Australian - International Model Solar Challenge

AIMSC

AUSTRALIAN-INTERNATIONAL

MODEL SOLAR CAR

CHALLENGE

2014
REGULATIONS

Sections 1 to 7

Administration of the Event

Event will be held in Australia late November 2014 date and venue to be advised.
Additional information will be published on web site www.modelsolaraustralia.org

Issue 1: January 2014
Sections 1 to 7 (this document) cover the administration of the event
Section 8 (a separate document) covers the car specifications.
N.B. All eight sections must be read as a single document.
Details of the design for a suitable light box are also available on web site.

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 renewables.

OVERVIEW

This is a race for model solar cars built by school age students which compete on a figure of 8 track. Two cars race at a time guided by parallel guide channels attached to the track surface. Time trials are held to "seed" the cars, that is, to allocate them to groups in such a way that the faster cars should not compete against each other in the earlier rounds. Pairs of cars then compete in an elimination competition in which the winners continue to the next round, the losers are eliminated. This process of elimination continues until a winner is decided by being the only undefeated car. Early rounds are run as best of three heats and finals are run as best of five heats.

Administration of the Event.

CONTENTS.

CONTENTS (ctd).

1. INTRODUCTION

1.1 Event name

The event shall be known as the Australian-International Model Solar Car Challenge (AIMSCC) and is conducted annually. This, along with boat races, will form a part of the Australia-International Model Solar Challenge (AIMSC).

1.2 Spirit of Intent

The challenge is designed for students to learn, consequently the design and manufacture must be predominantly that of students. It is recognised that some components need to be either purchased or made using equipment available unavailable to students. Students should be able to show some understanding of the processes which were or could have been used for making non standard components.

The students must understand the working of their car and be able, without outside assistance, to make all necessary adjustments or repairs over the weekend of the race.

Teachers, parents or other adult advisors are encouraged to teach the students the appropriate scientific and technical principles, however they are not to undertake any physical work on the car.

In the past there have been instances of inappropriate adult input, which can significantly advantage the team involved. The committee view this problem very seriously. Adults seen to be acting inappropriately will be given one warning before penalties will be applied to the team involved. Flagrant and repeated breaches will attract penalties commencing at 200 g additional ballast, progressing ultimately to disqualification.

Special circumstances such as car damage due to crashing should be reported to the Adjudication Sub Committee who will consider the circumstances and may if deemed appropriate sanction or provide assistance.

1.3 Allocation of Points.

To promote student learning, a trophy will be awarded to the team which scores the highest number of points based on car performance, their posters and an interview. Points will be awarded to the car performance, poster and interviews on the following basis:

Car performance: 5 points per knockout round won, this will apply to rounds 1 to5 and the quarter finals	maximum points 20
Poster	maximum points 20
Interview (involving all team members)	maximum points 30

1.4 Competitors

The competition is open to invited Australian schools or other organizations for school aged students to secondary level, year 12 inclusive, approved by the Committee. International invitations may also be issued. All teams entering this event will need to meet the regulations listed below.

1.5 Correspondence

International correspondence should be addressed to:

Mr. Paul Wellington
Chairman AIMSC
Tel. 613 9885 7828 Mob. 613 419 871 033
Email paulwellington@modelsolar-vic.net

Australian correspondence should be addressed to:
To be published on web site www.modelsolaraustralia.org

Entry information for the 2013 National competition should be addressed to:
2014 Event Coordinator
Email nationals@modelsolar.org.au

2. INTERPRETATION OF THE REGULATIONS

2.1 These regulations have been agreed by the organising committee and will pertain to the AIMSC event. Individual states may vary regulations for their state event but all decisions at the national/international event will be based on this document. Selected members of the committee will form an adjudication subcommittee at the event which will make any required clarifications or decisions not covered by these rules.
If, during the event or at scrutineering, AIMSCC officials discover that an 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 excluded from the competition.

3 ENTRIES

3.1 Number of Australian teams

The AIMSCC National Coordinator appointed for the event shall request each State Coordinator to invite four teams who have proved to be among the top entrants in their state event. Additional entries may be invited at the discretion of the Committee. Unless there are extenuating circumstances no more than 2 cars from any one school will be invited to compete.

