



*Swinburne Engineering*

**VICTORIAN MODEL SOLAR VEHICLE  
CHALLENGE**

***2011 Regulations for:***

***Model Solar Boats***

**To be held at Scienceworks on  
October 22<sup>nd</sup> and 23<sup>rd</sup>, 2011.**

*For further assistance, information and resources, please go to;  
[www.modelsolar-vic.net](http://www.modelsolar-vic.net)*

*or contact the Secretary of the Challenge Organizing Committee  
Email: [contact@modelsolar-vic.net](mailto:contact@modelsolar-vic.net)*

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# MISSION STATEMENT.

To promote and develop interest and expertise in using solar and renewable energies by school students throughout the world by using active learning processes in addressing real challenges. By so doing, it is hoped that the citizens, scientists and engineers of the future will be more likely to participate in developing a more environmentally aware approach to energy usage, both by more efficient use of old technologies and appropriate introduction of renewable energy sources.

## 1. INTRODUCTION

The model solar vehicle challenge includes races for solar powered cars and boats. The Victorian Model Solar Vehicle Committee (VMSVC) believe that the skills necessary to build a competitive boat are more appropriate for younger students and give a learning experience which can lead on in later years to designing entries for the car race. The boat race will provide both a less demanding and less expensive opportunity for students in a technology based, problem solving activity.

The VMSVC event officials are empowered to make a decision on any case not covered or clarified by these regulations. In the case of dissent from a VMSVC official's ruling, the dissenting team may be excluded from the competition.

If any entrant or crew has deliberately violated these regulations to gain unfair advantage over other entries, or has departed from the spirit of the event, that team will be disqualified from the competition.

## 2. AIMS AND OBJECTIVES.

The aim of the challenge is to encourage exploration of solar energy through design and construction of working models powered by the sun shining on solar cells.

The objective is to develop a boat that will most effectively travel along a guide line suspended above the water from one end to the other of a 10 metre pool, in the shortest possible time. Two or three boats will race each other in the pool at the same time to determine a winner.

### 2.1 Students must do the work

To maximize the learning experience students are to design and construct the boats themselves, though some adult help to improve their skills is acceptable. High level technical work on Junior division boats (routing, welding, moulding, spray painting, etc) is discouraged, as students will not normally have access to these skills. All students must sign a form indicating that the design and construction was essentially their own work.

Launching, retrieval and all adjustments to boats, must be done by the students themselves and not by adults.

## 3. ELIGIBILITY and DIVISIONS

The competition is run in two divisions.

**3.1 Junior Division.** Open only to primary schools or student groups of primary age.

**3.2 Advanced Division.** Open to **Primary or Secondary** students up to and including year 12.

## 4. POSTER.

Students should document their work as in any quality design and build project. To be awarded any of the prizes, entries are required to present a laminated or contact coated A2 Poster (size 420mm x 594mm – may be 2 A3 posters taped together) documenting the design and development of their boat, to the organizers prior to scrutineering. This record should document experiments and/or calculations and the design decisions made. Some discussion of the benefits or use of solar power for minimizing greenhouse gas emissions will be encouraged. Graphs, photos and design drawings will be marked favourably.

It should contain the school and boat and team member names. Teams may be interviewed to determine their technical understanding of and approach to the project.

The committee will keep the best posters for exhibition at the national race and at other places where the event is publicised.

The poster will be assessed as follows:

Item	Marks		
Headings readable from 5 metres	1	Presentation – photos, diagrams, drawings,	4
Writing readable from 2 metres	1		
Design decision making	2	Greenhouse relevance	3
Construction details	4	References, acknowledgements	1
Summary of test results	4	Total	20

The best will be subsequently displayed and a prize awarded for the best one in each division.

## 5. PRIZES

The schools which win prizes in the following categories will win a plaque and each student team member will receive a congratulatory certificate. There will be awards for both metropolitan and regional schools presented after their events, as well as the state prizes.

First Place	Best display of reused materials
Second Place	Most innovative design
Third Place	Best posters
Best first entry from a new school	Best team uniform

All students who participate in the event will receive a certificate of participation.

