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Cycle aerodynamics, what a drag..

For successful time trialling, finding an aerodynamic position is absolutely essential. If you train hard to improve your performance and then fail to exploit your aero opportunities, you are throwing away vital minutes. There is a common belief that unless you are riding at 25-30mph, aerodynamics are pointless, but the research does not support this theory.

I ride slow, is all this relevant?

Enhancing aerodynamics will save you a 'specific percentage' and if you are slower, you are out there riding much longer so this percentage may work out in your favour! The various charts in this article show time savings with various aero components when riding at 100, 200 and 300 watts for a 25 miles TT, you will see that whilst riding at lower power outputs produce slower times overall, the time savings from aero equipment are potentially greater. Novices should take heart from this as should those riding longer distances of 50 miles, 100 miles, 12 or 24 hours. If you are riding long and slower, don't presume that aero isn't relevant, it definitely is.

Is size important?

One of the key performance indicators for cycling is the power to weight ratio, if you complete a maximal 'ramp test' and divide the highest power output by your body weight in kilograms, that's your figure. There is a common presumption that power to weight ratio is only relevant for hilly courses, but that presumption in wrong. Bigger riders have a greater body surface area and the power to body surface area ratio is very important for time trial performance and research has shown that if you cut a big hole through the air you will go slower than smaller riders with similar power output (Jobson et al 2007).

It's all about the legs!

The legs definitely have a lot to do with it but it isn't 'all' about the legs. The first thing you can do is to optimise your body position and make the smallest shape possible. There is an issue with getting yourself into an aero shape, it generally reduces power output, sitting upright creates a greater hip angle which is associated with more power, crouching low closes the hip angle thereby reducing power output.

Look at the cyclist picture above, the red line marks the hip angle. If the rider were to sit up the gap between the thigh and the abdomen would open and the hip angle would increase, this would help to increase power output but aerodynamics would worsen.

There is a 'trade off' between power and aerodynamics, if you are riding into a headwind you may well go quicker by riding in a more aerodynamic position despite a slight drop in power, when you are climbing slowly it's likely that you would benefit more from opening the hip angle and sitting upright.

Look at the figures below which list the drag area (cm2) for different riding positions, less drag is more beneficial:

Position	Hands	Arms	Drag area (cm2)
Seated	Tops	Straight	4,010
Seated	Brake Hoods	Bent	3,240
Seated	Drops	Bent	3,070
Seated	Aero Bars	Typical	2,914
Seated	Aero Bars	Optimised Position	2,680

**Data taken from 'High Performance Cycling' Human Kinetics Publishers, stats for 70kg cyclist.*

Developing your fitness and your ride position are the first steps to going faster, always develop your aero position before buying a new bike, once you have found the optimal position for you, go to the bike shop and tell them the new bike must match your current set up perfectly!

I've got money to spend!

Lucky you, the tables below show time savings for various components. Some of them are relatively cheap such as bolt on aero bars, whilst disc wheels and aero frames are relatively more expensive

Wheel Type	40km @ 100 watts	40km @ 200 watts	40km @ 300 watts
Standard	87:50	67:43	58:29
Aero Wheels	86:37	66:46	57:39
Disc and Aero Front	86:20	66:32	57:26

Handlebars	40km @ 100 watts	40km @ 200 watts	40km @ 300 watts
Standard Handlebars and Clip on Bars	87:50	67:43	58:29
Integrated Aero Bars	86:40	66:48	57:40

Frame Type	40km @ 100 watts	40km @ 200 watts	40km @ 300 watts
Standard	87:50	67:43	58:29
Semi-Aero	86:52	66:57	57:49
Full Aero	85:14	65:39	56:40

Fork Type	40km @ 100 watts	40km @ 200 watts	40km @ 300 watts
Oval Legs	87:50	67:43	58:29
Airfoil Legs	87:10	67:11	58:01

**Data taken from 'High Performance Cycling' Human Kinetics Publishers, stats for 70kg cyclist.*

You can see that time savings for wheels and frames are relatively similar with aero frames saving more time at higher wattages. The first step is definitely a set of bolt on aero bars if you enjoy riding your road frame (or don't have a separate time trial bike) and next a set of aero wheels. Some riders have specific road and time trial bikes and if you are considering this option, there are some basic guidelines you need to take into account.

Helmet choice

Aero helmets may not look appealing in the car park but they have been shows to give up to 4% improvements in performance over a 25 miles time trial course. Some studies have shown that an aero helmet positioned effectively can give an extra 5.38 metres per watt, which equates to approximately a mile extra in one hour if you average 300 watts, possibly time to look odd and be proud?

Should I buy a time trial frame?

Your frame is a triangle made up of the top tube (runs from saddle to bars), the down tube (from bars to pedals) and the seat tube (from pedals to seat post). When you look at your bike from the side you will notice that the seat tube angles back slight so the saddle is behind the pedals. If the seat tube were more vertical (moving the saddle forwards) this would be a 'steeper seat tube angle'.

Time trial frames have steeper seat tube angles and in some cases shorter top tubes to push your forwards, this is great when you are using aero/tri bars as they place you in the perfect position but it's not great for 'sit up Sunday riding'. Road bikes by comparison are great for 'sit up Sunday riding' but when you bolt on the aero bars in most cases you will be stretching a little too far.

Time trial bikes are great for riding fast in straight lines and that is what they are generally used for, they are not so great for cornering, descending and climbing due to the frame geometry. Think about the events you will be doing before spending a lot of money on a new bike which doesn't do the job.

I have a road bike only but want to time trial

There are a couple of simple things you can do to turn your road bike into a time trial machine. We have already outlines above that generally you will reach too far if you add aero bars to a road bike so to reduce the reach either:

1. Buy mini aero bars (these are easy to find and go no further than the end of your brake hoods) and this reduces reach by bringing the front of the bike back towards you.
2. Buy a forwards angled seat post (this is a seat post with a forwards bend and replicates a steeper seat tube angle) and this reduces reach by pushing the saddle forwards.

Pushing the saddle forwards (forwards angled seat post) puts you in a powerful forwards position but isn't great for your 'sit up Sunday riding' as outlined earlier. Buying short aero bars doesn't affect your 'sit up Sunday riding' but the position isn't as powerful (and potentially not as aero), as you are not as far forwards.

One simple solution is to have 2 seat posts with saddles permanently attached and the correct heights marked on the posts. When you ride a time trial or triathlon event put your tri bars on and your forwards angles seat post, after the event, take off the tri bars and put your normal seat post back in. It will take you 2 minutes to swap posts and saddles and cost you £100 for an extra post and saddle.

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