DASSAULT SYSTEMES

SOLIDWORKS

FULL SPEED AHEAD

INNOVATING THE FASTEST BICYCLE AEROBAR WITH SOLIDWORKS FLOW SIMULATION

With SOLIDWORKS Flow Simulation CFD analysis software, Full Speed Ahead pushes the limits of aerodynamic bicycle component design.

Vision
BY FULL SPEED AHEAD

Challenge:
Increase the speed and performance of high-end bicycles used by competitive cyclists for time trials and triathlons by providing components that are more aerodynamic.

Solution:
Implement SOLIDWORKS Flow Simulation computational fluid dynamics (CFD) analysis software to cost-effectively optimize the aerodynamic performance of
bicycle components.

Results:
- Created fastest bicycle aerobar
- Cut prototyping costs by 75 percent
- Eliminated three rounds of wind tunnel testing
- Developed competitive aerodynamic bicycle wheel product line

Helping cyclists maximize speed is the mission of Full Speed Ahead (FSA). Based outside of Seattle, Washington, the company supplies the precision-engineered components that high-end bicycle manufacturers utilize to support professional road and mountain bike racing teams. From cranksets, headsets, and wheelsets to aerobars, handlebars, and other bicycle parts, FSA is committed to delivering the best possible components.

FSA continually pushes the technical boundaries of bicycle component design, which is why the manufacturer has leveraged SOLIDWORKS® 3D design software and wind tunnel testing for years. In 2008, FSA management's desire to drive innovation in bicycle component development led them to evaluate computational fluid dynamics (CFD) analysis technology to see how it could improve the aerodynamic performance of the company's products.

According to CFD Aerodynamics Analyst Ron Correa, the ability to simulate airflow around component designs is critical to cost-effectively refining the aerodynamic characteristics of FSA products. "Working with equations can only take you so far," Correa explains. "Wind tunnel testing is expensive, so using trial and error to refine aerodynamic features is cost-prohibitive. Investing in CFD analysis technology is the fastest, most cost-effective approach to achieving our goal of delivering the best possible components."

After evaluating leading CFD analysis packages, FSA selected SOLIDWORKS Flow Simulation because the software is integrated with SOLIDWORKS CAD software, making it easier to learn and use, and is backed by the quality support of Hawk Ridge Systems, FSA's SOLIDWORKS reseller.

"I had never used CFD analysis software and needed to educate myself," Correa recalls. "However, I was very familiar with SOLIDWORKS CAD software, with which SOLIDWORKS Flow Simulation is fully integrated. I knew that I would need a good deal of support to become proficient with the tool, and our SOLIDWORKS reseller has provided high quality support. SOLIDWORKS Flow Simulation was simply our best option for deploying the power of CFD efficiently and cost-effectively."

THE FASTEST AEROBAR PROJECT

With SOLIDWORKS Flow Simulation software, FSA set out to design the fastest 3:1 aerobar for its Vision product line. Aerobars are specialized handlebars used by professional cyclists during time trials and triathlons to support a more aerodynamic riding position. The International Cycling Union (UCI) has instituted a 3:1 rule for a bike's tubular construction, meaning that the length or height of a tube cannot exceed three times the diameter or width.

> **"From an R&D standpoint, SOLIDWORKS Flow Simulation software allows us to take an idea to a concept to a refined product more quickly."**
>
> — Ron Correa, CFD Aerodynamics Analyst

"We set out to design a 3:1 aerobar that is faster than anything currently available," Correa recalls. "We used SOLIDWORKS Flow Simulation software to scrutinize every part of the aerobar, including the foil, grip, and stem engagement mechanism. CFD analysis enabled us to continually refine the new design, which is nine watts faster than the competitor's bar tested and is four watts faster than our non-UCI-designed aerobar. A nine-watt gain translates into a cyclist knocking up to 40 seconds off a 40 km time trial."

"When you consider that seconds often separate the top finishers in a professional cycling event, that's a dramatic improvement in performance," Correa adds.

REDUCING WIND TUNNEL TESTING COSTS

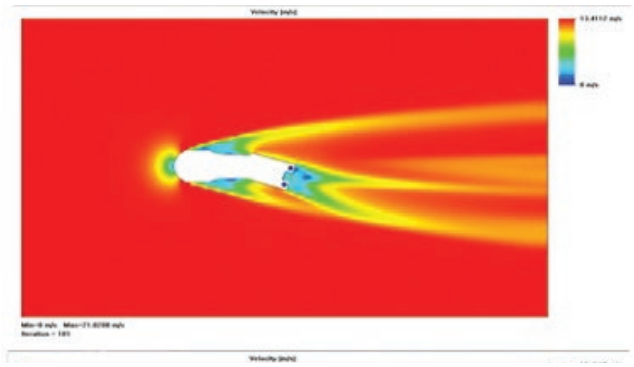
Using SOLIDWORKS Flow Simulation, FSA achieved its breakthrough Vision aerobar design while simultaneously reducing prototyping costs by 75 percent and cutting three rounds of wind tunnel testing from the process. "Because SOLIDWORKS Flow Simulation allowed me to refine the aerobar profile aerodynamics before we visited the wind tunnel, we validated the design's performance in a single round of testing.

"I can't imagine how many iterations would have been required without SOLIDWORKS Flow Simulation," Correa continues. "It would have taken at least four trips to the wind tunnel to isolate the airflows predicted by the software. From that standpoint, our savings on this first project paid for the software."

LAUNCHING A COMPETITIVE WHEEL LINE

In addition to supporting FSA's fastest aerobar project, SOLIDWORKS Flow Simulation has helped the bicycle component manufacturer develop a new competitive line of aerodynamic carbon-fiber wheels following the expiration in 2010 of prohibitive patents held by two competitors.

"From an R&D standpoint, SOLIDWORKS Flow Simulation software allows us to take an idea to a concept to a refined product more quickly," Correa stresses. "The wheel simulations are more complex because we're dealing with a rotating object and need to consider different yaw vectors. However, we're well on our way to launching a full line of aerodynamic wheels in 2014 featuring dramatic watt reductions and establishing the Vision brand as a top performer in the industry. Now, we put everything we do through CFD to optimize performance prior to final validation in the wind tunnel."



Full Speed Ahead used SOLIDWORKS Flow Simulation CFD analysis software to develop the fastest 3:1 aerobar, a specialized handlebar used by professional cyclists to support a more aerodynamic riding position.

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