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EXPERIMENTAL INVESTIGATION OF A DRAFTING CYCLIST IN CROSS-WIND ABSTRACT

During a cyclist race, drafting is a common practice to overcome drag forces. Nearly 90 percent of a cyclists' energy must be expended to overcome the forces of drag. Just like how many trucks use the decrease in cross-wind by riding behind other trucks on the road, a cyclist can use that same premise to save nearly 30% of their energy from drag effects. The linear pattern that dynamic cyclists naturally configure themselves are called echelons and is a very common practice for any race. This dynamic problem has not been thoroughly researched, so this paper addresses this problem and presents data to create a deeper understanding of this phenomenon. A very simplified 3D model of a cyclist was created to understand the drafting effects on a cyclist to investigate for different angles of attack (yaw angle) and the distance away from the wind stream. To minimize total drag on a cyclist, the data suggests that the rider should position themselves directly behind the forward rider in the wake (measured as high as 60%) and nearly eliminates any side forces at low yaw angles. An offset from the wake also has a noticeable effect on the total drag forces on the cyclist. At larger yaw angles, this offset can be used to decrease the drag coefficient on the rider (+1.68 m at full scale). In this configuration, a decrease in drag is shown to be nearly 80% and the cyclist should position themselves directly behind the leading cyclist in the stream-wise direction. This positioning can be hard estimate, and is favorable for an experienced rider. This phenomenon can be seen in any two-body dynamic situation, and will hopefully be further studied for multi-body cyclist situations to understand bigger wakes from multiple riders like we see in most bicycle races.