The prizes for the 4 top teams will include an invitation to the national finals. However, teams which have inadequate posters (<10 / 20) or cannot demonstrate to the committee that the boat was their own work may forfeit their place to another team.

## 6. ENTERING THE COMPETITION ( Registration and Entry)

Please note that registration and entry are two separate activities. First register your school then later enter each boat separately.

GST is not applicable to any of the fees detailed below.

Cheques should be made payable to **Victorian Model Solar Vehicle Challenge**.

### 6.1 Registration

Anyone planning to enter should visit the website [www.modelsolar.org.au](http://www.modelsolar.org.au) register online then mail your payment of \$50.00 to the address below by September 1<sup>st</sup>.

The Victorian Model Solar Vehicle Challenge  
PO Box 108 Darling 3145

Registration will be available on the website by mid July. Please note this registration fee includes the entry fee for the first boat, **an entry form is required for each boat including this first boat.**

## 6.2 Entry

Entry forms should be downloaded from the website shown above filled in and together with any additional payment required mailed back to

The Victorian Model Solar Vehicle Challenge  
PO Box 108 Darling 3145

by September 19<sup>th</sup>. Entries received by this date will cost a further \$25.00 for each additional boat after the first boat which is covered in the registration fee. Late entries, that is after 19<sup>th</sup> September will incur a cost penalty of \$15.00 per entry bringing the entry cost to \$40.00 per boat. Entry forms will be posted on the website listed above by early August.

Please note an entry form is required even if only one boat is being entered.

**A SUMMARY OF ENTRY AND REGISTRATION DATES AND FEES IS SHOWN IN THE TABLE BELOW**

<b>Registration &amp; Entry Information and Fees</b>	<b>Fees (GST not payable)</b>
School registration form with contact details	<b>\$50 before Sept. 1st</b>
School registration fees (includes first boat entry fee)	
Entry form for each boat (including the first with details of entry name and team membership)	<b>\$25.00 per entry by September 17<sup>th</sup></b>
Entry fee for each additional boat after the first which is covered in the entry fee.	<b>\$40 late fee per entry after 19/9 and by October 8<sup>th</sup></b>

## 7. CORRESPONDENCE

General correspondence should be addressed to:  
The Secretary of the Organizing Committee Committee  
Email: [contact@modelsolar-vic.net](mailto:contact@modelsolar-vic.net)

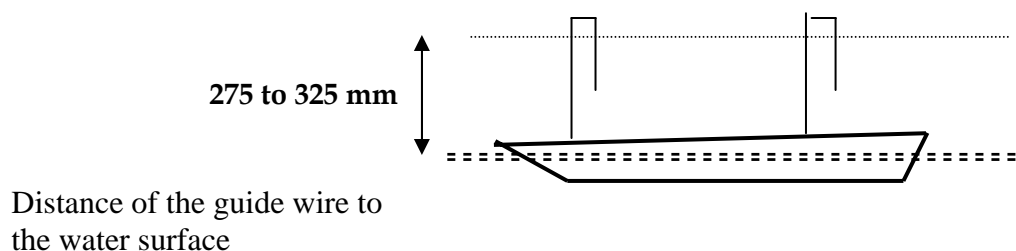
Mail: The Victorian Model Solar Vehicle Challenge  
PO Box 108 Darling 3145

## 8.0 BOAT SPECIFICATIONS COMMON TO BOTH DIVISIONS.

To be eligible to compete boats must conform to all specifications. The following list details the specifications which are common to both the Junior and Advanced division. The additional specifications which apply to one division only are detailed in 8.1.

1. The maximum boat length including any front and rear projections, shall be 550 mm to ensure that the boat fits behind the starting line. (see Fig.1)
2. The boat width (including the cells) must be no greater than 300mm at the widest point.

3. To enable boats to steer a straight line, they should be fitted with rods with open loops through which the guide line will run. This line will be located as near as possible to 300mm + or – 25 mm above the water. Other designs than the one shown may be used.



