Nuna II

Breaks All Records to Win the World Solar Challenge!

Eric Trottemant
Education Office, ESA Directorate of Administration, ESTEC,
Noordwijk, The Netherlands

The Dutch solar car 'Nuna II', using ESA space technology, again finished first in the 2003 World Solar Challenge, a 3010 km race from north to south across Australia for cars powered only by solar energy. Having set off from Darwin on Sunday 19 October, Nuna II crossed the finishing line in Adelaide on Wednesday 22 October in a new record-breaking time of 30 hours 54 minutes, 1 hour and 43 minutes ahead of its nearest rival and beating the previous record of 32 hours 39 minutes set by its predecessor Nuna in 2001.

The average speed of Nuna II, nicknamed the 'Flying Dutchman' by the Australian press, was 97 km/h, also an improvement on the previous record of 91.8 km/h set by Nuna in 2001. Despite two quickly changed flat tyres, Nuna II travelled 828 km on the third day of racing – never before has such a distance been accomplished on one day by a solar-powered vehicle. On the fourth and final day, Nuna II again pushed the envelope by driving at a top speed of 110 km per hour, a new World record.

The space-age Nuna II was already in the lead by the end of the first day, having started from 10th position. Before the race began, it was already tipped as a hot favourite because of its use – like its forerunner Nuna in 2001 – of advanced space technology provided to the team via ESA's Technology Transfer Programme, which gives the car a theoretical top speed of 170 km per hour.

The aerodynamically optimised outer shell consists of space-age plastics to keep it light and strong. The main body is made from carbon fibre, reinforced on the upper side and on the wheels' mudguards with aramide, better known under the trade name of Twaron. The latter is used in satellites as protection against micro-meteorite impacts, and nowadays also in high-performance protective clothing like bulletproof vests.

The car's shell is covered with the best triple-junction gallium-arsenide solar cells, developed for satellites. These cells harvest 10% more energy from the Sun than those used on Nuna for the 2001 race. Only weeks before this year's race, ESA had launched its first satellite to use these cells, the SMART-1 high-technology demonstration mission to the Moon.

Nuna II also carries Maximum Power Point Trackers, small devices that guarantee an optimal balance between the power drawn from the battery and that being generated by the solar cells, particularly under less favorable situations like shade and cloud. Many satellites now carry these devices, including ESA's Rosetta scientific mission to comet Churyumov-Gerasimenko, due for launch in February 2004.

Nuna II was built by a 12-strong team of students from the Universities of Delft and Rotterdam, strongly supported by a number of sponsors, including Nuon the Dutch energy company. ESA not only provided the team with engineering support via its Technology Transfer Programme, but also with general support via the ESA Education Office, previously headed by former astronaut Wubbo Ockels, who was an adviser to the team and also guided the first Nuna solar car to victory in 2001. esa

Pre-race preparations

Nuna II speeding across the Australian outback

Pre-race qualification speed trials

The winning team, in Adelaide

For more information, please contact:
Eric Trottemant
ESA Education Office
Tel.: 31 71 5655523
Fax.: 31 71 5655590
E-mail: Eric.Trottemant@esa.int
or
Pierre Brisson
Head of ESA Technology Transfer and Promotion Office
Tel.: + 31 71 565 4929
GSM: + 31 6 520 620 44
Fax.: +31/(0)71/565 6635
E-mail: Pierre.Brisson@esa.int

