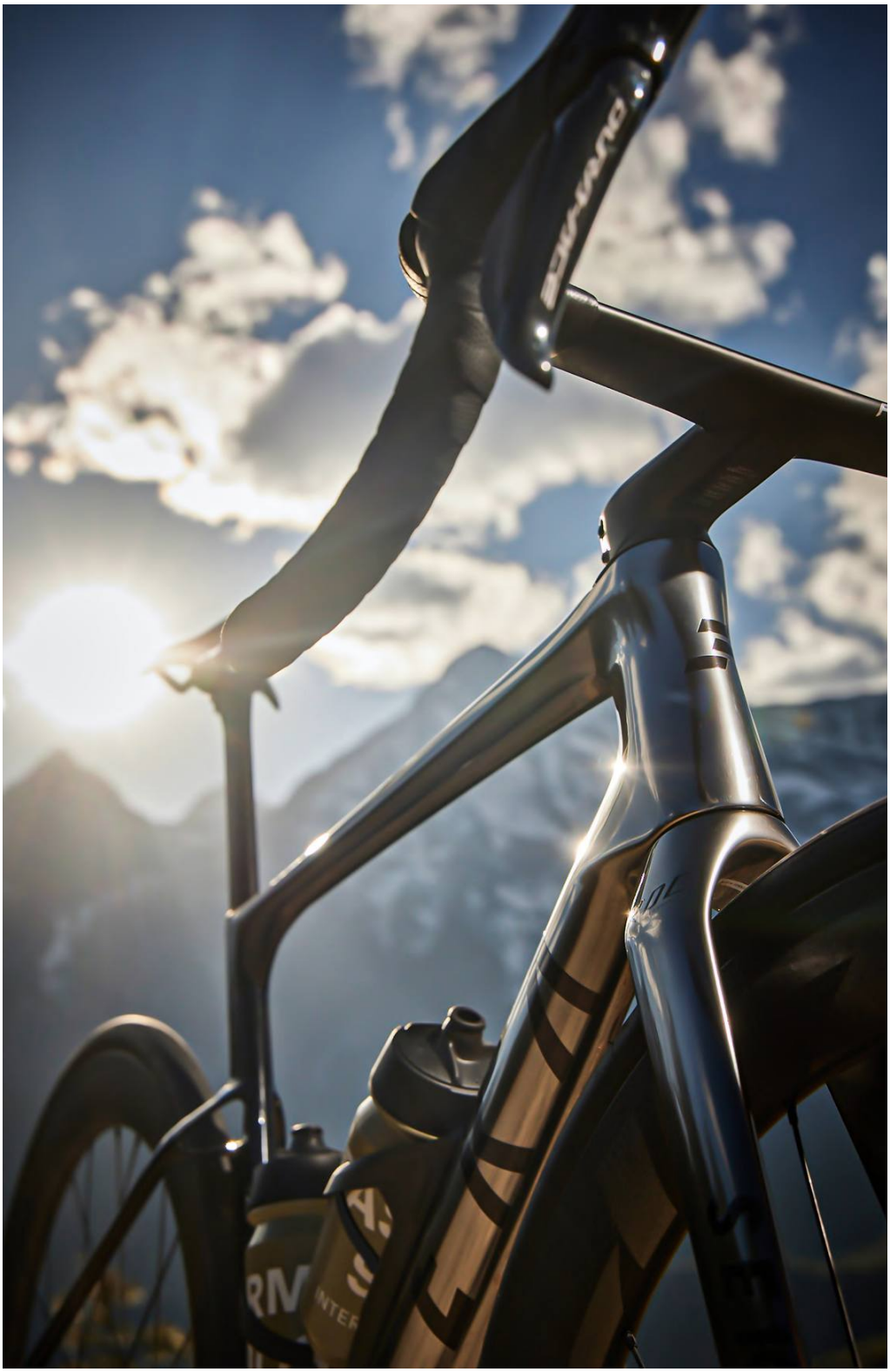
Spear Redefine your limits

Product Development Manual







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SEKA Bikes
Creating Extraordinary Products

What kind of road bike do you need?
This is the profound question SEKA Bikes has been the most concerned with and has been pondering for several years. If we put in our utmost effort, how excellent of a road bike could we make?
For three years, we have been constantly exploring, experimenting and trying, and Spear is our answer to that question!

It is simple to set high and ambitious goals, but achieving them is very difficult.
During the development stages, we continuously encountered problems and challenges and it would have been easy to make some compromises but that is not SEKA Bikes.

From the beginning to the end, our unwavering determination to face difficulties and never comprpomise on our vision is driven by one core belief: SEKA Bikes is committed to creating extraordinary products

Spear Data Overview

Air Drag
-6 WATTS*

Through CFD (Computational Fluid Dynamics) and wind tunnel experiments, we have optimized the tube design to significantly reduce the frontal area and control turbulence with the "Win Eye" (patent pending) structure, achieving a smooth airflow transition. Compared to Exceed, drag is reduced by 6 Watts.

Frame Weight
685 GRAMS

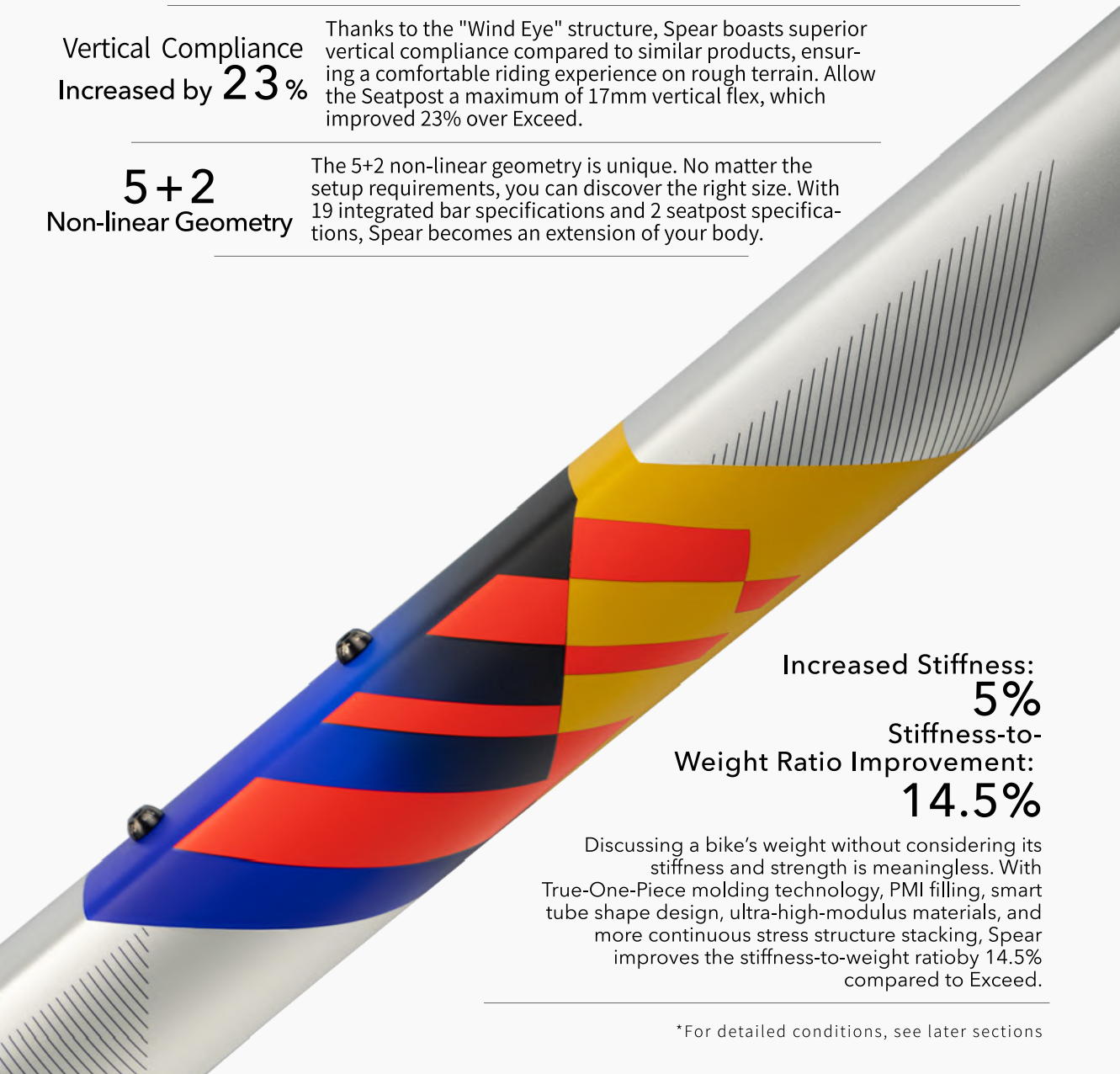
Spear uses the most advanced carbon fiber materials available on the market. With our self-developed stacking solutions and through dozens of iterations, each piece of carbon fiber cloth is precisely positioned and functional. Adding TeXtreme and ultra-high modulus pitch-based carbon fibers further enhances the product.

