cycles AP1

Behold the first cast aluminium DH bike, designed and manufactured in the UK. Take a look at tomorrow's technology

Words Dobby Pics Russell Burton

Many people balk at the thought of a cast bicycle frame – it brings back memories of the dreaded Kirk Precision cast magnesium monsters of the early 90s. But not all casting is bad. People forget – or simply haven't noticed – that casting has been around on bikes for some time – just look at the lowers on suspension forks. Most of them use high-pressure cast magnesium, happily hiding under paintwork and stickers...

Craig Robertson and Chris Williams of Empire Cycles have been working on their cast aluminium masterpiece – the AP1 – since 2005, and have refined it to the beautifully sculpted and intricately

thought-out machine you see here. But they're not just in it to build one of the most innovative DH bikes out there – they're presenting a technology that they believe will one day be common place in the cycling industry.

"This is the way bikes will be made in the future. Whether it's die-cast, pressure moulded, cast or whatever – this is the way. Maybe not for some time, but it's here to stay," enthuses Chris. "We've started this as a concept – entering into the highest level there is to show what's possible. At some point, a big company will look at the concept and they'll take it on board."

At first glance, this could be just another DH bike. But take a second

glance and you'll see there's something raw, industrial and different about it – it entices you to take another look.

When you do, simple and well thought-out features morph into a pleasing exo-skeleton shape. It's clear where the influence comes from: "Chris has the skills on the design side of things, my experience comes from the Global Titanium bikes I've produced," reflects Craig. "Originally we looked at producing a titanium tubed DH frame, but the material doesn't really have the right characteristics for DH bike design.

"So looking at the design of MX bikes, we decided to design a cast rear end to go with a tubed front end, but then thought we may as well go for a

What makes this bike a Super Bike?

- Unique three-piece design
- Casting technology paves the way for gearbox concepts
- British design construction and manufacture



complete cast frame. In motocross, extrusion is getting smaller and casting is getting bigger. Yamaha's first aluminium MX frame had lots of huge cast sections – and only small sections of extruded material."

So looking at cast design, it's logical to see where Empire are coming from and where they might go – a modern DH frame has around 30 pieces of material welded together. On each weld, the tubing is distorted by heat and as a result, reaming and facing of areas like head tubes and bottom bracket shells is a must before installing components. Many manufacturers boot their frames out of the factories like this, leaving bike shop mechanics to tidy them up.

The AP1 has three parts and no welds, and because the last process is the machining, every single component fits together perfectly. And everything has been thought of from the ground up – it's a thoroughbred DH race bike. Unlike many DH bikes, which are swamped with adjustments, the AP1 has just one – the wheelbase. For many riders, the difference between marginal head angles and BB heights doesn't mean a lot. With a 14in BB height and a 65 degree head angle, the bike is perfect – the adjustable wheelbase just affects how it handles at speed. Running it short keeps things twitchier for technical courses, and running it longer dictates stable handling.

A high single pivot offers a square bump-swallowing rearward axle path, and uses an idler wheel chainguide to tame the pedal feedback, so it

effectively pedals like a low-pivot bike. What makes this single pivot design special is the use of needle bearings, which can take five times the load of cartridge bearings and offer an incredibly slick action. This, combined with the low unsprung mass of the simple rear end, makes for a very compliant suspension action. "Think about designs like VPP," Chris says. "The front ends tend to be very light, and the rear end with all the moving parts is heavier. They're trying to move 60 per cent of the mass while 40 per cent stays stationary. It doesn't take a rocket scientist to realise you don't want to be moving all that mass."

The Empire AP1 isn't the lightest DH frame out there, but it's incredibly well balanced, and the maths simply makes it work. To get a similar effect, we've heard of people strapping lead to the front of their bikes – which stabilises the light structure and deadens it, allowing the shock absorber to get better results. Chris and Craig took this into account when designing the frame. Their development of casting really is a look into the future of mountain biking.

"The next step is that our frames could take a gearbox unit, but where most would adapt a frame to house a gearbox, we wouldn't do that. We'd cut a mould that has it integrated – so it would effectively be a crankcase with a steering assembly and a pivot point. Weight-wise, it would be a huge advantage because you can minimise overlaps and lugs. As the gearbox comes of age, casting technology will encourage others to follow." ⚙

MBUK Super Bikes

1 Pivot

The Empire uses full complement needle bearings rather than cartridge bearings. The assembly is more complicated and weighs more than cartridge bearings, but they take about five times the load.

2 Head tube

During the prototype stage, Empire managed to crack a head tube while fitting a headset that had been machined to Cane Creek's exact installation tolerance – that is, how much room there is to spare when fitting it. They scratched their heads and wondered what was going on. It turned out the installation tolerance of a headset is just 12microns – that's the same thickness as a piece of paper. So Chris and Craig talked to their machining guy, telling him he was trying to do the equivalent of driving a bus under a low bridge

– to which he replied: "Easy, we'll bring that down to 2microns then." So the headset now fits perfectly. Everything on the AP1 is made with the same precision.

3 Shock Absorber

A high pivot gives a rearward axle path, enabling the wheel to move around and over square edged hits – the type of bump that really slows racers down. "Think about this in layman's terms," Craig pointed out to us. "If you roll a football at a curb it doesn't go over the curb – it bounces back towards you. If you let the axle go that direction and actually take the force in to the shock, everything works properly. Our shock is doing its job properly – it's a shock absorber". Housed neatly, the Cane Creek shock can easily be reached for adjustment, and is mounted on Empire's own hardware.

4 Adjustable dropouts and disc mount

With no adjustable geometry, the AP1 has one simple adjustment

that can be used by any rider. Chris and Craig thought too much adjustment would mean many people wouldn't get as much out of the bike as they should – so they stuck to proven geometry and allowed for adjustable dropouts. Beautifully machined, the brake mount moves with the dropouts, which house a regular 135mm rear wheel, spaced to fit the 150mm rear end. Contrary to common belief, most 150mm hubs don't make a wheel as strong as a 135mm unit, because the flanges tend to be too close together to make a difference.

5 Cable routing

Cable routing always seems to be an afterthought on DH bikes, but the Empire AP1 has it incorporated into the frame. Running in grooves that are moulded into the frame itself, the cables follow the most direct route, gliding along the frame's natural lines. Machined fork stops are part of the frame design – so you won't be squashing the cable outers on this design.

Empire Cycles AP1

With a complete cast frame, adjustable wheelbase and well balanced geometry, the AP1 is a truly unique bike. Empire believe that one day, all bikes will be made this way





The essentials
Price Frame kit from £2,095
Contact www.empire-cycles.com