



# ZIPPER WHEELS

## GOING THE DISTANCE, GOING FOR SPEED

Ever wonder why Zipp is the choice of CSC, one of the top UCI teams in the world? Take a wind tunnel tour as the Indy-based crew pushes to find aero nirvana while proving to Bjarne and company that they are indeed strapped with the fastest wheels in the game.

One week before the start of the Tour of California, Fabian Cancellara languishes in an office chair in a dark San Diego office building, content as a man who could retire this year and have a palmares anyone would be rapt with; Paris-Roubaix winner, World Time Trial champ, stage wins at the Tour de France and Paris-Nice, four-time national TT champ. Check, check, check. Nothing like a rainbow tunic to make you rest easier at night.

But there's much more to be achieved by the powerful Swissman. As much as the guy looks like he belongs in a velodrome at the Six Days of Bremen with quads reminiscent of two hearty Redwoods, Cancellara has made a name not only as a classics hardman, but a favorite rolling up to any at any prologue start ramp, where a furious flash of power makes him a top pick against the clock.

Surprisingly for the chrono success he has earned—one UCI world title, four Swiss national titles and two junior worlds titles, all in the time trial—the 26-year-old had never been in a wind tunnel to hone his position or test his equipment. Of course, there's a first time for everything, and as his director sportif says, there is always room for improvement.

"This is something that everyone is now doing," a studious Bjarne Riis said of the tunnel testing with athletes as he peered from the San Diego Low Speed Wind Tunnel into the testing section as his mountain goat, Carlos Sastre, tucked in on his P3 Carbon and powered furiously against a 30 mile-

per-hour headwind. "It's always import if you can take time off. Right now Fabian's the fastest man in the world. If you can take more time out of his performance, it's fantastic."

But while Riis represents the brains behind CSC, he gives credit where due. "What Zipp has done here is very impressive, and it's very important to us."

In early February, Zipp and Cervelo joined forces to help three athletes—Cancellara, Sastre and Frank Schleck—get windblown in San Diego, all the while learning that their gear and fit is so well optimized, so superior, that all they have to worry about is putting in the miles.

As if it was that easy!

But before the athletes showed up playing with cockpit position and wheel options, Zipp flew out from their home base of Indianapolis and put in three full days. No media, no bikes. No Bjarne. Just 42 wheels, \$35,000 in prototypes, a handful of engineer brainpower and a desire to create the fastest wheels in cycling.

"Real glamorous, huh?" Zipp engineer Josh Poertner deadpanned as a bevy of engineers swirled around at the San Diego Low Speed Wind tunnel days before the athletes were set to arrive. There was the testing area, engineers scrawling drag numbers across a dry erase board, and wheels, lots and lots of wheels sprawled across the tunnel like a splash of giant poker chips. Existing Zipp

models, competitor brands and funky prototypes made using techniques and materials that some of the Zipp team previously employed making Indy Car wind tunnel models, each waiting for their turn in the wind.

With each test the wind came up and the platform balance pivoted upwards of 30 degrees. Data was read, and the giant propeller on the opposite side of this massive wind doughnut was shut down. Zipp's braintrust rushed in, pulled the wheel out of the fork brace, slotted in a new hoop, shut the doors and the process started anew. They would do this a total of 106 times. "Yeah, Josh, real glamorous."

Suddenly, things get animated, and Poertner is the first to relay the news. "We just got negative 80 grams at 15 degrees!" he exclaimed, pointing to a disc in the brace with a curious flare added to its outer edge. For Zipp, it's a major result. A disc that not only has no drag effect with wind approaching at a 15 degree angle (right in the middle of what Zipp calls the "SweetSpot" of real world wind angles), but also provides an 80-gram of propulsion equivalent to about 10 watts of power? Ladies and gents, that's why they test.

And just to make sure, they re-test.

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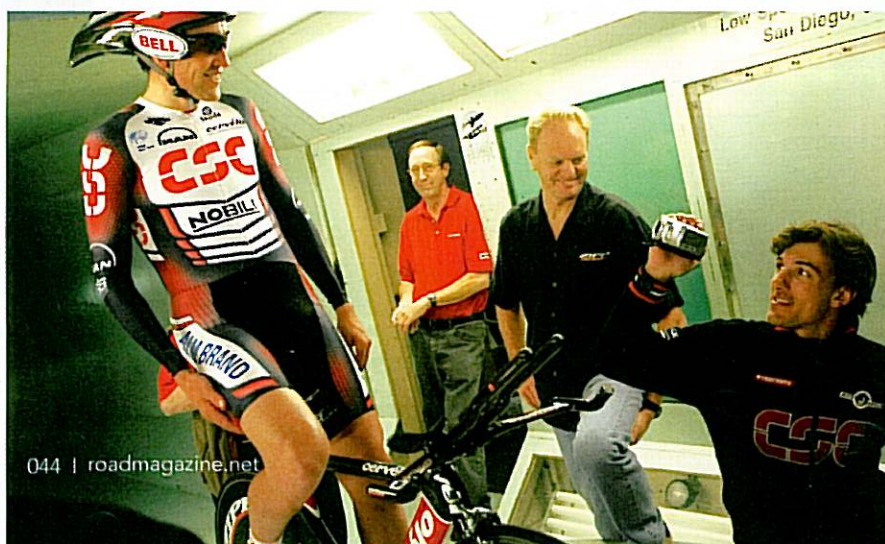
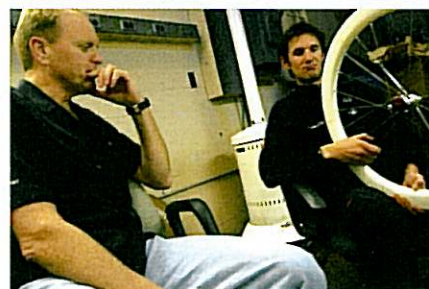
"It's like a plane," Zipp president Andy Ording explains. "You get enough air under it and you have lift. And we got that at two data points with that wheel. It was a huge victory yesterday. We were dancing around, ready to start drinking right then! And we repeated it today. Anytime you get under or close to zero, it's special."

