UNSW
SOLAR
RACING
TEAM

NRMA

sunswift II

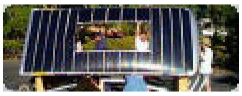
UNSW Sydney Institute of Technology

LAND ROVER National Power

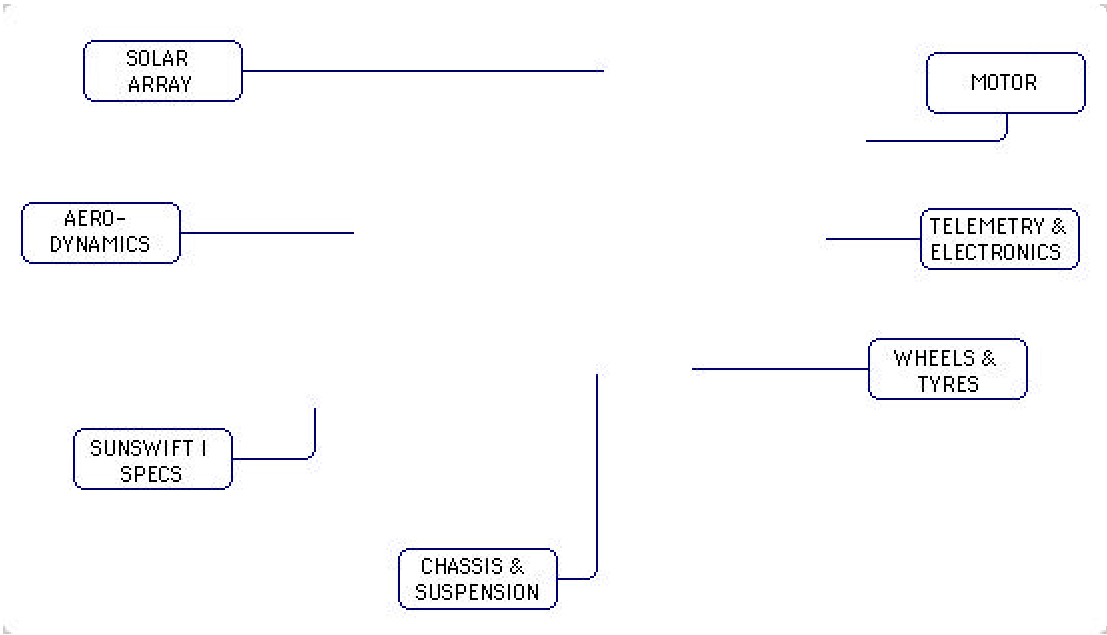
MOTOROLA Telstra

The University of New South Wales Solar Racing team is currently preparing NRMA Sunswift II for 1999 World Solar Challenge.

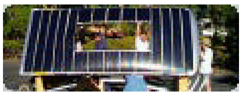
This web site contains information about the team, the people in the team, technical information about *Sunswift* and *NRMA Sunswift II*, the 1996 World Solar Challenge and the 1998 World Record Attempt - Perth to Sydney. Please enjoy your visit!



TECHNICAL INFORMATION



Click on the map above to view detailed specifications about each part NRMA Sunswift II. Please note that some sections are still under development, like the car!



TECHNICAL INFORMATION

Wheel Motor


The wheel motor magnets & stator

Wheel motors are the most efficient way to power an electric vehicle, due to the lack of mechanical loss present in a normal drive train.

The team has designed its own wheel motor using a magnet and winding kit from a commercial supplier. The casings were designed by Mechanical Engineering students Lyndon Young and Doug Smith.

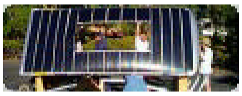
The casings were machined by Ken Ferguson and Geoff Ball using CNC and manual machining. The material was 5083 plate aluminium, kindly supplied by Capral Alumnium.


Stator connections inside the wheel motor

Emily Harper has designed a motor controller which will drive the brushless DC motor to peak efficiency.

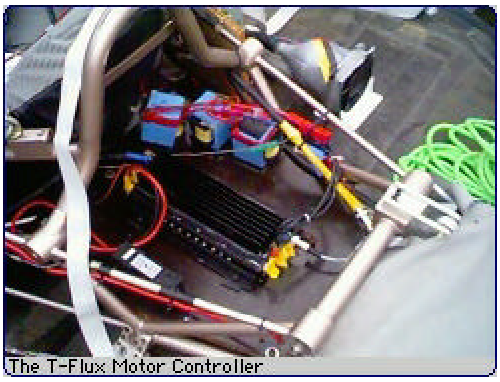
The team will also use a conventional T-Flux motor, mounted on a replaceable swingarm suspension unit, as a backup motor and for poor weather where the gear ratio can be adjusted to suit the conditions.


