

# Ghost in the machine

Cyclist tests the technology that has forced the UCI to start checking beneath the skin of World Tour team bikes – concealed motors

Words PETER STUART Photography HENRY CARTER

**I**n Stage 2 of this year's Tour de France, Mark Cavendish finished a frustrating fourth in the sprint for the win. Insult was added to injury immediately afterwards when his bike was inspected to check whether he had a motor fitted. Many people thought it ridiculous and demeaning that such an investigation was required, but the potential for cheating with hidden motors is real. They do indeed exist, and we've got one.

There are various ways in which motors can be integrated into a bicycle. They can be placed in either the wheel hub or at the bottom bracket. Hub motors, though, are complex and bulky items – certainly not fitting within a svelte carbon hub. So, if one of the goals is

concealment, that leaves us with a cylindrical motor inserted into the seat tube, and this technology has been around for some time.

The Vivax-Assist (below) is the descendant of the Gruber-Assist motor, an ingenious device launched in 2008 that turns a bevel gear fastened to the crank axle and gives a power boost of around 100 watts. The new Vivax-Assist is quieter, with a more compact and well-hidden battery. Whereas the main battery used to sit in a large seatbag, it is now located in the bottle, although the motor also has an internal battery that can power a bike for 60 minutes. The power switch, previously secreted under the saddle, is now housed at the bar-end.

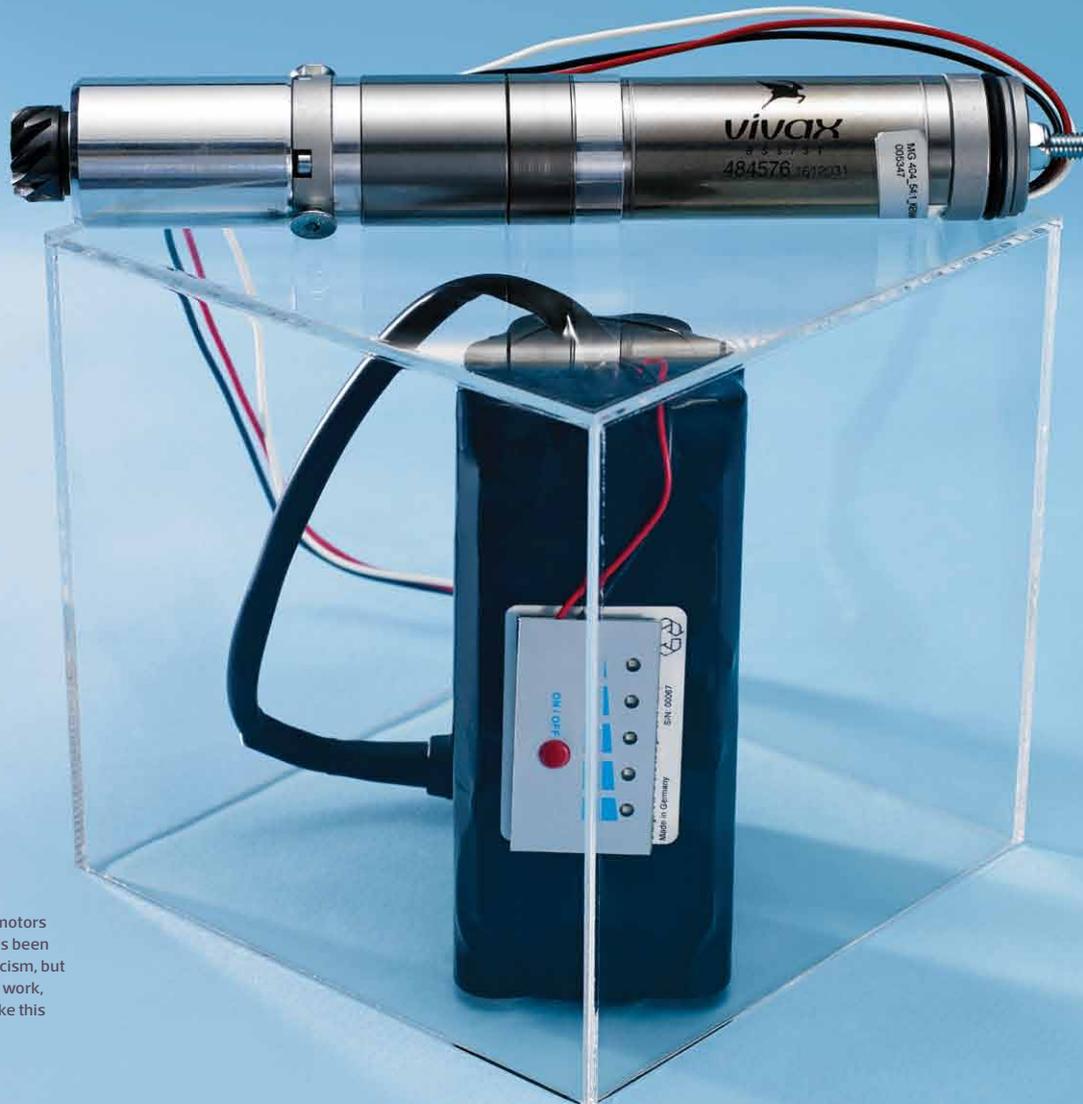
Some might think it odd that the UCI should be seriously concerned about this technology

