

A **MULTI-DISCIPLINARY** APPROACH

CREATING A LONG-LASTING COLLABORATION IN ELITE CYCLING

TU Delft's Sports Engineering Institute made Dutch headlines with its wind tunnel research on a mannequin of team Giant-Alpecin's (now Team Sunweb) top cyclist Tom Dumoulin. However, behind the scenes the collaboration between the professional cycle team and the university covers a much wider area of expertise. The agreement covers four areas of expertise: aerodynamics, bicycle stability and handling, optimal power distribution, and the application of data science. Giant-Alpecin's scientific expert Teun van Erp and TU Delft's Daan Bregman wholeheartedly agree that sports and science can be of mutual benefit to each other.

A 3D printed mannequin of Tom Dumoulin Aerodynamics has so far delivered the most tangible results, helped by all the publicity surrounding Tom Dumoulin's new time trial skin suit. This project shows the multidisciplinary approach that is typical of most research at TU Delft. Sitting in a time-trial position, Tom Dumoulin's body was scanned at all possible angles, and the resulting scan was used for a 3D printed mannequin. This part of the project was led by Dr.ir. Jouke Verlinden of the Faculty of Industrial Design Engineering. The mannequin was then used for experiments in one of the university's wind tunnels. Here, in a unique process developed by Professor Fulvio Scarano of the Faculty of Aerospace Engineering, the airflow around the cyclist's body was visualised with the help of helium-filled soap bubbles. Based on the outcomes, a new suit was designed. 1

“ IN CYCLING, AND
ESPECIALLY IN TIME
TRIALS, IT IS ABOUT
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SMALL WATTS. IF WE
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WILL MAKE A BIG
DIFFERENCE MAYBE IN
RESULTS.”

*TOM DUMOULIN
DUTCH CYCLIST
TEAM GIANT-ALPECIN*



*Scan this code for a movie of
The making of the 3D Mannequin*

Tom Dumoulin went on to win the individual time trial during the big Tour de France and a silver medal on the Olympics, the latter despite racing with a broken wrist. Although the time trial suit is only one factor in such a prize-winning performance, the results are encouraging enough to continue this line of research.

Bicycle handling

Can the right suit help you win a time trial, knowing how to descend can make or break your chances of winning a multiple stage bicycle race, as we also saw recently. Descending is all about bicycle dynamics. Enter the 'sensor bike', TU Delft's tool to help riders gain insight into the way they steer, brake, handle their bike in corners, and so on. "We are trying to help our riders improve their descent with the help of this 'sensor bike'", says Van Erp.

Power distribution

Another factor playing an important part in especially time trials is optimal power distribution. Van Erp: "You only have a certain amount of energy as an individual. What is the best way to expend this during the race, so you give your best performance?" This is the kind of question that researchers at the Faculty of Electrical Engineering, Mathematics and Computer Science (EEMCS) can help with.

Big data

As team scientific expert, Van Erp is also in charge of the data. "Every bike is kitted out with a power meter that measures everything, during every second of training. Add to this the information from logbooks, matches and so on, and it is a huge amount of data." Van Erp can analyse these data up to a point, but he stresses

he is no data scientist. Help is at hand, because TU Delft has its own data science centre, Delft Data Science.

So far, the collaboration has been very fruitful, but why TU Delft, exactly? "I've worked with other universities, but that was always on an individual and one-off basis", says Van Erp. "The Sports Engineering Institute is really my portal to all the knowledge at TU Delft." Bregman is enthusiastic too. "We have a good and open relationship with Giant-Alpecin. They understand that science is a long-term business. They are also setting long-term goals for their team, and they are not afraid to go off the beaten track."

Partner

Team Giant-Alpecin (now Team Sunweb)

TU Delft scientific expertise

PhD Candidate Wouter Terra,
Dr. Andrea Sciacchitano, Faculty of
Aerospace Engineering, Dr.ir. Jouke
Verlinden, Faculty of Industrial Design
Engineering

Highlight

2016: National Sport Innovator
Award for 'Measurement-Bike' project