



How low can you go?

Nuna5 on its way to an even lower C_dA

In a world where everything is changing fast you have to be able to keep going given increasing demands. However possibilities are running out and alternatives have to be found soon. We live in a world which craves for energy. And in such a world ways have to be found for catering to our demanding energetic needs.

With fossil fuels being depleted we have no other choice but to turn to some other source of energy. And what better source than one that is permanently there, that cannot be depleted and is free of charge.

by: Mariana Popescu, Nuna5 team member

With an area of eight million square kilometres Australia is the sixth biggest country in the world. The largest part of Australia is flat and dry. A third of the landscape is desert. It is in this wonderful place that the World Solar Challenge takes place every two years. The objective of the teams participating in the race is to cross the Australian desert starting in Darwin and ending in Adelaide. That means about 3000km, solely driven by the energy coming from the sun.

For the past four editions of the World Solar Challenge the Nuna has crossed the finish line first at the end of the 3000km race through the hostile Australian desert. This year there is a new challenge set for the Team: building yet another winning vehicle when the competition is growing fierce, the Nuna5.

Naturally when such a task is at hand you need to be innovative and find the optimum in every single area of your project, think outside the box and take technology to the

limit.

There are a few particular areas on which every single team has been working since the beginning of this adventure. The vehicle has to always be lighter, faster and more efficient, in one word better, no concessions made.

The cooperation of different disciplines and finding the perfect combination between the electrical, mechanical, aerodynamic and ergonomic aspects is the greatest and most exciting challenge of all.



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The vehicle works in intricate ways. The top list requirement is generating the energy needed to power the vehicle. To generate energy, six square meters of

solar panels are used. These are made up of more than 2000 GaAs Triple junction PV cells. Triple Junction cells have three layers, each layer converting a different part of the spectrum into energy.

The first three Nuna's used optical reject cells from the space industry, Nuna4 used a completely production cell solar panel. Nuna5 will be using a combination of optical rejects and the best production cells available. These cells have an efficiency of approximately 30%.

The cells are covered with a special laminate which has its surface covered with microscopic triangular prisms. This type of laminate helps with redirecting the light rays into a perpendicular angle to the cells in order to increase their efficiency.

Besides trying to make everything lighter by using efficient production techniques and innovative design of the mechanical parts a great deal of effort goes into making the car as aerodynamically as possible, since this will result in a lower energy consumption.

The Nuna5 is built up of airfoils. There are several standard foils, each with their own aerodynamic characteristics to choose from. If the size is known, the best fitting profile can be chosen and further modified. This development process started with the standard foil of the Nuna1 after which further optimizations have been made throughout the years (with Nuna2, 3 and 4) to reach the current custom foil.

Furthermore there are a few other techniques that we use in order to keep the air drag of the car as low as possible.

First of all an important factor is the frontal

area of the vehicle. This area is mostly determined by the size of the pilot. The pilot will be sitting much like in the Nuna4 within the back wheel cover.

All wheel covers are also derived from standard airfoil profiles determined mainly by analyzing the average side wind direction occurring during the race.

Second, the canopy is placed as close as possible to the rear of the vehicle in order to keep the laminar flow for most of the body of the car. The technology of lowering drag using laminar flow can also be found in gliders and similar forms of flight vehicles.

Sail plane expert ir. L.M.M. Boermans has been willing to help our team yet again in the optimization of the airfoil profile for the Nuna5. He has proven to be a great mentor and support in the design and testing process.

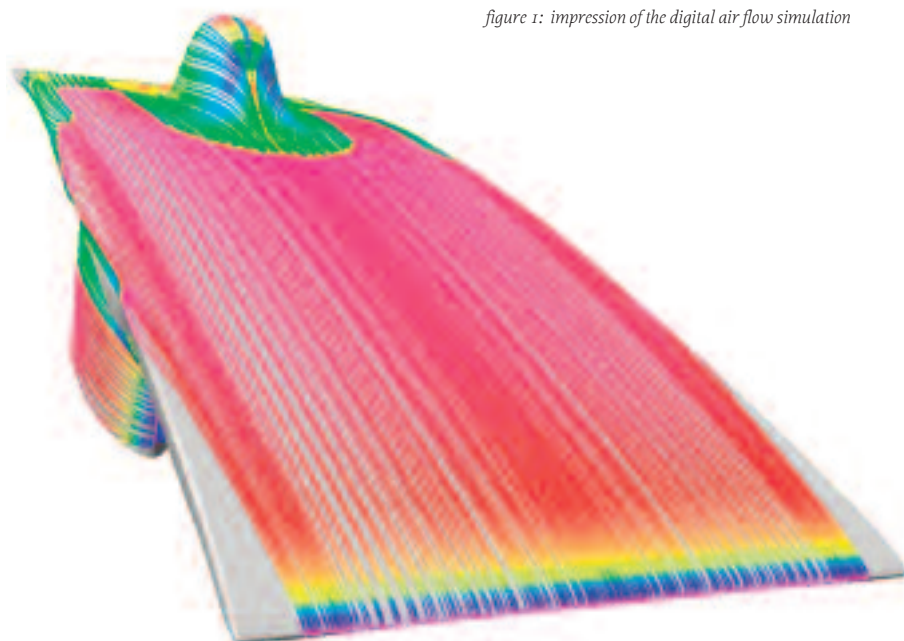
In order to make sure that the results of the design are optimal, the aerodynamic design is checked using specialized software. Pink represents a low friction coefficient, which is exactly what we are looking for, while green and red represent turbulent flow, see figure 1.

Finally when an optimum result has been reached, a scale model of the design is milled and placed in the wind tunnel. This is the moment of truth. In the wind tunnel the accuracy of the digital model can be checked. After two times in the low speed wind tunnel of the Delft University of Technology the results for the Nuna5 are staggering and it can finally be built with the confidence that it will ride as smooth as possible.

Even though the design concept of using laminar flow has not changed since the very first Nuna came into existence, major leaps have been made in the development and optimization of the aerodynamic design.

If you still have your doubts about Nuna5 flying over the finish line we invite you to follow our process to a sparkling take off in Australia this October. 🚀

figure 1: impression of the digital air flow simulation



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For more information you can check our website www.nuonsolarteam.com or even receive a monthly news flash you can subscribe to by sending an e-mail to nieuwsbrief@nuonsolarteam.com