4. Both divisions' boats may be powered only by commercial silicon cells with a maximum active area of 350 square cm. Panels must be securely attached, so that they cannot fall into the water.
5. A functioning on/off switch must be installed between the solar panel and the motor.
6. No commercially available boat hulls or kits may be used. Entrants are to design and construct their own boats in the year of the race. Hulls unaltered from previous state or national competitions are not eligible. Boats re-entered with very substantial modifications must have alterations documented to the satisfaction of the race coordinator.
7. Multiple boats entered by one school/group cannot be of an identical hull design – eg each entry from a school would not be allowed to use a hull vacuum formed using the same mould or made of fiberglass from 1 mould. Advanced students using vacuum formed or other moulded hulls must have designed and substantially made them themselves.
8. No batteries or energy storage devices are allowed. However capacitors are allowed as part of an electronics system in the advanced division.
9. Each boat must have the school and boat name clearly visible to the starter and judges. Teams will be provided with a “flag” with the boat’s number and name this flag is to be affixed to the rear guide wire.
10. Propulsion: there is no restriction on the use of underwater propellers, air propellers, paddle wheels, oars etc.
11. A poster is required for teams to be eligible for prizes. See 4
12. It is strongly recommended that the boat should have a bow section with a minimum radius of 25 mm. This is to ensure they do not become lodged in the 10 mm square mesh of the starting gate.

## 8.1 BOAT SPECIFICATIONS SPECIFIC TO A DIVISION

As well as conforming to the boat specifications common to both divisions detailed in 8.0, all competing boats must additionally conform to the specifications applicable to their division as detailed below in 8.1.1 for the Junior Division and 8.1.2 for the Advanced Division.

### 8.1.1 Junior Division

1. Only one motor of maximum cost \$ 50.00 is permitted.
2. Only hulls made from drink bottles or cans, polystyrene foam, cardboard or balsa wood (appropriately waterproofed) may be used. Moulded hulls, eg. vacuum formed plastic and fiberglass hulls are not allowed in this division.
3. Maximum cost of the whole boat must be \$50.00 not counting the solar panels and motor.
4. Boats built by primary students which do not meet these restrictions will be required to compete in the advanced division.

### 8.1.2 Advanced Division

1. Any type or number of motors may be used.
2. Any materials including vacuum formed plastic, fiberglass or carbon fiber hulls can be used.
3. Electronics and capacitors may be used, but capacitors over 15000 $\mu$ F will be discharged at the start line.

## 9. THE POOLS.

Two pools will be used where the numbers of entries dictates. Information provided at registration on the day of the event will indicate the pool each boat is to race in.

The pools are rectangular pools at least 70mm deep and between 6 and 10 metres long and over 1.6m wide . They will have fine wires, strings or fishing lines fixed to supports at either end of the pool so that the tight lines are 300 +/- 25mm above the water level and over 350mm apart.

There may be either 2 or 3 lines suspended above the pool, allowing 1, 2 or 3 boats to start in each race. Boats will be designated to specific lanes.

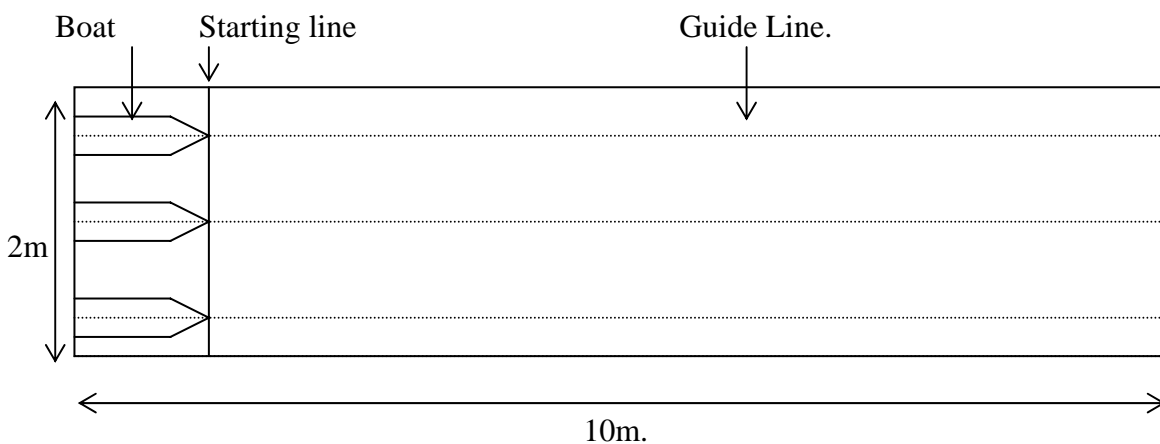


Figure 1. Layout of pool showing 3 boats lined up at the starting line.