3.2 Number of overseas teams

The AIMSCC Executive Committee may request coordinators of events in other countries to invite one or more teams who have proved themselves to be among the top entrants in their event.

3.3 Team members

Each team must contain at least one student unique to that team, and no team will be permitted to enter more than one car. There is no limit, within reason, to the number of students in any one team, but each entrant must represent his or her school or other organization accepted by the Committee.

3.4 Original work

All teams must be able to provide evidence to the scrutineers that the car is the original work of the team members in both design and construction, performed in the current year, and not simply

a restyling of a previous existing car. This will include both the chassis and the body of the car. Solar panels, motors, drive systems, wheels, suspension, guide systems and other similar components will not be included and may be reused. If any school has more than one car entered, the cars must be significantly different in both chassis and body to indicate to the scrutineers that the cars are the work of different teams. This work will be verified by submission of a poster (3.6) and discussions with delegated committee members in an interview (3.7)

3.5 Statement of work
All students must sign a form indicating that the design and construction was essentially their own work.

3.6 Posters required
All entries will be required to present a laminated or contact coated A2 Poster documenting the design and development of their car to the organizers prior to scrutineering. All engineering projects require documentation and research is often presented as a poster. This record should document experiments and or calculations, which were used in the design of the Model Solar Car. Some discussion of the benefits or use of solar power for minimizing greenhouse gas emissions will be encouraged. Graphs and design drawings will be marked favourably.

The poster will be assessed as follows:

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

This poster will become the property of the organizers and may be used for promotion of the event, but will ultimately be returned by the State Coordinator.

3.7 Interviews.
An interviewing panel will interview all team members about the design and construction and testing of their car or its component parts. Each student should be able to contribute to the answers. Questions could relate to a number of the following:

Wheel and bearing selection and rolling resistance
Effect of weight and tyres on rolling resistance
Design of steering mechanism
Design of chassis
Effect of cloud on solar intensity
Effect of solar intensity on panel performance
Explain how solar cells work
Explain how gear ratios and panel wiring can be changed to suit the weather conditions (if not using electronics)
Explain the function of any electronic controls on their car
Discuss your team’s organization and decision making

3.8 Entry registration

Australian entrants must confirm their participation with their local event coordinator within 3 days of their State or Territory event. Potential overseas entrants should notify the AIMSC Chairman of their intention to compete by October 1st 2013. Invitations will be sent to the State and Territory coordinators before their events.

4. TRACK

Note: All track information detailed below is general. The exact track to be used will be notified before the event. It is probable that the track resident in the State hosting the event will be used. For details of various state tracks go to the respective state web site.

4.1 Size and Shape

The track used in this event will be in a 'figure 8' configuration with a low bridge at the crossover point. The corners will feature curves with an approximate minimum radius of 5 metres. The track can be considered to be flat in that there is no banking on the corners. The track length is variable from approximately 85 metres to 100 metres.

4.2 Slope

The uphill and downhill sections of the track at the crossover point will have a minimum vertical clearance between tracks of 200mm. The slopes will range between 1:16 to approximately 1:8.

4.3 Construction

The track will have a smooth surface with two parallel guide rails of PVC channel such as 'UM20' or 'basket track' or similar, (nominal dimensions 16mm wide by 14mm high) screwed to a plywood base. As the track is assembled in sections, minor misalignments will exist there will be some mismatch at joints and the track surface will not be perfectly flat. Car design must allow for this.

4.4 Starting Position

All races will start near the top of the downhill section of the track. Cars will be started by resting against the start gate which will be rotated away from the cars by a person appointed by the Committee. (See 7.4 Starting Procedure.)

4.5 Finish Position

All races will finish at a point on the straight flat section of track after the corner which follows the finish line timing position. NOTE: Even though timing has been completed, the race will not be complete and a winner declared till the car has been safely removed from the track within the designated stopping area. See (7.5 Stopping Procedure)

4.6 Race Format

Unless varied at the Committee's discretion, time trials, round robin races and initial elimination races will be held from the starting position and cover a single full lap of the track plus the distance to the finishing position, a total distance of approximately 100 metres. Again at the committee's discretion based on weather and available time, later stages of the knockout races may be staged over 2 laps.

