

In the Colorado Premier Training Wind Tunnel – Don't Leave Valuable Time out on the Course
By: Coach Peter Cummings

I have been coaching now for quite a few years and in that time I have helped train and position (bike fit) at least eight (8) State Time Trial Champions, two (2) National Time Trial Champions, a handful of National Time Trial Podium finishers and more than a dozen other very successful Time Trialist. My Fort Collins, Colorado wind tunnel experience was great. I am still learning, every day!

One tool that has really helped me learn more about helping people go fast is the power meter. You see, it is the power meter that allows me to see the power output and the result (speed) of that power output. When you see certain power outputs you expect to see certain speeds. If you don't, you know it is time to start looking for the seconds (or minutes sometimes) that are being left on the table. In this article you will read about how the wind tunnel is measuring similar things and reporting them in a slightly different, but very interesting way.

On January 12th2008, I went to the Colorado Premier Training Wind Tunnel in Fort Collins to figure out why one of my athletes wasn't riding as fast as I would expect him to ride considering his power data. You see, Will's power output and the fact that he was using identical equipment and similar fitting methodology (mine) to some of my other athletes and not getting similar results showed we had an issue. More importantly, we knew after comparing power files and insuring the power meter was properly calibrated that some power or speed was being lost in his aerodynamics.

Robby Ketchell would be our guy in the Tunnel. When we got my athlete, Will O'Donnell, in the tunnel Robby immediately mentioned that Will's baseline measurements were actually as good as some of the pros he has worked with for hours. This is the second time I have heard this about my athletes from wind tunnel experts. So, while Robby confirmed Will's position was fast, we still knew there was more to be gained. As you may recall from my visit to the MIT wind tunnel with Steve Goldman, Steve also achieved a "sick" baseline drag number and that we made few if any changes while there. But, more importantly,



Will's Baseline Position - Fast but not good enough!

Steve is Will's teammate with Westwood Velo in New Jersey and it is Steve that uses almost identical equipment and as mentioned was fit using similar methodology. I know because I did the fit. So, it was Will's results in time trials when compared to Steve's that helped us to realize we needed to start the pursuit of these seconds.

After talking with Will on the way out to Colorado we came to conclusion that the watts that were mysteriously being lost were probably being lost in the front end, specifically in his arms. We knew we needed to look at this area

closely. This year, we had already focused on getting his head lower, "Face to hands" as I like to call it, with good results. So, we aimed at testing helmets, head positions and arms position.

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We started with head position and arms. We tried to form a better "unity" between his head and arms almost as though we were trying to make them one unit and close up any holes between them. These holes were between his arms and between his hands and face. You see, the air, or wind reacts with what it comes in contact with and with arms apart it is contacting and creating two separate contact points, and separate flow and exit systems. By bringing Will's arms together we were able to create one contact point with the flow going around the arms and exiting off each arm. This cut back the amount of air that was "tripping" behind his arms. While my description of this change might not seem to make a big difference the result was a drop in his overall drag by 4.2%. That is significant. We knew we were headed in the right direction.

We then moved on to examine his head position. So, that last improvement was accomplished by arms being brought closer together and with a slight praying mantis position. Now we tried to close the hole between his head and hands. Just telling him to train to keep his head down is one thing we already have done. Something I have heard was that one of the advantages of the praying mantis position was that it was actually easier to hold your head down. It seems that in this position the shoulder and upper back muscles were more relaxed. So, we tried raising his hands a bit, or in other words a slightly more extreme praying mantis type position. Again, this showed a drop in his overall drag to the likes of 9.2% from baseline. This was dramatic.



Robby Ketchell and Coach Cummings are using Tufts to see how the air flows over Will and the bike. Will's New Position – It is fast but can he produce power?

Now that we felt we had a much better position we wanted to know the best helmet for this position and his body type. At this point we tested the Bell Meteor, the Giro Advantage 2, the UVEX TT helmet, the Rudy Project TT helmet and the LAS helmet. I had a feeling from what I was seeing that the UVEX was going to be our winner and sure enough the data confirmed we had attained an overall 10.5% reduction in drag with this new position and helmet combo.

What does this all mean? In theory, CPT's reports show what power output it takes for person with Will's drag to ride at 30mph. Their formula assumes other reasonable constants for

rolling resistance, air density etc. So, what was the conclusion? Our changes reduced the wattage Will needed to go 30mph by 28 watts or slightly over 10%. If you don't use a power meter you may not realize how big that is but it is huge. Another way the CPT report explains this change is in Seconds it will take to travel 1kilometer presuming you are producing 350 watts. As an improvement from his baseline, when Will is producing 350 watts he will now travel each kilometer 5.2 seconds faster than he did. Do the math. Over a 40km TT that works out to be a little over 3 min faster! How would you like to find a little over 3 minutes in time for your 40km?By the way, Will can produce 350 watts!