The sensor board for the wheel motor

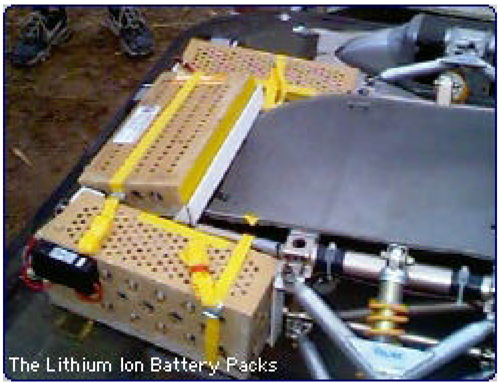


TECHNICAL INFORMATION

Telemetry and Electronics


The T-Flux Motor Controller

Motor Controller: NRMA Sunswift II can use either a T-Flux motor controller or a Unique Mobility Motor Controller hooked up to either the T-Flux motor or the CSIRO Wheel motor.


The Lithium Ion Battery Packs

Telemetry System: A Fluke Hydra Data Logger is used to collect data from the various sensors in the car (voltage, current and temperature). The data is transmitted to the support bus laptop using wireless modems.

Power Trackers: The array uses 6 AERL buck-boost power trackers (2 of these are in the canopy). These are paralleled together and connected to the batteries and motor controller.

Batteries: The three Lithium Ion battery packs were constructed by Premier Batteries. They have a storage capacity of 3kWhr and only weigh 30 kgs. The packs are located in the front section of the car near the drivers feet.

TECHNICAL INFORMATION

Wheels & Tyres

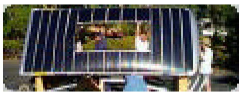
The Michelin Solar Car tyres

NRMA Sunswift II is using the Michelin solar car radial tyres, which are the best available tyres for this purpose. They have been developed for low rolling resistance and reliability, and run at 90 PSI.

The wheels have been developed and manufactured by the team.

They are of carbon fibre and honeycomb core sandwich construction, with an aluminium hub which houses the drum brake unit. The brake drums are manufactured from Ultalite, a revolutionary aluminium-silica matrix developed by Cyco International.

A front wheel prior to assembly

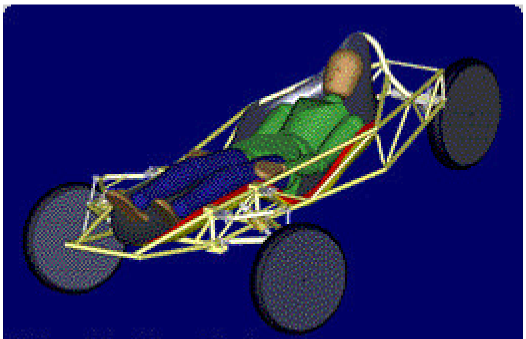


TECHNICAL INFORMATION

Chassis & Suspension

The chassis and seat of NRMA Sunswift II was designed by Lars Forsman for his 1997 Master of Engineering Science project.

The chassis is a chrome-moly steel space frame which incorporates a structural carbon fibre seat. Manufacture of the space frame took place over three weeks by Ken Ferguson, Alan Chandler and Joe Ledesic of Sydney Institute of Technology.


A 3D model of the rolling chassis

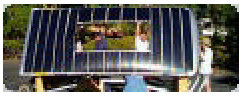

The mould for the seat unit

A race seat has been manufatured from carbon fibre, with a total weight of 2.21 Kg. The bottom shell is also complete, and weighs 13 Kg. The carbon fibre materials and facilities have been provided by Hawker de Havilland.


Rear suspension swingarm & Ohlins shock absorber

The front suspension is a double wishbone arrangement constructed from aluminium tube. The shock absorbers are custom made Ohlins units built by Steve Cramer Products, who are the Ohlins importer for Australia.

The rear suspension is a single sided box-section aluminium trailing arm. The front and rear shock absorbers are interchangeable, except for a different spring rate.



TECHNICAL INFORMATION

1996 - Sunswift I specifications

Sunswift was bought by the University of New South Wales from the Aurora Vehicles Association. The vehicle was extensively modified prior to the race.