Vertical Compliance
Increased by **23%**

Thanks to the "Wind Eye" structure, Spear boasts superior vertical compliance compared to similar products, ensuring a comfortable riding experience on rough terrain. Allow the Seatpost a maximum of 17mm vertical flex, which improved 23% over Exceed.

5+2
Non-linear Geometry

The 5+2 non-linear geometry is unique. No matter the setup requirements, you can discover the right size. With 19 integrated bar specifications and 2 seatpost specifications, Spear becomes an extension of your body.



Increased Stiffness:
5%
Stiffness-to-Weight Ratio Improvement:
14.5%

Discussing a bike's weight without considering its stiffness and strength is meaningless. With True-One-Piece molding technology, PMI filling, smart tube shape design, ultra-high-modulus materials, and more continuous stress structure stacking, Spear improves the stiffness-to-weight ratioby 14.5% compared to Exceed.

*For detailed conditions, see later sections



Everything starts with the tube shape!

Tube Design

From the first sketch, we had a clear vision for Spear and tube shape was a key concept in Spear’ s design. Since tube shape affects aerodynamic performance, cross-sectional shape determines the frontal area and turbulence management. Tube shape affects weight; NACA profiles have excellent aerodynamic performance but are not the best choice for lightweight bikes. Tube shapes with shorter wall perimeters have a lighter weight but make compromises on aerodynamics and stiffness.

Tube shape affects stiffness. Circular tubes are ideal for enhancing stiffness but result in higher drag. So, is it best to strike a balance with each performance indicator in a mediocre way? For us, it was not. Spear does not want to sacrifice any performance aspect.

Thus, we introduced the concept of **"Sectionalized Design,"** where each tube in the frame has its specific function. in the frame has its specific function.

The slender rear triangle ensures rear-end comfort and contributes to weight reduction.

The unique "Wind Eye" (patent pending) structure optimizes turbulence while enhancing vertical compliance, achieving two goals simultaneously.

Compressing the front tube shape reduces the projection area and improves aerodynamic performance.

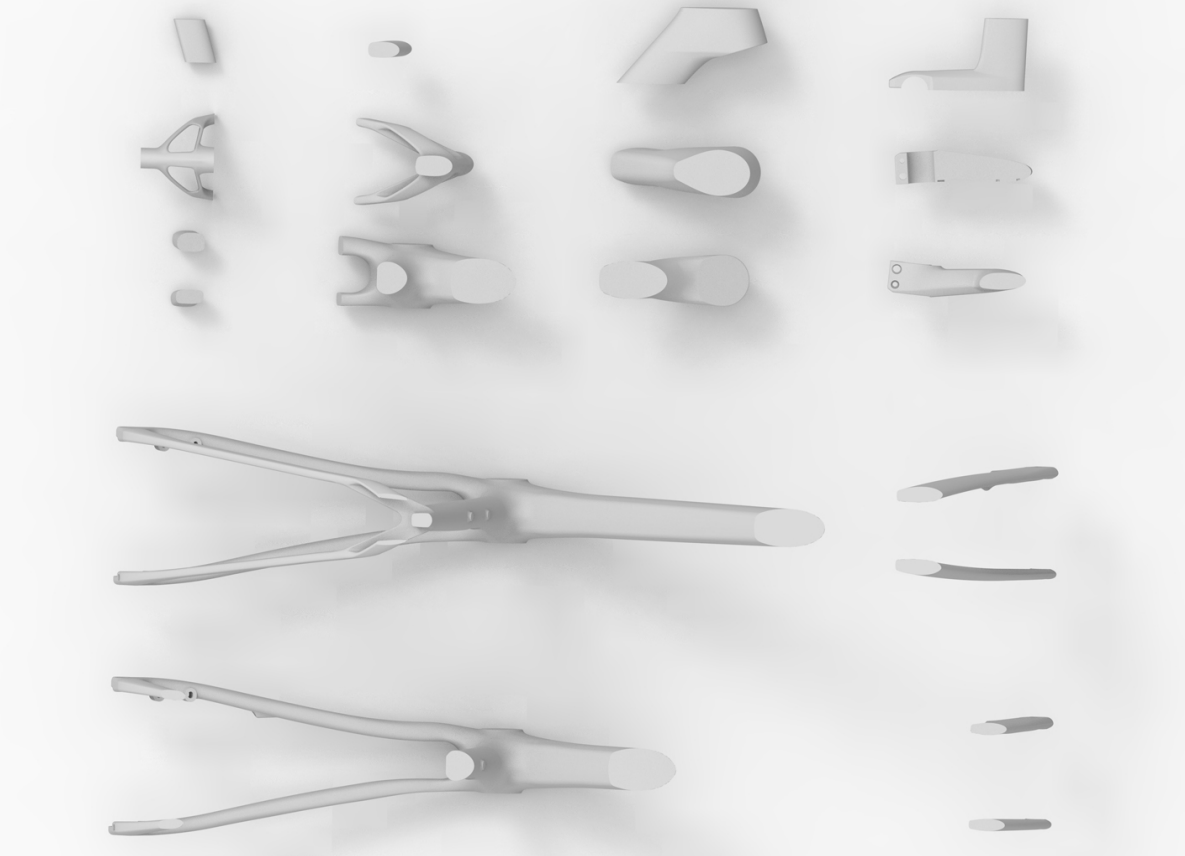
We optimized all rear-end shapes of the tube profiles based on NACA shapes to reduce low-pressure area turbulence.

The front fork uses NACA profiles, increasing the gap between the front wheel and fork to enhance airflow and reduce turbulence from airflow collisions.

The BSA threaded bottom bracket ensures stiffness while further compressing the bottom bracket volume to reduce weight.

The sleek Rapier integrated handlebar reduces the frontal area by 17% and 2% compared with the first and second-generation Exceed’ s integrated handlebars.

Respectively the "Sectionalized Design" concept, combined with advanced materials, science analysis, and manufacturing processes, ensures Spear does not compromise on any performance aspects.

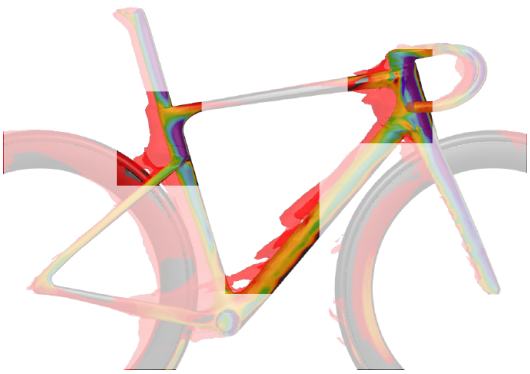


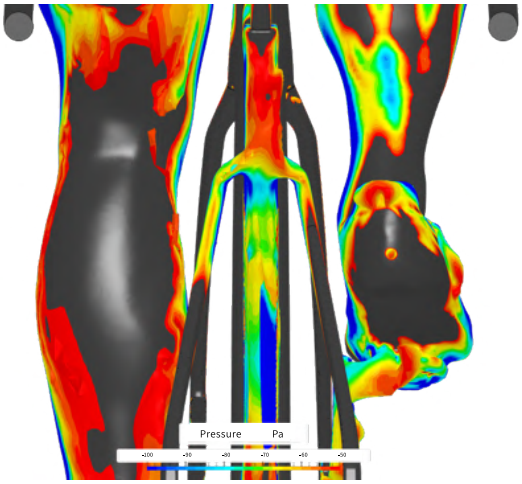
Developing and iterating tube shapes based on CFD was crucial in Spear's design evolution.

Although analyzing individual tube components is faster and simpler, comparing entire frame models is more meaningful and beneficial to development progress. Therefore, when selecting basic tube shapes, we built complete models for comparison.

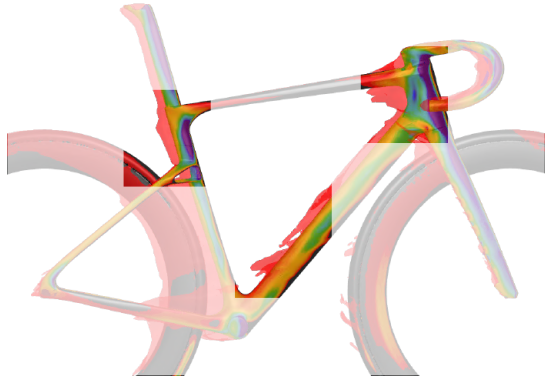
Proto A was an early design version of Spear without the "Wind Eye" structure, 4mm less head tube depth, and a lighter tube shape setup for the down tube.