The 'Nuna' Solar Car's European Tour

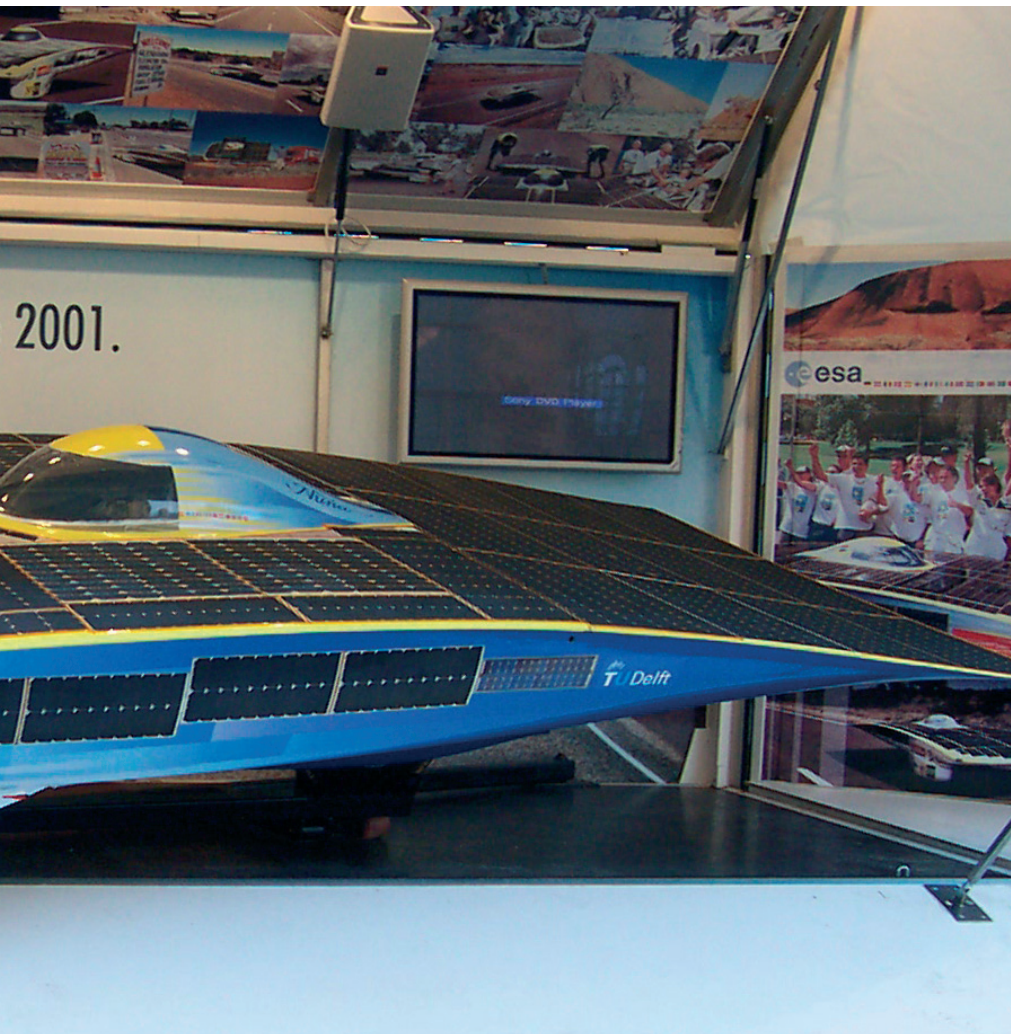
Corinne Flandy
ESA Education Office, ESTEC,
Noordwijk, The Netherlands

Following the victory of the ESA-sponsored Dutch solar car 'Nuna' in the World Solar Challenge 2001, the 3010 km race across Australia for cars powered only by solar energy, the Agency decided to give schools and museums throughout Europe the opportunity to put the spectacular vehicle on show. The objective of the tour was to give youngsters, students and teachers the opportunity to examine the space technology that had given Nuna its winning edge in 2001, and to raise general awareness of renewable energies.

The tour started on 4 November 2002 with a first exhibition at the Vetenskapens Hus (House of Science) in Stockholm. Thereafter Nuna continued its travels through 12 ESA Member States, visiting 36 schools and museums and finishing its journey in France, at the Collège la Côte Radieuse school in Canet en Roussillon. The enthusiasm shown by the youngsters and their teachers at every stop, and the coverage received in the local press, clearly demonstrated the success of the tour.

A Unique Opportunity for European Schools and Museums

Two months after having won the World Solar Challenge 2001 with a record time, ESA officially announced its decision to send Nuna on a European tour to help demonstrate the practical applications of space technology here on Earth. The announcement was sent out to all teachers who had participated in the TeachSpace Workshop (26-28 October 2001) and the Physics on Stage 2 Festival (2-6 April 2002). In addition, the tour was advertised in the second issue of the EDUnews newsletter, published in March 2002 and on the Education Office website. Teachers were invited to send an e-mail if they were interested in organising a one-day exhibition at their school. The ESA Education Office's mailbox was flooded with requests, proving straightaway that the project was very attractive.



The response was in fact so large that it would clearly not be possible to meet the demand, and it was therefore decided to contact all of the teachers who had expressed interest and ask them to submit a summary of the type of activities and events that they would propose to organise to raise the youngsters' interest in solar cars and renewable energy sources if Nuna would visit their school. An important aspect of the selection criteria was also the teacher's commitment to ensuring local media coverage of Nuna's visit. By the end of August 2002, thirty-six schools and museums with great ideas for putting Nuna in the limelight and involving as many youngsters as possible, had been selected. In the meantime, the ESA Education Office had been working hard on the project's logistical aspects.

Organising the Tour

After many discussions, there was a general consensus that it would be nice to create a sort of 'travelling museum', and so a special display trailer with opening front and side panels was designed to house Nuna during its travels.

To set the scene, the interior of the trailer was decorated with an Australian landscape and a patchwork of pictures of Nuna and the winning team. To provide the viewing public with more information about ESA and its activities, seven panels carrying more general information were also designed. To give the youngsters a flavour of the race itself, audio and video equipment was installed in the trailer and a DVD showing the Nuna adventure was produced. Thousands of A3 format posters of Nuna were printed for distribution to the youngsters as a souvenir of the solar car's visit to their school. By the end of August 2002, the small 'mobile museum' was ready to hit the road.

Taking to the Road

The Agency had decided that the tour would be more beneficial for the youngsters if two members of the Nuna Alpha Centauri race team could be present at each school visited to make a short presentation about the race, the car and renewable energy sources, and to respond to the many questions that the youngsters would certainly be asking.