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Did I mention theory? Oh yeah, Will has never ridden in this position. How do we know he can even ride this position let alone produce power in it? This was our next step, verification. We now went down stairs to the Velotron. For those of you that don't know the Velotron is a totally customizable, computerized ergo meter that is extremely accurate. You see we then took the measurements from Will's new position using a transfer square and duplicated this position on the Velotron and got him warmed up to test.



Duplicating the New position on the Velotron

It just so happens that we tested Will's power output at 10 beats under his 30 min sustainable HR just 3 days before heading to the wind tunnel. So we knew exactly what power he could produce somewhat comfortably (171bpm) in his old position. We needed to insure that this new "fast" position netted us a speed increase, or in other words didn't lose more power due to poor biomechanics than it gained us in drag reduction. So, after we warmed him up we dialed in the intensity to get his HR up to 171bpm. Well, after holding 171bpm for 15 minutes we had our answer. Will was not able to produce the same power in his new position. He was actually losing 14 watts in this new position but this wasn't so bad. Remember, we had gained 28 watts in drag reduction and this was Will's first time in this new position. With training, it is January, we had plenty of time to acclimate to this new position and potentially gain some of those 14 watts back.



Verification - It is faster and he can produce power

So, what is the real bottom line? In a few paragraphs earlier I suggested the 28 watts gained in aerodynamic improvements would get Will over three (3) minutes faster in a 40km Time Trial but we didn't really gain a total of 28 watts. We netted 14 watts. So, what will those net 14 watts mean to his 40km time? Well, according to the calculations we are talking about 2.7 secs faster per kilometer or in other words for a 40km time trial Will has the potential to be one minute and forty-seven (1:47) faster in this new position before any adaptation.

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After we packed up the bike and equipment we loaded up the van and started our hour drive back to Denver. As we drove down the highway I asked Will what the total cost of the trip was including airfare, hotel, tunnel time and power verification. He totaled it up to about \$1600. Now, I think it is time to ask the question was it worth it?

I see it being WELL worth it. Consider this, (and this was verified from one of phone conversations with Robby after the tunnel testing as well) the rider makes up between 80-85% of the aerodynamic total while the bike makes up 15-20% of that total. The difference between a bike that uses round tubes and 32 spoke Aero rims (nothing special) with clip ons and an aero tubed Zipp Disc, 808 front wheel is probably in the neighborhood of 5-10% from BIKE TO BIKE, not of the total. With no changes in equipment, other than the helmet, we gained 10.5% improvements in aerodynamics by changing Will's position for \$1600. What would it cost to upgrade your round tube, 32 spoke Aero Rim (nothing special) bike with clip ons to a Cervelo P3C, Zipp loaded machine? Do you think \$1600? I think Not!

*Now with that said I highly recommend an aero bike and aero wheels. I am not downplaying their importance in the outcome of Big races that are often being decided by tenths of seconds. I am saying if you haven't looked into getting an aero fit and power verification I would HIGHLY recommend it over spending too much more on equipment. Tip - If you are looking for one of the cheapest ways to get better aerodynamics, (Robby verified this as well), and I have been saying this for years, **Get an Aero Helmet!** For \$150-200 an aero helmet really cleans up one of the most unaerodynamic areas a rider has. But if you are looking to do your very best, buy good aero equipment. Most of the top end stuff will suffice, BUT DEFINITELY get into the wind tunnel and optimize your position.*

One last note, we did a baseline on Will's "bikeonly" when we started and we also did a baseline "bike only" with the bike in its new position. The "bike only" now has worse aerodynamics by over 3% from when we started but as I told Will, "Until you can get the bike to do the Time Trial on its own, that just won't matter." One more Tip – you can have your bike race Will's bike, but I wouldn't recommend you racing him this season.

Special thanks to Robby Ketchell at Colorado Premier Training. Robby really was great to work with and his data reporting was excellent.



Peter Cummings was certified by the American College of Sports Medicine in 1993 and is the founder of One on One Health and Fitness Center. He is a Certified and Licensed USA Cycling Level II (Expert) Coach, and Certified USA Cycling Skills Instructor. He has directed and overseen the programming of over 10,000 individual and has been racing bicycles since 1991. His many athletes have stood on podiums at Nationals, State and Local championships and have worn the Stars and Stripes National Championship Jersey. He is available for consultations, presentations, testing, programming or coaching. Those interested can contact him at Peter@Plan2Peak.com. For more articles on training, racing and other cycling specific topics by Coach Cummings visit www.Plan2Peak.com.