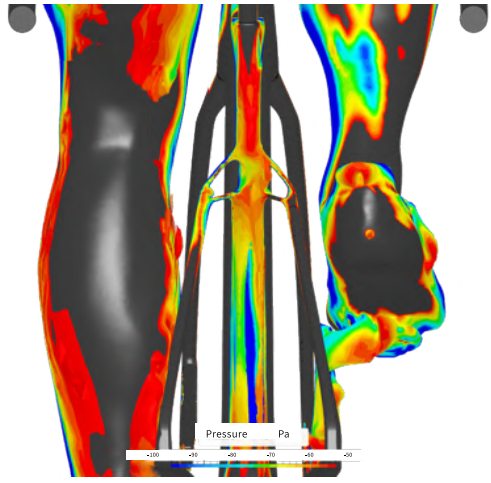
Through CFD analysis you can quickly clarify design direction and measure benefits, reducing trial and error and making advances in the wrong direction during development.





Proto A
Features a common aerodynamic rear stay shape without the "Wind Eye" structure.





Spear
Has a more slender and rounded rear stay shape with the "Wind Eye" structure.

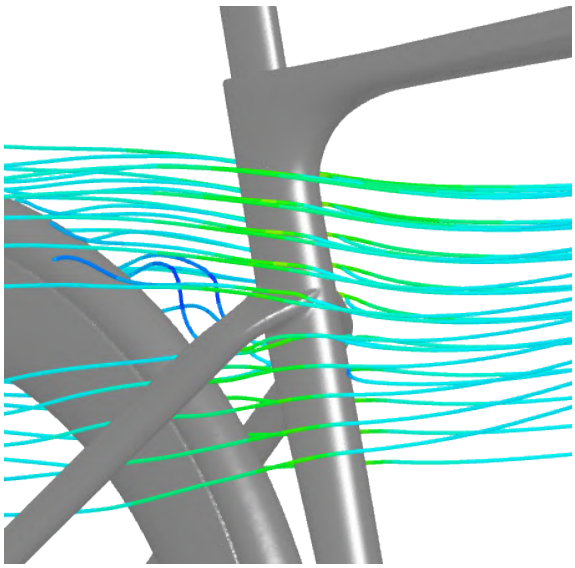
CFD analysis compares both static and dynamic pressure for both models. By comparing the low-pressure areas behind the head tube, downtube, and seat tube, it is evident that Spear has significantly optimized these areas compared to Proto A.

Is there a structure that can optimize drag reduction while bringing revolutionary comfort improvements?

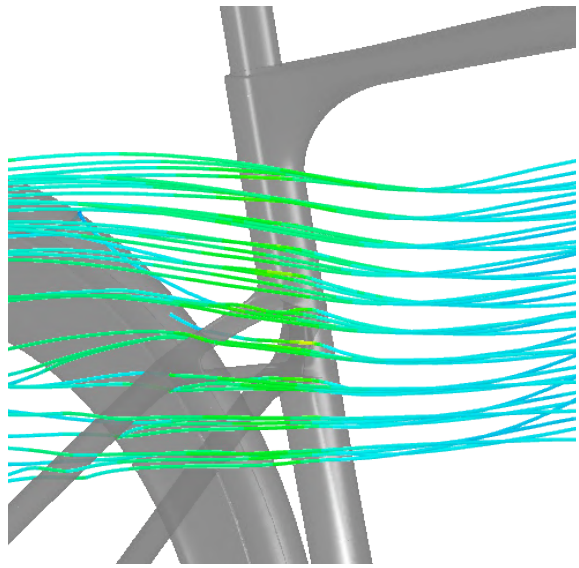
"Wind Eye" (patent pending) is our ground-breaking innovation for Spear!



CFD analysis played a crucial role in the aerodynamic design of the "Wind Eye." We conducted CFD simulation analysis for both Proto A and Spear models: Proto A with conventional aerodynamic rear stays and Spear with the "Wind Eye" structure.

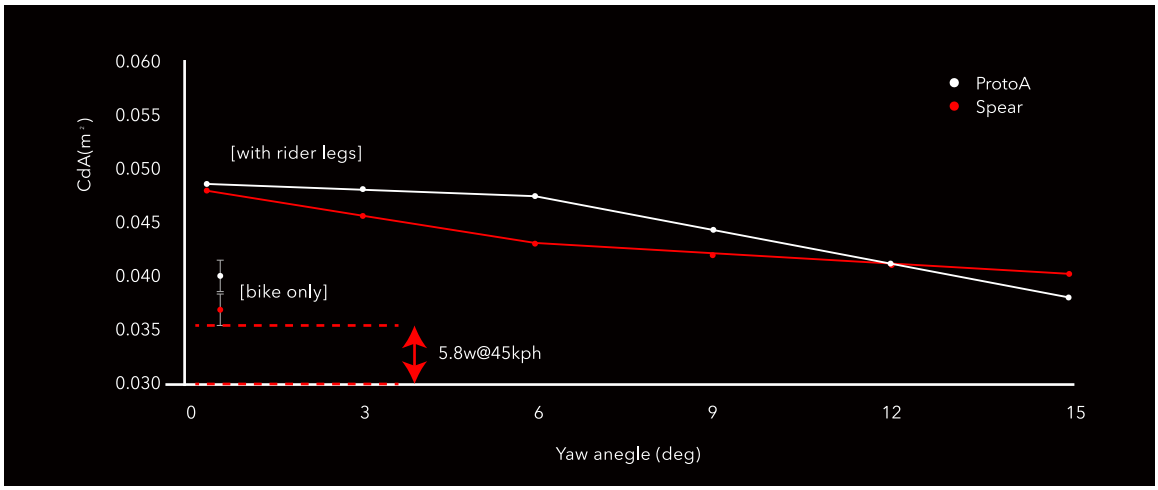


Proto A



Spear

Speed streamline diagrams show that "Wind Eye" intuitively suppresses turbulence caused by low-pressure areas at the seat tube and rear wheel.



CFD comprehensive simulation analysis indicates that "Wind Eye" can save 2.66 Watts for the Spear frame set at a relative wind speed* of 40km/h.

*For the definition of relative wind speed, please see below

The "Wind Eye" has two triangular shapes that effectively mitigate
vertical impact forces from severe bumps and dampen subtle road
vibrations before they reach the seatpost.

The three-dimensional space formed by the thin structures creates an "airflow accelerator," reducing turbulence in the low-pressure area behind the seat tube, allowing part of the turbulence generated by pedaling to pass through this area more quickly.

To achieve the final aerodynamic and shock-absorbing effects, we iterated the "Wind Eye" design subtle adjustments 20 times. Combining CFD and real-life testing, we found the optimal solution.