Indeed, the Alpha Centauri team members were heartily welcomed at every stop, with teachers and pupils both enthusiastic about and highly interested in the presentations that they made. It was a chance for the youngsters to learn that the World Solar Challenge event was initially conceived and organised by Hans Tholstrup, a Danish adventurer, who first proved the feasibility of solar-powered transport by crossing Australia from west to east in 1982 in his solar car 'Quiet Achiever'. In the first World Solar Challenge competition in 1987, twenty-three solar cars participated and the race was won by the General Motors 'Sunracer' at an average speed of 67 km/h. The fact that Nuna won in 2001 with a record-breaking average of almost 92 km/h added to the interest in learning more about the car. The DVD was a perfect complement to the presentation in that respect.

After the film, it was time for the children to hear more about the technology used to build Nuna, the importance of aerodynamics, the special solar cells, the special tyres to reduce rolling resistance, and the race strategy applied. The youngsters therefore learnt, for instance, that Nuna's solar cells (triple- and double-junction gallium-arsenide type) had been developed for use in space and had a far higher efficiency than those currently found on the roofs of houses. They also learnt how the team managed to build such a light body for the car, by employing the 'Kevlar' material first used in space.

Teachers in the secondary schools that were visited exploited the Nuna presentation by linking it to their mathematics and physics lessons and encouraging the pupils to work on practical examples. In one primary school, a teacher demonstrated the concept of solar energy by showing the output from a small solar cell graphically on a computer screen.

The Alpha Centauri team members reported that it was amazing how many interesting workshops, drawing competitions and courses had been developed in the schools that they visited to make it an exciting and useful educational event. Many of the schools had also gone to great lengths to involve other schools in their area and to ensure extensive local press coverage.

Conclusion

The Nuna tour certainly proved to be a very successful initiative, giving thousands of youngsters an opportunity to learn more about the solar car's design and technologies and about the renewable energy sources that will more and more become a part of their daily lives. With Nuna II having just won the World Solar Challenge 2003, there will hopefully be the possibility to organise another such series of event to stimulate the interest of youngsters in science, space, and alternative sources of energy.

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ITINERARY FOR THE SOLAR CAR'S EUROPEAN TOUR - November 2002 - January 2003

Date	Country	City	Name of School
November			
04/11/2002	Sweden	Stockholm	Vetenskapens Hus
06/11/2002	Sweden	Gothenburg	Chalmers University of Technology
07/11/2002	Denmark	Copenhagen	Tycho Brahe Planetarium and Omnimaxteater
08/11/2002	The Netherlands	Groningen	Faculteit Techniek
12/11/2002	The Netherlands	Heerhugowaard	Montessorischool
13/11/2002	Belgium	Châtelet	Athénée Royal Pierre Paulus
14/11/2002	Belgium	Aarschot	Koninklijk Atheneum
16/11/2002	Belgium	Charleroi	Athénée Royal E. Solvay
18/11/2002	Germany	Dusseldorf	Schlossgymnasium Benrath
19/11/2002	Germany	Daun	Geschwister - Scholl - Gymnasium
20/11/2002	Germany	Darmstadt	Lichtenbergschule - Gymnasium
22/11/2002	Switzerland	Barbengo	Scuola Media
26/11/2002	Italy	Modena	ATCM
27/11/2002	Italy	Milan	Museo Nazionale della Scienza e della Tecnologia "Leonardo da Vinci"
December			
03/12/2002	England	York	Ampleforth College
04/12/2002	England	Bedford	Mark Rutherford Upper School and Community College
05/12/2002	England	Chislehurst	Farringtons and Stratford House
06/12/2002	England	London	St. Paul's School
09/12/2002	England	London	Highgate School
10/12/2002	England	Steyning	Steyning Grammar School
11/12/2002	England	Marlborough	St. John's School and Community College
12/12/2002	England	Bristol	Sir Bernard Lovell School
13/12/2002	Wales	Llanelli	Morfa Junior School
16/12/2002	England	Leicester	Wyggeston and Queen Elizabeth I College
17/12/2002	England	Tamworth	Wilnecote High School
18/12/2002	England	Burntwood	Fulfen Primary School
January			
08/01/2003	Scotland	Lenzie	Lenzie Academy
09/01/2003	Northern Ireland	Belfast	Queens University Belfast
10/01/2003	Northern Ireland	Belfast	Science Centre WhoWhatWhereWhenWhy
11/01/2003	Ireland	Dublin	Royal Dublin Society RDS
13/01/2003	Ireland	Dublin	Dublin City University
14/01/2003	Ireland	Galway	Galway Mayo Institute of Technology
20/01/2003	Portugal	Porto	Escola Secundária de Fontes Pereira de Melo
22/01/2003	Spain	Madrid	Universidad Complutense de Madrid
24/01/2003	Spain	Alicante	IES Haygon
27/01/2003	France	Canet en Roussillon	Collège la Côte Radieuse