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Wind tunnel measurements complemented by numerical simulations can help improve cyclist posture and develop technology capable of reducing drag for competitive cyclists.

For competitive cyclists, aerodynamic drag could be the difference between finishing first and last. Every element from the helmet to cyclist posture must be optimized to reduce drag, but first, it is essential to understand the airflow structures that contribute to the unwanted air resistance.

Zheng et al. used a custom sports wind tunnel and numerical simulations to investigate the flow structures around a stationary track cyclist mannequin. The team followed the evolution of wake structures to inform drag-reduction strategies.

The mannequin was fitted in a long-sleeve skin suit, helmet, and shoes, typical of a competitive human rider, and placed in the specific track cyclist form on a bike. During the wind tunnel experiment, the team used a Cobra probe to track the wake formation. Numerical simulations complemented the experimental data and validated drag force calculations.

Because of the uneven nature of the biking stance, the team found asymmetrical vortex formation and identified the elbows, upper thighs, and helmet as significant contributors to the dominant flow structures.

This test demonstrated the usefulness of these measurements. The team also developed a pedaling mannequin that can provide more information on flow structures. In future tests, they hope to identify and develop drag-reduction methods to help track cyclists.

“The research framework and study can help cyclists to reduce air resistance on several fronts,” said author Xin Zhang. “Our team has developed low aero resistance skin suits used by professionals. The wind tunnel testing and optimization procedures can aid in equipment design of aero helmets, shoes, bikes, and posture optimization.”

Source: “On the evolution of flow structures around a track cyclist,” by Chuntai Zheng, Peng Zhou, Xiaochen Mao, Sinforiano Cantos, Guangsheng Liu, and Xin Zhang, *Physics of Fluids* (2024). The article can be accessed at https://doi.org/10.1063/5.0188946.