Spear's vertical
compliance reaches

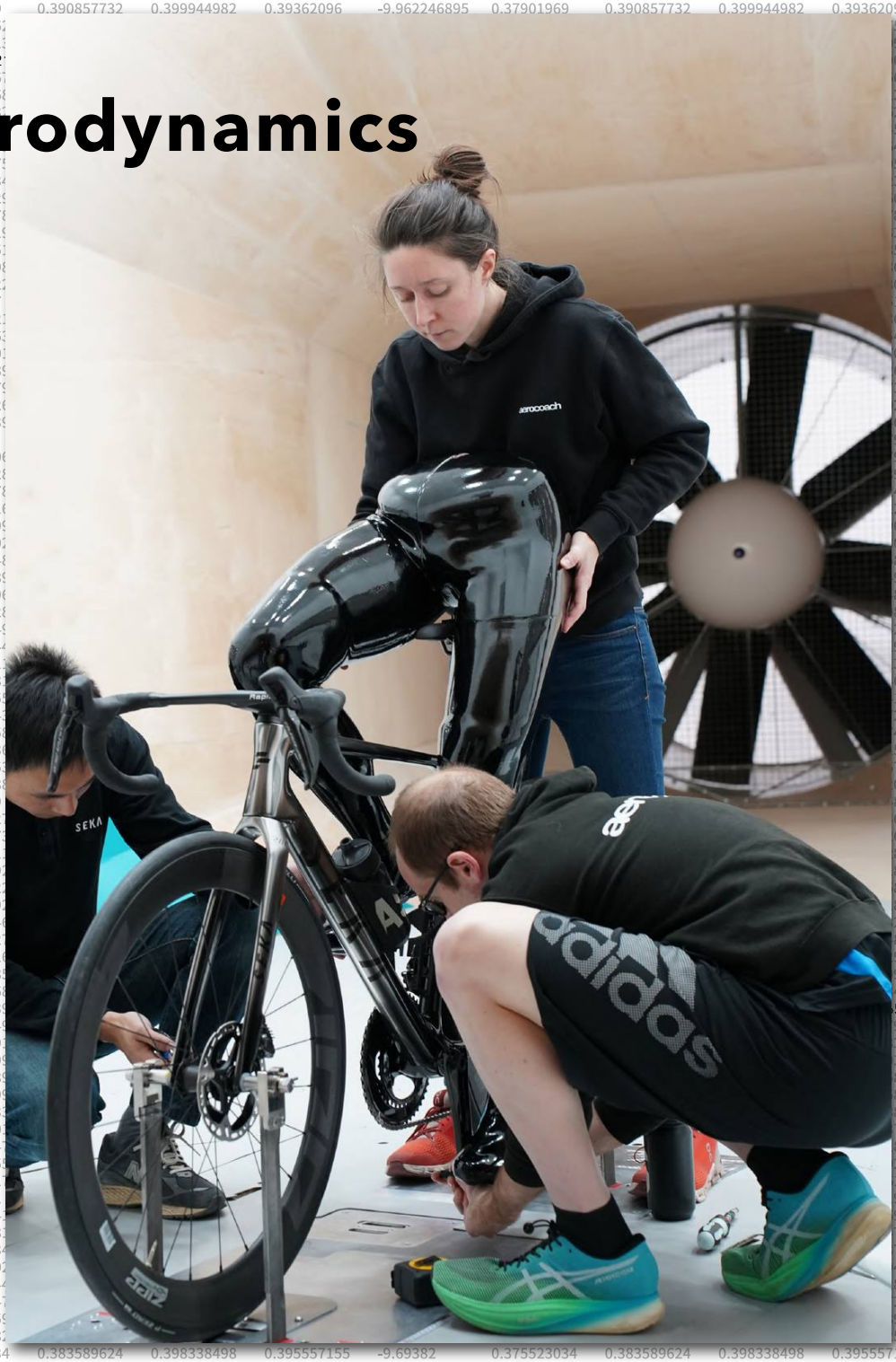
109N/mm

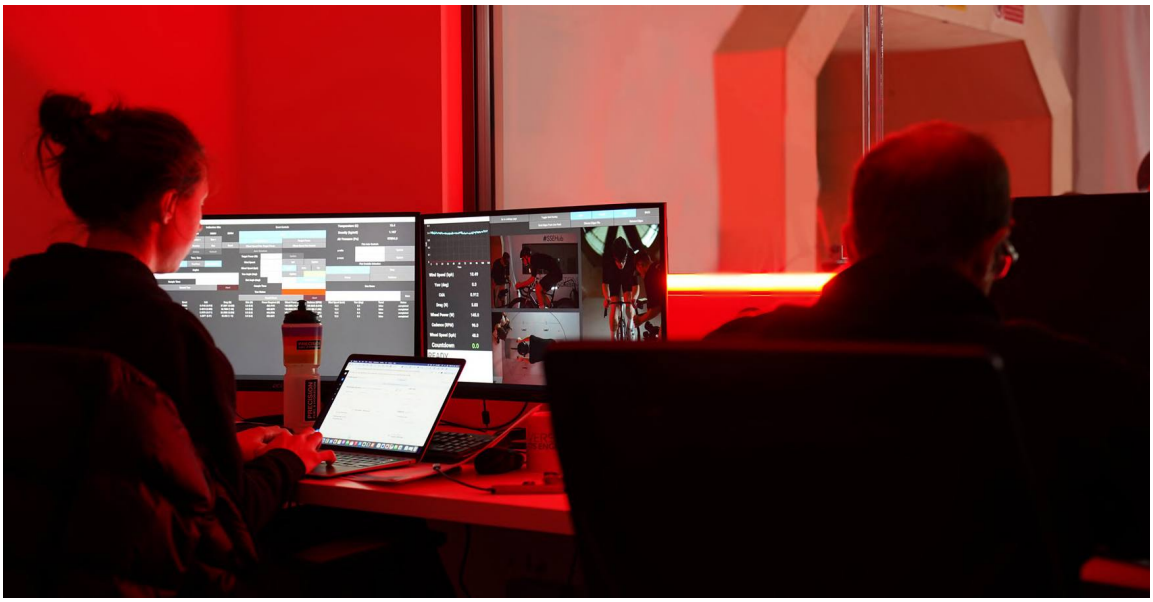
a **23%** improvement
over Exceed
(based on ISO seatpost fatigue testing methods)

Significantly enhancing riding comfort on bumpy roads or rough terrain.



Aerodynamics





Explanation of Data & Concepts:
Earlier, we mentioned that the shape of the frame' s tube shape is a major factor affecting the aerodynamic performance of the frameset. We will provide a brief explanation of the science behind it using an air resistance equation.

$$F_D = 1/2\ \rho v^2 C_D A$$

F_D : Drag

ρ : Air Density

v : Relative Wind Speed *

C_D : Coefficient of Aerodynamic drag.
It is a factor describing the impact of an object's shape on air

A : Projected Area of the Object in the Direction of Motion

*For the definition of relative wind speed please see below

v Relative Wind Speed (with different Yaw Angles)

The speed value set in wind tunnel tests refers to the relative wind speed between the wind and the rider in real-life biking conditions, rather than just forward speed. The calculation of the yaw angle involves trigonometric relationships. The diagram below explains in detail the meaning and relationship between "relative wind speed" and "yaw angle":

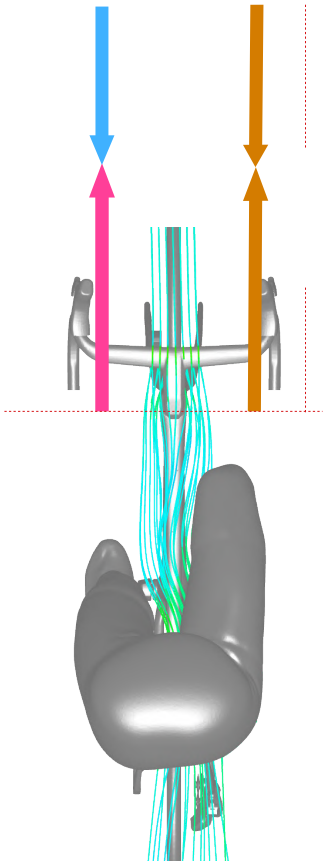


Diagram of "Relative Wind Speed" at 0 Degree Yaw Angle

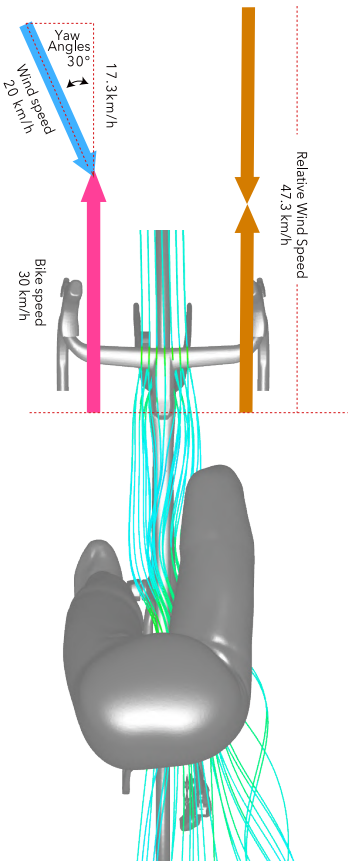


Diagram of "Relative Wind Speed" at 30 Degree Yaw Angle

C_DA Coefficient of aerodynamic drag & the frontal area

CdA is a metric used to measure an object's air resistance. It combines the object's drag coefficient (Cd, Coefficient of Drag) and its cross-sectional area (A, Area), thereby providing a value that takes into account the size and shape of the object.

The smaller the CdA, the less the product will be affected by air resistance. For tube design, the key to achieving superior aerodynamic performance is to reduce the CdA without compromising the overall performance.

Wind Tunnel Test Personnel and Facilities*1

We collaborated with the Aero-coach team to conduct wind tunnel tests at the Silverstone Sports Engineering Hub (SSEH) in the UK.

Aerocoach is an experienced team of seasoned aerodynamics experts in the cycling industry, with extensive experience and a wealth of data in aerodynamic cycling research. Silverstone is one of just a few specialized wind tunnel facilities in the world built specifically for bicycle aerodynamic testing and research.



