Up to the penultimate day, the students from Delft had been in a neck-and-neck race with their main competitor, the Tokai Challenger from Japan’s Tokai University. In the past two races, this Japanese team won the biennial World Solar Challenge (which was held this year from 6 through 10 October), leaving the TU Delft to be content with silver.

During the penultimate day, the Nuna7 was in the lead, increasing its distance from the Japanese team. Both teams were struggling with very strong cross-winds, at times up to Beaufort force 6, and it required considerable effort for them to stay on the road. Leslie Nootenboom, one of the drivers, later wrote on the Delft team’s blog: “Particularly after calm stretches – as when passing through forested areas – we had to be very careful.”

He was also distracted by “a large (5 cm) and very annoying grasshopper in the small cockpit.”

This was the seventh time that the Nuon Solar Team from TU Delft competed in the race, which runs along the 3000-km motorway across Australia, from Darwin in the north to Adelaide in the south. This was the team’s fifth gold medal. In all, 29 teams from all over the world were competing in the Challenger Class. In addition to this class, which is all about speed, eight teams competed in the Cruiser Class, which emphasises designing a practical and user-friendly solar car.

On the last day of the race, the Japanese team drove themselves “to pieces,” according to Nootenboom. “The Japanese team wanted to keep up with us no matter what, and they emptied their batteries completely. Because the sun wasn’t shining today, they weren’t taking in any more power, and they had to stop by the side of the road to recharge. We started with a significant lead in the morning, and we never gave it up.” The Nuna7 would ultimately roll over the finish line three hours before the Tokai Challenger.

After two silver medals, the students of the Nuon Solar team once again won the gold medal at the World Solar Challenge held this autumn. This was thanks in part to a “bloody clever” interpretation of the rules.

Tomas van Dijk

Nuna7 smart and fast
The Nuna7’s secret weapon was its concentrators: boxes of lenses that concentrate sunlight by a factor of 1100 onto the small but very efficient solar cells located beneath them. These were used to provide additional charging while the vehicle was stationary during the mandatory pit stops of 30 minutes every 300 kilometres. The boxes, which were tucked away under the bonnet, were then removed from the car and aimed at the sun.

Charging capacity
The students kept this additional charging capacity a secret until the last possible moment. When the car was presented to the press last summer, the focus was on the design of the vehicle. It had been necessary to revise the design completely, because the organisation of the World Solar Challenge required four wheels this year, while all of the previous Nunas had been three-wheelers.

“We had to go back to the drawing board”, recounted Allard Lambers, one of the people responsible for the car’s aerodynamics, in an interview with Delta. The race organisation had decided to require a four-wheeled version in order to nudge the designers in the direction of more regular vehicles.

The four-wheeled Nuna7 was the first to have the driver’s seat on the side. Another difference from the previous Nunas is that the underside of latest model is hollow. There is also no bump on the underside where the driver’s seat had been in the previous Nunas. "Our greatest competitors, the Americans and the Japanese, thought that the left would be better", continued Lambers. "When we saw that, we thought, ‘How stupid!’ But the biggest trick was yet to come: the concentrators.

According to the rules, teams must choose. They may build either six square metres of silicon solar cells into their car, or half of this amount of the much more expensive and much more efficient gallium arsenide cells. At least, this is how most of the participants interpreted the rules.

Concentrators
The TU Delft students built 5.9 square metres of silicon solar cells into the exterior of the car. They then filled up the remainder of the permitted quota with a set of 3600 gallium arsenide cells, which they equipped with the solar concentrators. During first inspection, the Nuna attracted quite a few stares from the competing teams, particularly when the bonnet was raised to expose the carbon boxes with the solar concentrators. Nooteboom: “The students from Tokai University and the University of Michigan were looking at the boxes with their mouths wide open. “A lot of people had no idea what they were. In the audience, one team member from the University of Michigan’s Solar Team did say to one of his team mates: ‘Oh shit... I know what that is.” The Delft team’s strategy was not without risk, however. They were fortunate that the weather during the race was mostly sunny. “The concentrators work only in direct sunlight. If there are a lot of clouds during the race, so it’s also cloudy during the pit stops, you might be dragging along 14.4 kilograms of dead weight.”

According to a journalist from the popular scientific journal New Scientist, the director of the Solar Challenge, Chris Selwood, had a good laugh when he saw the TU Delft team’s trick. Selwood commented: “The limits are always being stretched.” He did add, however, that the organisation will have to consider very carefully whether this type of adaptation should be allowed in the future. “This was bloody clever, though.”

Eindhoven wins
“TU Eindhoven, Winner of the World Solar Challenge” read the headline on the front page of the NRC Handelsblad newspaper on Tuesday 15 October. The TU Eindhoven had placed an advertisement in order to take credit as well – and rightly so. Students from the Solar Team Eindhoven won the Cruiser class with their solar-powered family car. Their car, Stella, carried three or more occupants for most of its racing kilometres. A jury also evaluated the Cruiser-class cars on such aspects as comfort, convenience, boot space and parallel parking.

‘Concentrators were its secret weapon’

Nuna7
The four-wheeled Nuna7 was the first to have the driver’s seat on the side. Another difference from the previous Nunas is that the underside of latest model is hollow. There is also no bump on the underside where the driver’s seat had been in the previous Nunas. This reduces the disturbance of the airflow, and therefore resistance. At 100 kph the wind resistance is equal to that of one hand held outside of the window of a vehicle. This is partly thanks to the streamlined design, but also due to a special dust-repellent coating. The car weighs 150 kilograms. With a peak power of 1500 Wp, it can run at a speed between 90 and 100 kph. The Nuna7 also has about 5 kWh storage in its 21 kilograms of Li-ion batteries (the maximum allowed capacity), for additional power when overtaking or during cloudy stretches.