being used in the pro peloton, but in recent months the authorities have been taking it extremely seriously.

## Motor doping

In the infamous CIRC report into doping in cycling published in March, a section on page 85 was dedicated to 'technical cheating'. Part of that page read, 'The Commission was told of varying efforts to cheat the technical rules, including using motors in frames. This particular issue was taken seriously, especially by top riders, and was not dismissed as being isolated.'

Consequently, the UCI has raised the fine for contravention of Article 1.3.010 (forbidding electrical assistance) to a new maximum fine of 1 million Swiss francs (£674,000) and began



Talk of hidden motors in road bikes has been met with scepticism, but they exist, they work, and they look like this



implementing regular checks on bikes in the pro peloton. Why all the suspicion, though?

One of the most famous rumours of motorised assistance surrounded Fabian Cancellara in 2010. Italian journalist Michele Bufalino posted a video alleging Cancellara's hand movements and rapid accelerations were indicative of someone using a motor. Another Italian, ex-pro Davide Cassani, examined the Gruber-Assist system to demonstrate how it could be used by the pro peloton. Commissaires inspected Cancellara's bike and no sign of a motor was found, nor was the specification of his bike suitable for the motors available. Cancellara replied to the accusations by stating they were 'so stupid I am speechless'.

Yet the concern has been raised at the highest level of the sport. 'The UCI takes extremely seriously the issue of technological fraud such as concealed electric motors in bikes,' the UCI said in a statement. 'We have been carrying out controls for many years and although those have never found any evidence of such fraud, we know we must be vigilant.' The UCI wouldn't comment on whether it had reason to believe

motors were being used in races, with UCI head of communications Sébastien Gillot stating simply, 'It is our utmost responsibility to be vigilant, knowing that the technology exists.'

Whether the threat is real or unrealistic in the pro ranks, the technology is now available to all racers, amateurs and elite riders alike, meaning there's the possibility that criteriums and TT races could already be infiltrated with stealthy users of electric motors.

'There's no way of me knowing. It could have already happened,' says Steve Punchard, UK distributor of Vivax-Assist, when asked if the UK race scene is vulnerable to such cheating. He claims almost all of his customers have bought the unit with pure intentions – to keep up with club mates or spouses. 'Most of my customers are coming up to retiring age,' he says. 'This system is really for the cyclist that wants to keep up with the people they're cycling with now.' The manufacturer, Vivax Drive, confirms that riders aged over 60 are the main customers for its motors.

Punchard describes one customer who raised his suspicion, though. 'They bought a



Vivax-Assist from me with the battery, but they didn't even ask me for fitting instructions, so they must have known what they were doing.'

With so much speculation and suspicion surrounding these motors – much of it based on very few facts – we decided to try one out.

#### Pressing the button

Vivax sent *Cyclist* a Vivax Passione CF for test – a bike frame that has been custom built to fit the motor, although the unit can be retrofitted into many frames. The first impression was that the bike was a little heavy at 9.9kg, but no more than one might expect from an entry-level frame. Otherwise, the frame is completely normal in appearance and feel.