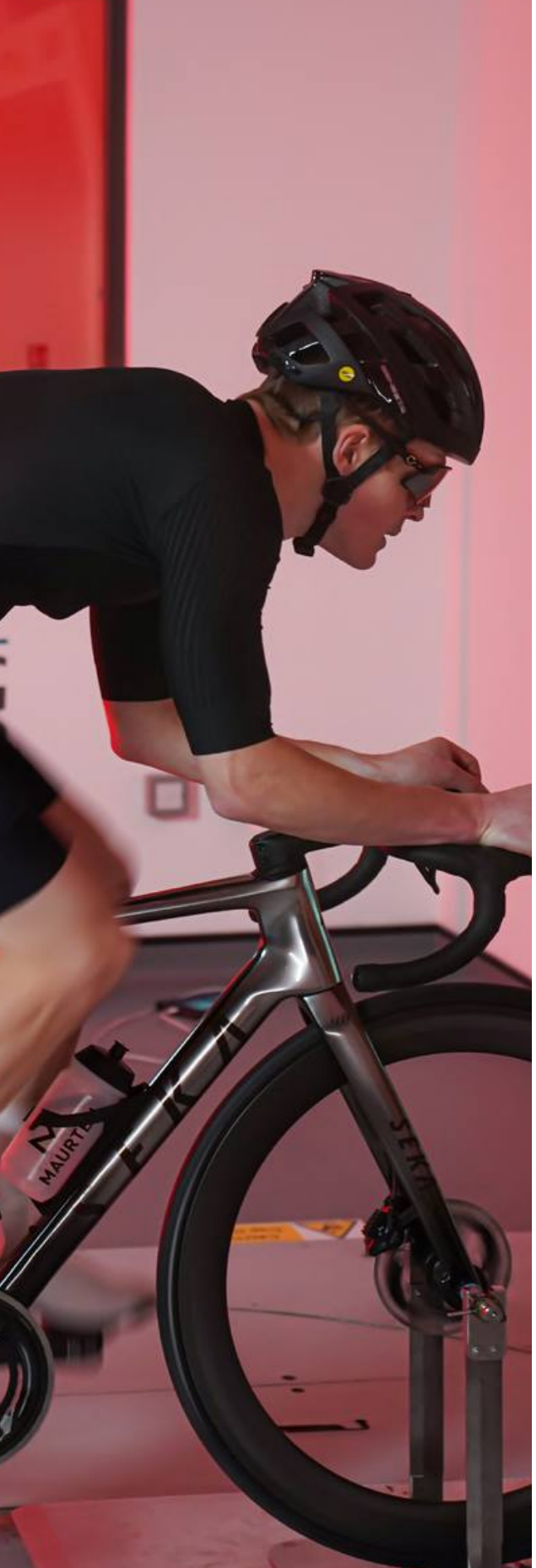
Test Reference Objects:

To fully understand the aerodynamic performance of the Spear, we selected three representative reference objects to participate in the test alongside Spear*:

SEKA Bikes Exceed RDC (Aero Road Bike)	Specialized S-works Tarmac SL8 (All-round Road Bike)	GIANT TCR SL MY24 (All-round Road Bike)

Each model is equipped with its top-spec handlebar set.
Uniform wheelset: Zipp 404 Firecrest.
Uniform tire: Pirelli Pzero 28C tubeless tire.
Uniform groupset: Shimano 9270 Di2.

*1 Detailed testing equipment settings (wheelset/handlebar and saddle height), athlete, dummy model setup parameters, see Appendix 1.
* Wind tunnel test site and Aerocoach team, see Appendix 1.



Test Setup Conditions:

Air Density: 1.2 kg/m^3
Effective Wind Speed: 40 km/h
Slope: 0%
Rolling Resistance Coefficient: 0.0055

Weighting Function calculation method:

The test is based on the Barry 2018* standard for setting weighted parameters such as yaw angle. For a long time, the Barry 2018 standard has been one of the most authoritative testing standards in the field of aerodynamics for bicycles.

* For more information on Barry 2018, please see the reference.

Test methods:

Yaw Angle Setting: -20° to +20°.
Data Collection Method: The bicycle rotates at 0.167° per second, dynamically collecting data during the rotation. Data Collection Frequency: Data is collected every 0.01 seconds, resulting in 6000 data points per minute.

We conducted multiple rounds of tests with different variables.

Half-body prosthetic legs (static):
Testing the aerodynamic performance with a stationary half-body dummy.

Professional cyclist (dynamic):
Testing with a professional cyclist in various riding postures.

Statistical calculation method:

After obtaining 280,000 sets of raw data, we conducted statistical calculations on the test data for different test items. Under a single test, the CdA data for each yaw angle is averaged from approximately 330 data points within a 0.5° range (approximately 600 data points obtained during a 4-minute test). Then, the CdA values at 17 different angles are weighted using the Barry 2018 method to obtain the final CdA comparison data.

Yaw angle	yaw angle	Exceed Hoods	Spear hoods	Giant hoods	SL8 hoods
-20	-19.91406856	0.402163822	0.39968525	0.414482311	0.402689958
-17.5	-17.52626571	0.391188947	0.38979531	0.410392325	0.3934867
-15	-15.02566711	0.388249627	0.38478568	0.409073247	0.393616372
-12.5	-12.52609303	0.383532501	0.383461651	0.403399657	0.392321528
-10	-10.02574795	0.386105226	0.386734021	0.395087744	0.387449021
-7.5	-7.526440388	0.382061129	0.38393004	0.395605874	0.381957699
-5	-5.026617804	0.386618497	0.382649696	0.396491513	0.382499512
-2.5	-2.525010373	0.390002214	0.383001421	0.398954923	0.385995455
0	-0.024078566	0.389551093	0.383573578	0.395690999	0.384060315
2.5	2.477877427	0.387846629	0.382615158	0.397981877	0.383011237
5	4.977730471	0.383318035	0.372938968	0.397264395	0.375004659
7.5	7.477453783	0.382233537	0.372418074	0.394742706	0.375151568
10	9.976648661	0.381884252	0.375317061	0.389182724	0.378129342
12.5	12.47550896	0.383459861	0.386456267	0.398046028	0.384680604
15	14.97662349	0.386082103	0.390851133	0.406340113	0.386197553
17.5	17.47366286	0.391662794	0.389959898	0.410830004	0.390181705
20	19.96375579	0.39815881	0.39435775	0.414892161	0.398799416

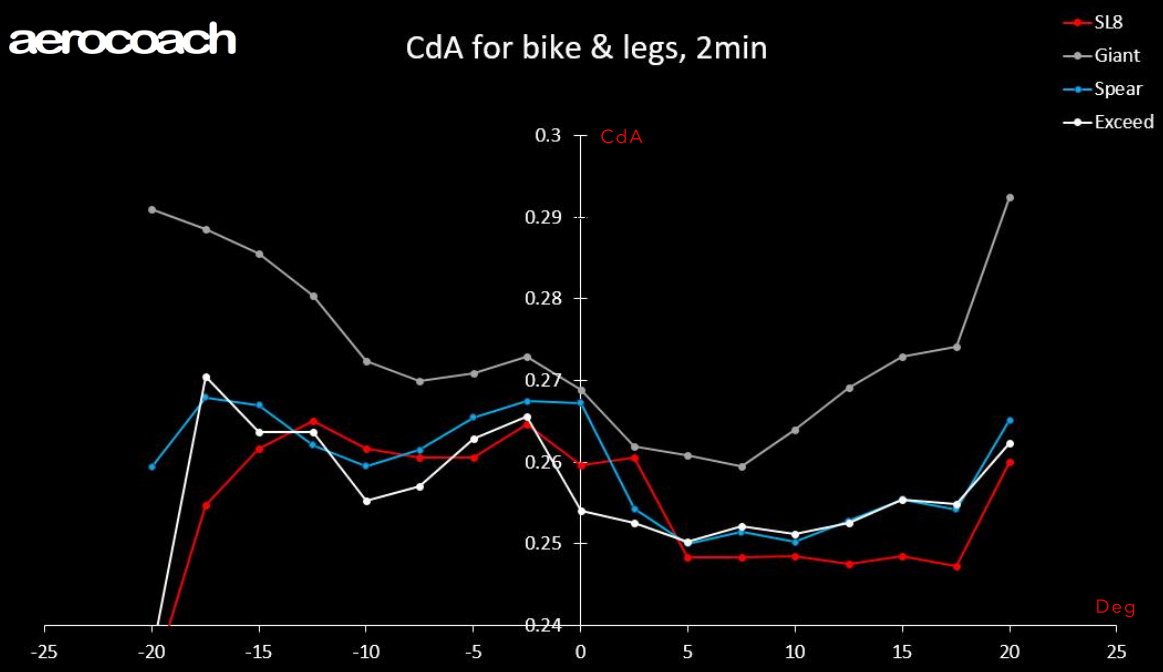
The "average CdA" after statistical calculation at different yaw angles.