The specifications are as follows:

Vehicle Dimensions:	Length:	4455mm
	Width:	2000mm
	Height:	1010mm
	Wheelbase:	1700mm
	Track:	1600mm
	Weight:	255kg

Body:	Bottom made from Carbon fibre/Nomex honeycomb sandwich with divinycell structural members inside. The top shell/Array is made from glass fibre
Chassis / suspension:	Rigid unsprung tricycle frame. The body is sprung to this, with 3 oil shocks.
Wheels:	20 inch BMX rims with custom made hubs
Tyres:	Tioga competition pool and competition ramp BMX tyres
Brakes:	Honda motorcycle caliper and disc.
Transmission:	The LH rear wheel was driven by an 8mm chain. Driven sprocket sizes ranged from 80 to 65 tooth. Drive sprocket was attached to a longitudinally mounted shaft which connected to the motor.

Aerodynamics:	Cd:	0.13
	Frontal Area:	0.75m^2
	CdA:	0.0975

Performance:	Speed at 1000W:	69km/h

	Speed on 1200W:	73
	Speed on 1500W:	76

Array:	Approx 2000 UNSW monocrystalline Buried Contact and PERL Cells	
	arranged into 6 strings with one AERL Maximum Power Point Tracker per string.	
	Individual cell eficiency:	18-21%
	Peak Power:	1640W
	Normal midday power:	1150W
Batteries:	58 Gates sealed lead acid cells arranged in series	
	Voltage:	116V
	Capacity:	3kWh
	weight:	96kg
Motor and Controller:	Lillington T-Flux motor, rated up to 6kW	
	Efficiency	88-92%
	Weight:	9kg
	Lillington Motor controller and AERL DC-DC Converter	
Telemetry:	Fluke Hydra Data Logger	
	weight:	4.5kg
	Wireless modem used to transfer data to telemetry bus.	

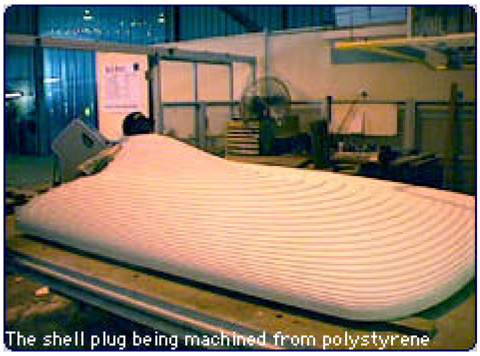
TECHNICAL INFORMATION

Aerodynamics


The two contenders for wind tunnel testing

Two possible shells were designed initially by Robert Simpson using Pro Engineer and Fluent. Then, the shell designs were modelled in craftwood using a CNC milling machine, and tested in the UNSW wind tunnel to determine the most efficient design.

The shorter design proved to be consistently 5% better than the longer one, and besides, it would fit in the trailer, so it won out in the end.

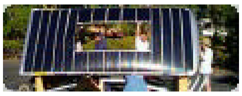

The shell plug being machined from polystyrene

The same data which was used to cut the wind tunnel model was then sent by email to ANI Bradken in Brisbane, who machined the full-scale plugs from polystyrene foam. Once the plugs were delivered to Sydney, the team made these perfectly smooth (thanks to the spray shpo at Sydnet Institute of Technology) by painting and sanding, repeatedly.


The Wind Tunnel in operation

The fibreglass moulds for the shells were then made from the completed plugs, using tooling resin capable of withstanding autoclave temperatures of 180蚓 required for the moulding of carbon fibre shells.

The bottom shell and moulds were layed up by the two boat builders on the team, Chris Tucker and Mark Hewitt.



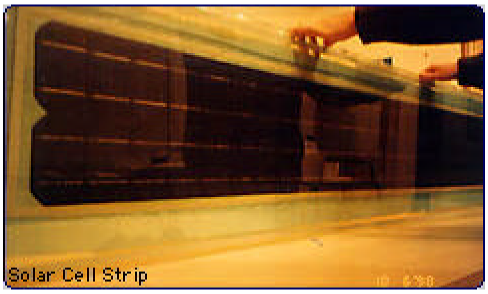
TECHNICAL INFORMATION

Solar Array


Testing a completed cell strip

The solar array consists of strips of solar cells, bonded onto a skeleton structure. Two arrays are being developed, one for practice-run manufacture and to act as a spare, and the other as the race array.

The solar cells for the practice array are BP Solar screen printed cells with a nominal efficiency of 13%. The race array uses BP Solar "Saturn" cells with a nominal efficiency of 16.5%. These were developed at UNSW by Professor Martin Green and the Photovoltaics Special Research Centre, the world's leading solar research facility.


Solar Cell Strip


The top mould after being released from the plug

A mould has been created from fibreglass in order to manufacture the skeleton and to construct the arrays.