The Vivax CF is made of carbon but has a reinforced seat tube to accommodate

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Vivax-Assist Passione CF, £5,499 (approx £4,034), vivax-assist.com

Vivax-Assist motor conversion, £2,199, electricmountainbikes.co.uk



## Taking the unit around one of our local 6km loops on a windy day, we were sure that on a lighter build we could have ridden every bit as fast without the motor

the torsional force of the motor. 'I don't recommend fitting it to a random carbon frame as the seat tube has to be reinforced with Kevlar,' PUNCHARD says. 'I'd guess that an average carbon frame isn't strong enough as standard, but Vivax has fitted it to carbon frames and has had success.'

PUNCHARD speculates that any pros using one of these motors in competition would need to have their bikes redesigned to accommodate the force of the motor, as well as account for the fact that it requires at least a 31.6mm seat tube.

With the *Passione CF*, the motor battery and control unit is concealed in the bottle. To activate the motor, the cranks need to be moving. Once up to a reasonable cadence, the rider presses the bar-end switch and the motor kicks in. It does create a whirring noise, which is noticeable when riding solo but is unlikely to be detected in the buzz of a large pack.

With 110 watts of additional power, the speed boost on the road is tangible. Some swift calculations indicate, however, that even with the extra 110 watts, *Cyclist's* power output would still be too low to compete with the likes of Chris Froome, who pumps out 6.2 watts per kilo compared to our motor-assisted 5.8. But there

are plenty of riders in the pro ranks who, if they used this motor, would boost their wattage enough to leave Froome in the dust. So perhaps it's understandable that the UCI is worried, bearing in mind that the weight of the motor could probably still be accommodated within the UCI minimum weight of 6.8kg.

The potential for cheating with a motor is real but, having tested the system, we at *Cyclist* are not convinced that it is yet a problem in professional cycling. The *Vivax-Assist* is very good at what it was intended to do – offering assistance in maintaining a certain cadence and speed – but it is not a high-powered motor that will propel you to a consistent 50kmh.

Taking the unit around one of our local 6km loops on a windy day, we found ourselves a little faster than expected, but still around 30 seconds off our best time. Experience suggests that on a stiffer and lighter build we could have ridden every bit as fast without the motor. While there is an advantage, it probably wouldn't account for the moped-like accelerations of Cancellara if he were not already producing near-moped-like power.

Also, the workings of the motor are more complex than one might assume.

Rather than simply adding extra power, the motor works

to maintain a pre-determined cadence. If the system has been programmed for 90rpm, it will work to keep the pedals at that cadence regardless of the power the rider puts in, meaning that in a low gear it will quickly stop assisting you once 90rpm is exceeded.

In too high a gear, though, the motor can become overstrained and produce less power. The trick is to move into a high enough gear for the motor to be working at its maximum capacity in conjunction with the rider's own input. The cadence the motor targets can be set by holding the on/off switch for five seconds while holding a desired cadence. For the purposes of racing, this system would require regular adjustments to set the cadence to a useful level.

Then there's the bulk of the system. A battery concealed in a bottle would not go unnoticed in the pro peloton, although a smaller, more covert system could be developed. 'I think getting the motor smaller and lighter would be possible,' PUNCHARD says. 'The system comes in three parts: the crank, the freewheel and the motor. So a smaller unit with only 80 watts could be used and that would still make a difference in a race. Then instead of having a 6mA battery you could have just enough battery power for 10 minutes or so.'

### The boost is out there

Intriguingly, Vivax claims that the UCI has not contacted the company as part of its investigation into the practice of 'motor doping', but the technology is already in common recreational use with approximately 1,000 units apparently being sold each year, and some could easily have been modified.

Systems like the *Vivax-Assist* will no doubt become more prevalent and, with the automotive industry honing the sophistication and power of lithium batteries and electronic motors, the technology behind it is likely to take significant leaps forward in the coming years. With that in mind the UCI is right to be vigilant. It's only a matter of time before the technology to effectively and discreetly cheat is with us. 🚫



The rider controls the motor via the bar-end switch (shown in situ, right) – a discreet way of concealing the operation of the unit