## 10. EVENT SCHEDULES

All events will be held at Scienceworks Museum, 2 Booker Street, Spotswood.

- **Junior division: for teams from metropolitan schools on Saturday 22<sup>nd</sup>**
- **Junior division: for teams from rural and regional schools on Sunday 23<sup>rd</sup>.**
- **(Schools between 40 and 50km from Scienceworks should confirm their day to compete)**
- **Junior division: top metropolitan schools from Saturday will be invited back to compete against top regional schools in the Victorian finals on the afternoon of Sunday 23<sup>rd</sup>**
- **Advanced division: on Sunday October 23<sup>rd</sup>**

Each team should register upon their arrival at Scienceworks. Upon registration they will receive information indicating the pool in which they will compete and other relevant information.

All boats will be scrutineered when they arrive to ensure that they meet the regulations. It is important that your boat is durable and water proof so as to maintain its efficiency in a series of races. Your poster must be given to a scrutineer. The best posters will be displayed on race day. Please remember to pick up your poster at the end of the races. The committee will keep the best for exhibition at the national race and at other places where the event is publicized.

The committee reserves the right to limit the total number of entries from any 1 school if there are too many entries for a satisfactory competition.

## 11. RACE PROCEDURE

### 11.1 Round Robin and Knockout Races.

The events for each division will commence with a “round robin” in which each boat will have a number of races the results of which will be used to seed the boats for the subsequent knockout competition. In the knockout competition boats will race with either 2 or 3 boats to a pool (depending on total numbers of entries) with only the winner continuing to the next round. Boats may be run in either a North – South or a South – North direction at the discretion of the race coordinator. All races in any round will be run in the same direction. In finals where the winner is determined on a best of 3 race principle, the boats will race in alternate lanes. Racing in the opposite direction may be used if necessary to resolve a dead heat.

### 11.2 Scrutineering

All boats will be scrutineered before racing to ensure that they meet the regulations of their division. If the scrutineers require, boats which fail to meet the Junior Boat Regulations will need to either be modified to conform to the regulations or race in the Advanced Division. Boats which fail to meet key regulations such as cell type or area, will be required to carry a ballast penalty of up to 400gms, although flagrant and excessive breeches that are expected to result in an unfair advantage will result in disqualification.

### 11.3 Starting.

Starting will be carried out either by use of a starting gate or by team members releasing their boat as instructed by the starter.

**11.3.1 A starting gate** made of 10mm square steel mesh provides a simple means of ensuring all boats are aligned at the start. The gate pivots forward and down, allowing the boats to start to race. If boats have very pointed bows, they may need to release the boat manually from behind the gate. Boats are recommended to have bows with at least a 25mm radius.

**11.3.2 If a starting gate is not used**, the start will occur when competitors release the rear guide of their boat on “Release” after the starter states “ready, set, Release”. This process will be slower than the starting gate as the boats need to be visually aligned by the starter prior to giving the

starting orders. Boats which are pushed or released early may be penalized if the starter so judges and requires the race to be repeated. If incorrect starting procedures are repeated, the boat may be disqualified.

#### **11.4. Judging the results**

A judge will be appointed by the committee to sit level with the end of the pool to observe and record which boats win and come second and third in each race. The race will finish only when the boat strikes the end wall of the pool. If the judge is unable to select between boats, the race may be rerun with boats starting in different lanes.

#### **11.5 Mishaps**

Some boats fail to finish the race, either by submerging, having insufficient power or their guides coming off the guide lines. If a boat interferes with another boat in a 3 boat race, the judge and starter will confer to determine whether to rerun the race with all starters competing or only 2 with the boat causing the interference being disqualified from that race. If there are multiple heats, the boat causing the interference will only lose that 1 heat.