Yaw angle	Weighting function (Barry 2018)	Exceed	Spear	Giant	SL8
-20	0.09	0.036194744	0.035971672	0.037303408	0.036242096
-17.5	0.158	0.061807854	0.061587659	0.064841987	0.062170899
-15	0.237	0.092015162	0.091194206	0.096950359	0.09328708
-12.5	0.377	0.144591753	0.144565042	0.152081671	0.147905216
-10	0.543	0.209655138	0.209996573	0.214532645	0.210384819
-7.5	0.683	0.260947751	0.262224217	0.270198812	0.260877108
-5	0.857	0.331332052	0.327930789	0.339793227	0.327802082
-2.5	0.952	0.371282107	0.364617353	0.379805087	0.367467673
0	1	0.389551093	0.383573578	0.395690999	0.384060315
2.5	0.952	0.369229991	0.364249631	0.378878747	0.364626698
5	0.857	0.328503556	0.319608696	0.340455586	0.321378992
7.5	0.683	0.261065506	0.254361544	0.269609268	0.256228521
10	0.543	0.207363149	0.203797164	0.211326219	0.205324233
12.5	0.377	0.144564368	0.145694013	0.150063353	0.145024588
15	0.237	0.091501459	0.092631718	0.096302607	0.09152882
17.5	0.158	0.061882721	0.061613664	0.064911141	0.061648709
20	0.09	0.035834293	0.035492197	0.037340295	0.035891947
Weighting	8.794	0.386322799	0.381977453	0.398008348	0.383426176

The "average CdA" is weighted using the Barry 2018 weighting method.

Test results:

The test results for the half-body prosthetic (static) show that the Exceed with a more complete NACA duct shape exhibits the best aerodynamic performance.



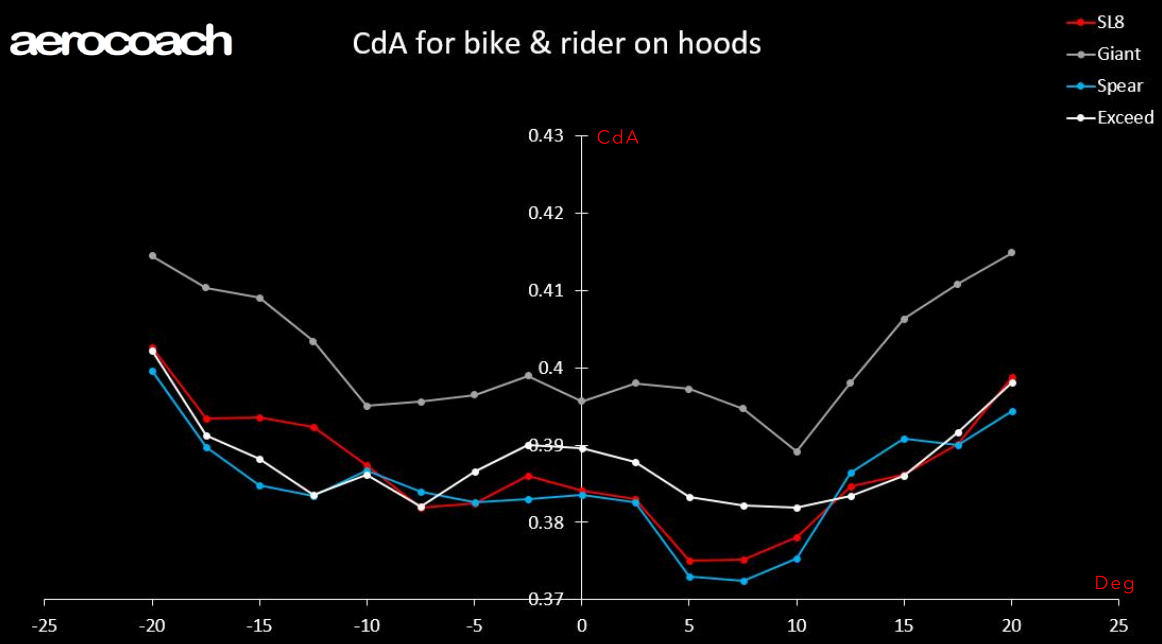
However, the excellent aerodynamic performance of individual products does not necessarily guarantee better aerodynamic benefits during actual riding conditions. In real-world riding situations, the bicycle and rider are a unit working together, and the turbulence generated by the rider's pedaling will affect the overall aerodynamic performance.



Considering both the rider and the bicycle as a whole, dynamic riding tests were conducted. Obtaining the final overall aerodynamic data is a more reasonable and reliable way to evaluate aerodynamic performance.

The results of the rider's dynamic riding test show:
The aerodynamic benefits of the optimized tubing through CFD simulation are beginning to have an impact.
At 0-degree yaw angle: The Spear RDC is slightly ahead of the Tarmac SL8, with both performing very similarly.
At 5-10 degree yaw angles: The aerodynamic advantage of the Spear RDC gradually increases.

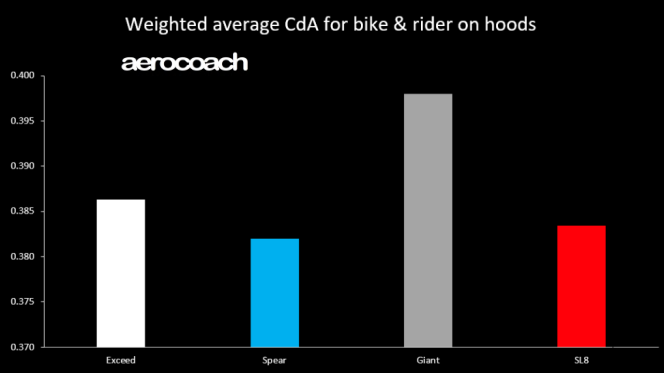
As the rider and the bicycle move forward synchronously, the turbulence generated by the rider's pedaling will contact the rotating rear wheel after passing around the seat tube, resulting in even more chaotic turbulence and increased aerodynamic drag. Due to the intervention of the "Wind Eye" structure, the Spear ultimately achieves a significant advantage in aerodynamic performance.



In comparison to the Exceed, under conditions of relative wind speed of 40kph, on a route covering 40km with 800m of elevation gain and descent.

Saving an average power of
6 watts at the same speed.

Time saved with the same average power:
15.27 seconds.



*Calculation methods and conditions, see references for details.



Stiffness, Weight, and Strength

For carbon fiber frames, stiffness and weight are two closely related properties. From a development perspective to some extent, they are also contradictory. We need to scientifically view stiffness. Excessive stiffness does not bring additional performance advantages but rather adds extra weight as a penalty. We need to study what stiffness settings and combinations can meet the needs of professional riders and, on this basis, set stiffness targets for different frame sizes. Next, the challenge to overcome is "how to reduce weight while ensuring strength and sufficient stiffness."

The stiffness coefficient is better than Exceed' s, and the weight is lighter than Exceed. This means Spear has a better stifness-to-weight ratio.

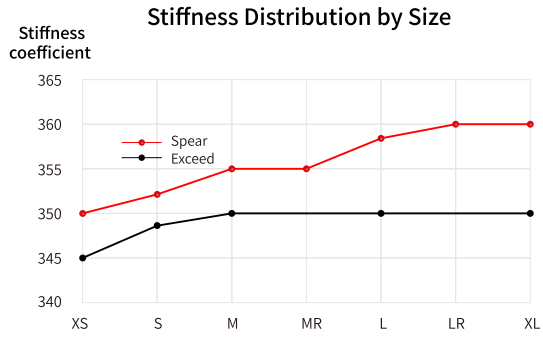
Compared to the Exceed RDC M size frame weight of 775g, **the Spear RDC M size reduces this by 90g, weighing only 685g, and the Shadow Black paint is 725g, with a stiffness-to-weight ratio improvement of 14.5%.**



The first prototype version of Spear was an astonishingly light 627g, but the stiffness could not meet our requirements.

In the second prototype version, we increased the weight to 650g, but we never stopped to discover a solution with lossless power transfer. It was only after 37 iterations that we finally achieved the set goal without any compromises on weight or stiffness.

In addition to the tube design, the choice of materials, the stacking scheme of carbon fibers, and the manufacturing process all contribute to frame performance.



Spear achieved its development goals and excellent stiffness-to-weight ratio thanks to the application of six main carbon fiber materials: TeXtreme,Mitsubishi 24T, 30T, 40T, pitch-based PITCH 65T, and PITCH 80T.

