STANDARDS IN SPORT: CYCLING

The International Cycling Union makes its rules and requirements for equipment sound straightforward, but secretiveness surrounds the development of new ideas frames, forks, wheels and other components.

Wheels of innovation keep turning

After Bradley Wiggins won the 2012 Tour de France in July and an Olympic gold medal in the road time trial in London on August 1, famous French sports newspaper *L'Équipe* had a burning question. It asked David Brailsford, performance director of the Great Britain Olympic cycling squad and also general manager of Bradley Wiggins' professional cycling team, Team Sky, what the secret was.

David Brailsford lived in Saint-Étienne in eastern France for four years in the 1980s and raced as a professional cyclist. It was during this period that he developed a keen interest in sports nutrition, health and sports psychology, subjects he later studied at university and in which he became a recognised specialist. He knows France and *L'Équipe* very well and, therefore, permitted himself the luxury of answering with a joke: "The secret is that our wheels are round."



The winner of Le Tour de France 2012, Bradley Wiggins sporting the famous Yellow Jersey.

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Clothing questions

Roundness of wheels and other technical requirements are the concern of the International Cycling Union (UCI). Based in Aigle in Switzerland, the organisation publishes rules for frames, forks and wheels for bikes and for riders' apparel. Its last update was at the end of 2011, which was appropriate with 2012 being an Olympic year.

In truth, the UCI has little to say about apparel, although it has a catch-all rule that any aspect of clothing with the potential to influence a rider's performance is forbidden. Specific examples the organisation mentions include built-in mechanical or electronic aids, but the rules also say that riders are not allowed to wear "non-essential articles of clothing that could reduce riders' air resistance or alter their body shape using stretch, compression or supportive material". What they must wear are shirts with sleeves (zip-up fronts that allow riders to bare their torsos quickly when they need to cool down breach no rules) and shorts whose length is above the knee. Teams competing in competitions such as the Tour de France must work hard on their colour combinations to make sure there can be no confusion with the special jerseys worn each day by the overall race leader (yellow), the leader in points classification (green), the king of the mountains (red dots on a white background), and the leading rider under 26 years of age (white). Temporary protective rainwear must be transparent or have the same colours and insignia as the team jersey. Safety helmets are a must, in training as well as in competitions for all types of riders: track, mountain bike, cyclo-cross, trial and BMX.

In the frame

With regard to the bikes themselves, the UCI has published long and detailed lists of approved makes and models of the components under scrutiny, as well as providing application forms and guidelines for companies or individuals seeking approval for new pieces of kit (for which it guarantees confidentiality of information, more on which later). The organisation says this system helps manufacturers by making it clear what aspects of their designs meet or fail to meet approval before moving to mass production.

Qualified UCI inspectors, known as commissaires, attend official events and will cast their eyes over the equipment competitors intend to use. It is perfectly within their power to reject a frame, a fork or a wheel design on the starting-line itself. Safety is always a primary factor, the organisation insists. For example, some of the tests it carries out on wheels are to examine their impact strength and ability to help a competitor stay safe in the event of a crash.



Lizzie Armistead models the Olympic Team GB women's cycling kit.

adidas

Followers of trends

For British Cycling's David Brailsford, the UCI's focus on safety makes sense, but his feeling is that the governing body often seems to be following trends rather than having its own master-plan in place for what the sport might look like in five or ten years' time and what the role of technology can be in helping to develop the sport.

Weight is an obvious point of discussion. One of the things manufacturers try to do is make the weight of their bikes lower all the time and there is, clearly, a compromise between weight and strength, which, as we have said, has a link to safety. So the UCI has come up with a minimum weight for bikes of 6.8 kilos. David Brailsford comments: "I think this is fair. And broadly, the key with the UCI is that there have been rules for quite some time. What we are seeing now is that the application of the rules is becoming more rigid. One could argue that if everyone plays within the rules as they currently stand, the opportunity for getting major advantages from the material design of bikes is at the point of diminishing returns now. The major gains have been made and the advantages are becoming smaller as time goes on, unless there is a major breakthrough waiting to happen." Diminishing returns do not mean diminishing efforts to find new advantages, as we shall see.