5. SCRUTINEERING

5.1 Race Ready
All competing teams shall be required to register upon arrival at the venue by a time to be announced when the invitations are issued. Cars must be in racing configuration when presented for scrutineering. Scrutineers have the right to examine each car at any time to ensure it conforms to these regulations

5.2 Failure
Any car failing to pass scrutineering by the end of time allowed may not be permitted to start the event, or may be required to carry additional ballast as determined appropriate by the scrutineers as a penalty. The scrutineers will make allowances for circumstances beyond the control of the students such as damage in transit.

5.3 Panel power output.
Solar panels will have their output power measured by the scrutineers using a light box with a controlled output. Panels must be presented in their ready to race form. For further details of determining panel performance see Section 8: Car Specifications. Each team must bring for testing the one panel that they intend to use for all time trials and races, and that panel alone will be measured by the scrutineers. The team must then use this panel, unmodified, for all time trials and races. See also 6.3 regarding damaged panels. The scrutineers reserve the right to retest any panel at any time.

5.4 Check weighing.
During scrutineering, the weight of the solar array, any ballast, and the total weight of the car will be recorded. Immediately prior to or after each race, all cars will be re-weighed. If the car weight varies from the recorded weight the team will be required to explain the reason for the variation. If after a race the panel plus ballast weight is found to underweight by less than 5% of the required total its race time will be increased by 2% for every 1% of underweight. If the ballast is over 5% underweight the car will forfeit that race.

6. SERVICING

6.1 Service area
An official service area will be set aside for student team members to carry out repairs or modifications. Students capable of representing their State at the national level will be expected to be capable of operating independently of teacher or parent support and hence only students are to conduct car adjustment and maintenance on race day.

6.2 Modifications
Students may modify cars during practice and between races, but the scrutineers may reassess cars at any time. However, cars as passed at scrutineering immediately prior to the commencement of the knockout rounds must be used in that configuration for all subsequent races. Tune up procedures such as changing driving wheels, gears, motors, steering mechanisms and panel voltage will be permitted between races.
Modifications specifically excluded include the changing of the solar panel, the car body and the chassis irrespective of light conditions. Repairs to these major components are allowed. Modifications to solar panels are specifically prohibited and any repairs to solar panels must be reassessed by the scrutineers.

6.3 Faulty and damaged solar panels

After scrutineering, teams will only be allowed to change or modify the car's solar panel if the original panel is damaged or becomes faulty. Any and all panel changes must be first approved by the scrutineers, and repaired or replacement panels will be required to undergo the same examination, testing and ballasting routine as the original panel.

6.4 Restricted areas

No person other than those nominated shall be allowed in the restricted area without permission of an AIMSCC official and must be accompanied by that official at all times whilst inside that area.

6.5 Hazardous substances

Note. Due to health and safety requirements, the use of bulk solvents, (other than water) and liquefied gases of any sort, for any purpose whatsoever, is **STRICTLY PROHIBITED** at all times and in all areas of the competition. This will not include small quantities of commonly available solvents and spray cans for the purposes of cleaning or lubricating bearings, etc. This means cooling solar panels with anything other than water ice will not be allowed at any time.

7. COMPETITION

7.1 Time trial

Following scrutineering each car will be timed over a single lap of the course for the purpose of seeding the car for the main races.

7.2 Structure of the races.

The event shall be conducted with pairs of cars competing against each other over equal courses in a series of round robin and/or elimination races to be announced in the official schedule of events. Where more than one car is entered from the same school or State, the seeding process will be implemented in such a way that they will not race each other during the first elimination round. However, if successful, they will be required to race against each other before or during the semi finals to ensure that one school does not take more than two of the major top 4 places.