Curiously, it's hard to argue that Zipp isn't the industry leader as one of very, very few brands on the forefront of testing and design as the rest of a flooded aero wheel market follows blindly in lockstep. In today's wheel market, it's easy for anyone to pick a deep-dish carbon wheel out of an Asian catalog, put your "brand" on it and sell it to the masses. But is it really fast? Has it ever been tested? Likely no, on both counts, Zipp says. It put the onus on Zipp to set the trends, but it's an onus they gladly accept.

"We created this market of superlatives—lightest, fastest, strongest," Poertner says. "It's our impetus to prove it, and that's why we're here. We've been working on this with three months of preparation. There's a lot of hard work invested, and we'd not be able to make those claims if we didn't go to these extents. Then to try and protect it we make all of the product including the tooling at our facility in Speedway, Indiana in order to make sure that our secrets remain secret."

And it's easy for Zipp to confidently say they are fastest. Not only can they back it with their test numbers, they have legal rim shape patent. Instead of a standard Deep V, Zipp has a bowed rim cross section, and of course, those dimples, both features unique to Zipp wheels that nobody can replicate. Zipp engineers say those two features allow for better aerodynamics across a wider range of wind angles. "Depth is important, but it becomes secondary to shape," Poertner says. "If you have two rims of the same depth, the difference is going to be shape." In fact, Zipp finds that shape can make a rim perform as if it is up to 25 percent deeper than it really is, while still remaining easily controlled in cross winds.

Which matters most in situations we all race in: headwind, echelon crosswinds, swirling gusts from any direction, the full gamut. "When wind comes off a rim, it creates turbulence," Ording says. "What we're trying to do is adhere the flow of wind to the rim as long as we possibly can and through the entire range of wind angles the rider will see in the real world."



What about aero wheels during stage races, where logic says that pack riding will negate some of the aero effect? The team wanted to correlate the wattage savings they were seeing with their power meters between 404's and 24mm deep box section wheels they use for training and for Paris-Roubaix (Zipp are the only carbon wheels ridden at every other spring classic by every rider on the team).

Result? Zipp engineer John Fearncombe laid it out for Cancellara. "Fabian, the difference between the classics and a 404 at 10 degrees of wind angle is 63 seconds per hour." That is, even in pack riding, deep-dish race wheels will beat out the old standby box rim, every time. "In their wind tunnel test *Tour* magazine in Germany predicted a 57-second advantage, bike and wheels only, no rider," Poertner said. "That matches up with the math models, and this test. A 58 to 60 second per hour, wheel-only calculation is great, because it shows that our math models for wheel only drag, wattage and time savings are within a few percent of what we see testing the entire bike rider system with those same wheels, and in fact this test shows our models may actually be a bit conservative."

Ording used the data to dig into Cancellara's ribs with a smile: "Now you've got no excuse!" Cancellara laughed, but quickly started digesting the data. For he knows that even with his power, the equipment advantage may be what gets him across the line first. And even if he was oblivious, Riis—one of the first managers to put proper equipment selection ahead of who was offering the top dollar—would impart it upon him.

"Bjarne finds it so important for me to find every way to improve, and I have wanted to do this for some time," Cancellara said. "Never before have I had a chance to test myself or my bike in the wind tunnel. I am the fastest man in the world right now. If I can find the good balance of aerodynamics and power, find ways to find extra speed, it's good—I'll be even faster."

Zipp's testing was not limited to the 30 mph guys like Cancellara and Zabriske. To put a myth to bed—that aero wheels don't have an aero effect for slower athletes—Zipp did a comparison of a box rim wheel, Zipp 404s, 808s and disc with winds at 30 mph, then at 20 mph. The result? The drag savings were proportionally identical between wheels, with the 404 having only half the drag of the 20-spoke 24mm deep box section rim at both 20 and 30 mph. So yes, even you can benefit from aero wheels on race day.

At the end of four days in a dark wind tunnel at \$850 per hour, Ording and Poertner emerged to the bright SoCal sunlight, thrilled with the results. "We learned so much," Ording says, "but much of it wasn't what we thought we'd learn. After a hard first day, we learned a lot the second day. It's been well worth it. And this test on this disc... this is a big achievement."

Poertner concurs, summing up the never ending chase for the fastest wheel in the world. "As we say in our engineering department, 90 percent there, 90 percent to go." **E**