Framework Foundation - TeXtreme

TeXtreme carbon material is best known for reducing weight, increasing stiffness and strength, enhancing impact protection, and improving thin-layer damping performance. Its weight is only 20 grams per square meter, making it the ultimate choice for manufacturing ultra-light composite materials. However, the cost of TeXtreme is about three times that of Toray T800 carbon material. The addition of TeXtreme to Spear saved 10g of weight in Spear's innermost layer, giving us more room to adjust the external stacking and enhance stiffness and strength while keeping the same lightweight.

MITSUBISHI CHEMICAL

PYROFIL™

Comprehensive and Stable Materials

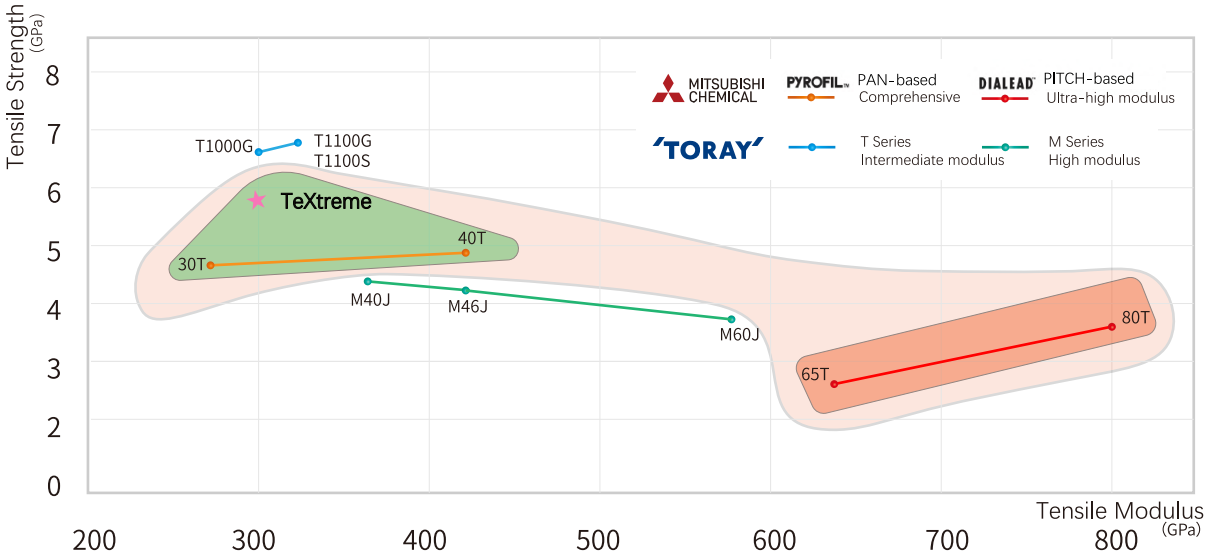
We use PAN based 30T and 40T as materials with comprehensive performance. FAW69 (Fiber Area Weight per unit area) implies lighter weight, more flexible stacking layers, and more stable resin loss rates, compared to T800 and T1000. This makes them the perfect choice for a foundation to build upon allowing unrivaled performance benefits.

DIALEAD™

Ultra-high modulus Pitch-based materials

To achieve higher stiffness requirements, it was only possible to achieve the goal by adding higher modulus pitch-based materials. We appropriately used PITCH 65T and PITCH 80.

In static bench tests, the modulus of PITCH 65T reaches 2.1 times that of T1000, and the modulus of PITCH 80T reaches 2.5 times that of T1100. The addition of these two materials takes Spear's stiffness index to a vnew level.



Tensile Strength: This is the maximum stress that a material can withstand while being stretched or pulled before breaking.
Tensile Modulus: This measures a material's stiffness or rigidity, specifically its ability to deform elastically under stress.
*Data from TORAYCA® Carbon Fiber and Mitsubishi Chemical Carbon Fiber and Composites.





Self-Developed Carbon Fiber Stacking Solution

Each Spear is made up of 350 pieces of carbon fiber cloth from six different types of carbon fiber materials. This was the result of more than 30 experiments to achieve our initial physical property goals through continuous optimization.

The proportions of each material were carefully calculated, and the size and shape of each piece of carbon fiber cloth were repeatedly tested by our engineering team to ensure that the size and angle of placement of the carbon fiber cloth could perfectly perform its required function. This avoided redundant stacking that does not contribute to performance.

Without the continuous efforts of our engineering team's stacking experiments, Spear would not have achieved the light weight of just 685g.

True-One-Piece Molding Technology

Spear uses the latest full one-piece molding process.

Compared to traditional frame manufacturing process, where tubes are produced from 3 or 2 molds and then glued together, the True-one-piece molding technology uses one mold to form a complete frame. This avoids the gluing of parts together, significantly enhancing the overall stability of the frame.

In addition, by reducing the tube stacking of glued parts, each Spear’ s weight is reduced by 25g compared to traditional molding methods.

This weight reduction provided opportunities for further strength and stiffness improvements.

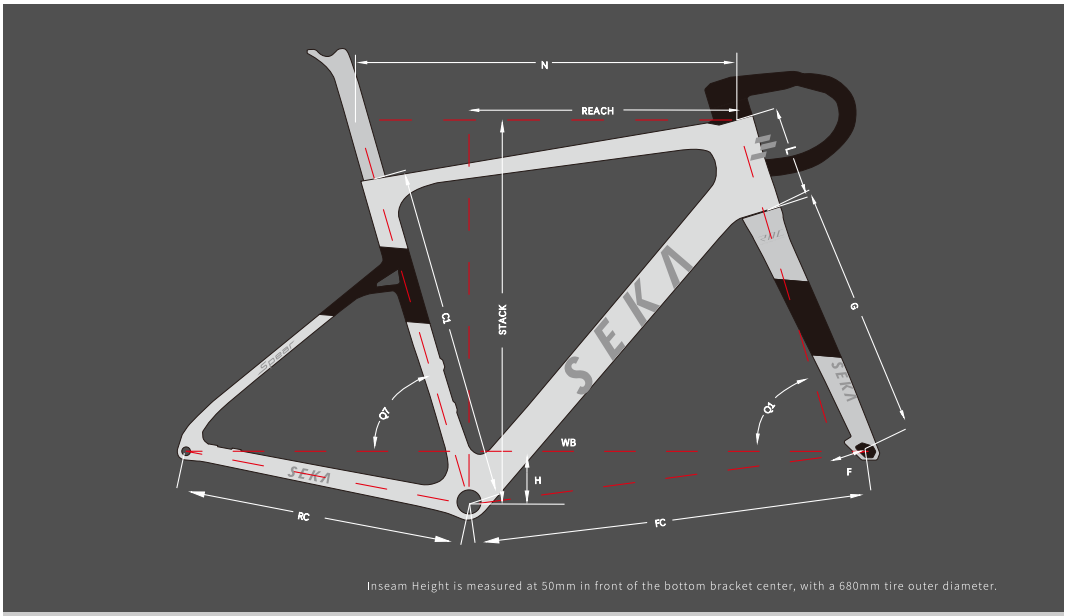


More stringent testing standards:

Testing for critical components was several times higher than the ISO standards.

For example, the seat post fatigue test the ISO standard requires testing at the rear of the seatpost, 70mm from the center, for 50,000 cycles under a load of 120kg. The Spear's testing standard required testing at the rear of the seatpost, 85mm from the center, for 150,000 cycles under a load of 144kg.

5+2 Non-linear Geometry



Inseam Height is measured at 50mm in front of the bottom bracket center, with a 680mm tire outer diameter.