7.3 Timing

Each car will be timed over the course. The winning car will be determined by an electronic timing device initiated by a light/infra-red beam. The Adjudication Sub Committee will adjudicate on any dispute as to the finishing position of any car and there can be no appeal against that decision.

7.4 Starting procedure

Cars will be called to the marshalling area 2 races ahead of their next scheduled race. If they are not present at the starting gate within one minute of being called to the start of their race they will forfeit that race. In the case of best of three or best of five heat races, cars will alternate between tracks. If the final race is needed (in best of 3 or 5 heat races) to determine the winner, the final race lanes shall be determined by a coin toss. If cars are required to race in consecutive heats, on request a 2 minute adjustment time will be allowed between heats. Failure to present at the start line within that time will result in race forfeiture.

7.5 Stopping procedure.

The race will not be finished until both cars have stopped and been safely removed from the track. There will be a rigid barrier 120mm high placed centrally between the two guide rails on

the first three straight sections of track after the corner following the timing equipment. Teams may only stop their car on these three sections of track. The car must be stopped before the end of these three sections of track, otherwise the race will be forfeit. If both cars fail to stop then this condition will not apply. At the discretion of the race organisers any stopping procedure may be used, provided there is no interference with the car in the other lane.

7.6 Stability

If the car comes off the track it shall be deemed unstable and will not be re-started in that race unless the officials are satisfied that the problem was caused by a deficiency of the track. There shall be no handling of cars during the race other than by officials or by people nominated by officials. If both cars come off, the race will be awarded to the car which travelled the furthest before coming off. If one car comes off and obstructs the other lane, the other car shall be awarded the race if it reaches that point and collides with the car which first dislodged. If one car or team, in the opinion of the officials, causes damage to the other car likely to affect its performance, then the offending car will forfeit that round. The damaged car team will be granted extra time and assistance to effect repairs.

7.7 Poor light / adverse weather conditions

At the discretion of the Committee, races may still be run in virtually any weather conditions. If light conditions do not enable the cars to complete the course, the car that travels the furthest, or, if two cars travel the same distance, the car which reaches that point first, within one minute of the start of the race will be judged the winner. Note, due to the geometry of the track, the car that appears to be in front may not actually have travelled the furthest distance. When both cars have come to a halt short of the finish line the race will be deemed to have finished if neither car has moved, for 30 seconds. If a car stops for any reason, that car may be restarted under the marshal's discretion from any point on the track behind the stopping position, but the car must not be pushed to restart.

7.8 Protests

In the event that a team believes that their car has been negatively affected by the actions of an official, another team, another vehicle or by a significant problem with the track, a protest may be lodged with the Adjudication Sub Committee immediately after that race is completed. The team captain, with the support of the team coordinator, will need to make a clear statement as to what they believe the negative effect was and how they believe it was caused. The Adjudication Sub Committee will discuss the protest with other race officials as they deem necessary and will deliver a decision within 5 minutes of the protest being lodged. Due to time pressures to reach a conclusion for the event, there will be no further challenge to this decision.

7.9 Practice and testing

Practice on the track will be allowed at any feasible time that marshals are in attendance.

7.10 Results

Final results will be decided after the provisional first four place winners have been re-scrutineered and passed by the officials.

7.11 Prizes

Prizes will be presented to First, Second, Third and Fourth place getters. The major trophy will be awarded to the winning team. The second trophy will be awarded to the team which wins the total points aggregate as discussed in1.3,3.6 and 3.7. The presentation of prizes will be held as soon as possible after the completion of the event. Additional prizes for best poster, team uniform etc. will be presented to teams deemed worthy. Such prizes will be announced at the time when invitations are issued.

7.12 Non Conformance

If a car fails to conform to the requirements detailed in either section of the regulations it must be modified in order to conform or penalties may be imposed. Penalties will normally be in the form of the requirement to carry additional ballast weight. Minor non conformances will typically attract a 50 g penalty with this increasing to 200 g for more significant breaches of the regulations as determined by the chief scrutineer in conjunction with the scrutineering team. In the event that the non conformance is judged to give the car a significant advantage unlikely to be negated by the carrying of additional ballast the car will be excluded from the event.