Lottery winners

Mr Brailsford makes it clear that the breakthroughs he and athletes such as Bradley Wiggins, Victoria Pendleton, Lizzie Armistead, Chris Hoy and Jason Kenny would not have been possible without funding coming into elite

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The UCI says riders have to wear tops with sleeves and shorts that stop above knee-length. Colour combinations must present no clash with the special jerseys that the leaders in big races have to wear every day.

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sport in the UK from the national lottery, a process that began in 1998. The team won 12 medals at London 2012: eight gold, two silver and two bronze. "What that funding allows us to do is to look at going out and hiring the best people in a number of areas, and bring back in expertise from the sport and the best experts in the relevant fields," the team manager says.

This group of experts includes specialists in carbon fibre and other materials, whose job it is to make bikes faster within the parameters of the UCI regulations. They include an aerospace engineer, Dimitris Katsanis, who was working in Nottingham before bringing his expertise to the cycling team of his adopted country. It helped that he had been part of the set-up at his own national cycling team before moving to the UK and he also happened to be a UCI commissaire, so knew all the regulations.

Eyes on the spies

At the 2012 UCI Track Cycling World Championships, which took place in Melbourne in early April, nearly four months before the Olympics, Mr Brailsford's team deliberately held back from using all the innovations its experts had prepared for the Olympic Games. "It was quite interesting that both the Australian team and the German team were riding on their full 2012 Olympic kit," he says, "whereas we decided not to until the Olympics. The kind of level that it's got to now is that you have plain-clothes people going round taking photographs of everybody's equipment and the Australians filmed our every training session. It gives you an idea of the efforts that go on to try to move things forward."

He feels there are two different things at play from an innovation point of view. On the one hand, the bike industry itself continuously tries to improve and strives for innovation, introducing new materials, new "stiffness" in bikes, for example, while all the time making them lighter. Business is business, and this is driven, financially, by the willingness of the end user, the weekend cycling enthusiast, to buy. This consumer focus puts a natural cap on the level of innovation (because of the level of expense) that manufacturers can bring to market.

Dogma 65.1 Think 2 – for 2013 updates the frame ridden by the champions of both Team Sky and Movistar.

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Best bikes

The British Cycling team, thanks to lottery funding, does not feel constrained in the same way. Mr Brailsford explains: "We looked around to see what the best bikes were and we left a bit dissatisfied. So we decided to make our own bikes and our approach was completely different [to that of commercial manufacturers], it was completely performance-driven. We wanted to create the best bikes. Our research and development and expenditure was going to go into 26 bikes. If the bikes cost £5,000 or £6,000 each to build, we could justify that. But if you went on to retail those bikes, they would probably retail at £15,000 or £20,000, so a consumer market at that level was beyond the reach of most manufacturers. We were in a unique position; we could create these ridiculously expensive one-offs that would drive performance."

An ideal world

The group started considering what the ideal track bike would look like. In cycling, there are engineers who specialise in handlebars, others who are experts in wheels, frames, seats, pedals and so on. It turned out, in David Brailsford's experience, that simply bringing together the best product from each component group did not produce a sum-of-the-parts advantage. Looking at the whole package, from an aerodynamic point of view (because a cyclist's job is to punch a whole in the air in front of him), is the key, he believes, aggregating small improvements in all of the things that contribute to a rider's performance in a cycle race. There has been an inclination among riders to want tyre-widths, frame designs and so on to produce improvement while insisting on sitting upright in the saddle. Instead, the most aerodynamic shape, David Brailsford says, involves tilting the hips forward quite dramatically, an uncomfortable position for athletes to be in, but worth the pain. So it wasn't "one big idea", he makes clear, but rather a look at everything.

And this, in the end, was the real answer he gave to *L'Équipe's* question. "We have won thanks to better training and better equipment," he said. "We know how to prepare for the Olympics. We know how to reach top form at just the right moment. For four years, all that counts is one week, the week of the Olympic cycling competitions."

David Brailsford made many of these comments in conversation with Mike Parsons of the University of Lancaster in the build-up to the Innovation for Extremes conference (sponsored by Pertex) in April 2012.

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