Frame Geometry & Size Height Chart

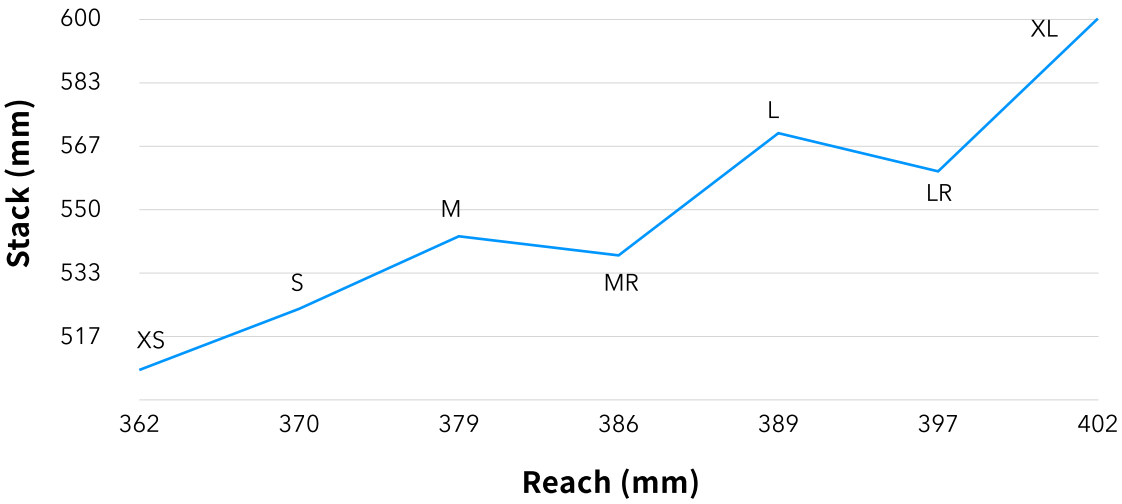
SIZE	STACK	REACH	TRAIL	C1	RC	H	FC	WB	L	N	Q1	Q7	F	G	Inseam Height (mm)	Recommended Height (cm)
XS	508	362	68	449	410	74	570	969	107	498	70.6	75	48	372	725	150-163
S	524	370	62	463	410	74	574	973	120	514	71.7	74.8	48	372	738	161-173
M	543	379	58	480	410	72	574	973	136	534	72.9	74	44	372	759	170-180
MR	538	386	58	476	410	72	578	978	130	540	73	74	44	372	753	171-186
L	570	389	58	508	410	72	591	990	164	557	73	73.5	44	372	786	177-187
LR	560	397	57	496	410	72	585	995	153	563	73.1	73.5	44	372	774	179-194
XL	600	402	55	535	410	72	608	1008	193	585	73.5	73	44	372	814	185-198

3 years ago, based on our research vast number of fitting data, we formulated the geometry structure for Exceed that better fit the body proportions of most riders. Compared to most aerodynamic or comprehensive models, Exceed has a more reasonable distribution of Reach and Stack, enhancing riding comfort with optional integrated handlebars and seatposts.

However, we also found that a choice of 5 sizes was too limited, and for a small number of riders with more aggressive fitting.

We aspire that the geometry of Spear can meet the needs of all riders, whether they are riding for a competition or just comfortable riding. How can this goal be achieved through a limited number of sizes?

Combining our team's many years of experience in bike fitting, we came up with the "non-linear geometry" scheme.
Combining the geometric data of each size, we interspersed two Racing sizes among the five regular sizes.
That is 5+2, a total of 7 sizes.



We maintain our design philosophy across five standard sizes featuring shorter Reach and higher Stack measurements. This allows riders to easily remove spacers and use longer stems, ensuring both comfort during rides and a more harmonious aesthetic for the whole bike.

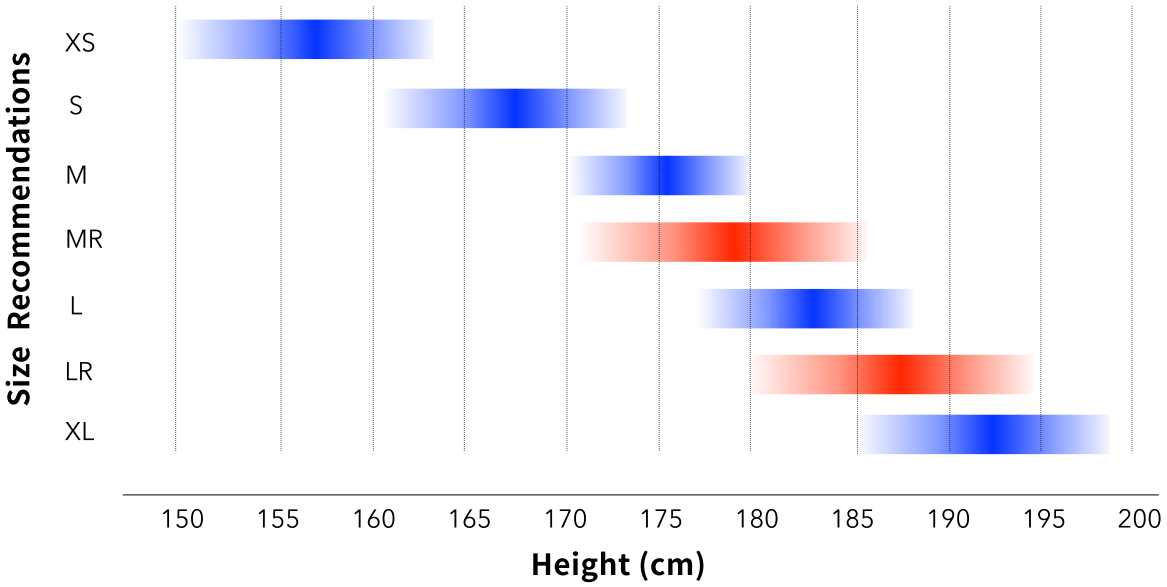
In between the M and L sizes, we introduce the M Racing size. It has a larger Reach than the M size, but with a lower Stack, enabling a lower riding position.

Same principle for LR, By incorporating both MR and LR sizes, the seven sizes of the Spear can accommodate the needs of riders of any height, whether they are focused on performance in competition or comfortable riding.

Why not add Racing sizes between XS and S, and between S and M?
What if riders within these height ranges wanted a more aggressive riding position?

Based on our experience and data analysis, riders of smaller sizes typically use shorter stem lengths, such as 80-110mm. If they needed a more aggressive position, they could choose a frame size one smaller than their actual height, which lowers the Stack and allows them to use a longer stem to increase the reach. However, riders of larger sizes usually use longer stem lengths, ranging from 100-130mm. If they were to choose a frame size smaller than their actual height, they might not find a longer stem to match it.

Therefore,we need to introduce Racing sizes between the larger frame sizes.



Through the 5+2 non-linear geometry concept, as well as our arrangement of data correlation for each size, we can ensure that for most riders' heights, there are 2-3 sizes available for them to choose from, catering to different riding styles.

For example:
A rider with a height of 173cm. If they prefer a relatively comfortable riding position, they can choose size M, keeping a 10mm spacer and using a 110mm stem.

If they want a more aggressive position, they can choose size S, keeping a 10mm spacer and using a 130mm stem.

If they feel that the combination of size S with a 130mm stem is not coordinated enough, or if they also prefer to remove all spacers because they don't like the look, they can choose the size M Racing. Then they can remove all spacers and use a 110mm or 120mm stem.



We dedicatedly designed a new integrated handlebar for Spear, named Rapier. Rapier can better meet Spear's overall appearance and performance needs.

Compared to the second-generation Exceed integrated handlebar, Rapier has a 5.2% increase in stiffness and a lighter weight. The 400-100mm specification weighs only 310g, 20g lighter than the second generation Exceed Integrated Handlebar.

Rapier offers four upper handlebar widths from 360mm to 415mm (lower handlebar 385mm to 440mm), and six stem lengths from 80mm to 130mm, for a total of 19 different specifications to help you achieve the best fitting and most comfortable posture for your riding style.

The riding posture of the upper body has a great impact on the overall aerodynamic effect. Rapier's width is 5mm narrower than other conventional handlebars on the market, which will reduce riding wind resistance to a certain extent and provide a more comfortable riding experience. The lower flared handlebar design provides a better grip for sprinting.

Hood Position	360mm	375mm	395mm	415mm
Drop Position	385mm	400mm	420mm	440mm
80mm	✓	✓		
90mm	✓	✓	✓	
100mm	✓	✓	✓	✓
110mm	✓	✓	✓	✓
120mm		✓	✓	✓
130mm		✓	✓	✓

Details
Making an Extraordinary Product

Spear is a comprehensive road frame set fully independently designed and developed by SEKA Bikes.

A Spear frame set consists of 66 different parts available in a variety of sizes. It was independently designed and developed by the SEKA Bikes product development team over the past three years, which was then combined with China's best industrial production resources to complete production.

From the frame, the integrated bottle cage that matches the frame, to the thru-axle rod, to every rubber plug and screw, the SEKA Bikes team strives for perfection.

We always believe that extreme attention to detail can create extraordinary products.

We hope you like it!





Reference Documentation

Weighting method:

Barry N, 2018, A new method for analyzing the effect of environmental wind on real-world aerodynamic performance in cycling, Proceedings MDPI, 2(211), doi:10.3390/proceedings2060211

Calculation method for power/time difference:

Martin JC, Douglas ML, Cobb JE, McFadden KL and Coggan AR, 1998, Validation of a mathematical model for road cycling power, Journal of Applied Biomechanics, 14, p 276-291

Aerodynamic Testing Attachments

Wind tunnel testing specific equipment settings.
Athlete's body dimensions and personal equipment,
specific data for prosthetic models.

sekabikes.com

