



## Regulations for 2015

### Sections 1 to 7

### Administration of the Event

The Event will be held in Adelaide, South Australia, on the weekend of the 24<sup>th</sup> and 25<sup>th</sup> of October 2015. Additional information will be published on the web site [www.modelsolaraustralia.org](http://www.modelsolaraustralia.org)

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 the web site.

This document supersedes all previous versions.

## MISSION STATEMENT

*To develop and encourage an interest in using solar and renewable energies in school aged students throughout the world and to give these students the opportunity to gain some experience and expertise in this by using active learning in addressing real life challenges. By doing this, 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 the way energy is used, both by a more efficient use of old technologies and the appropriate introduction of renewable energies and technology.*

## OVERVIEW

*This is a race for model solar cars built by students studying at primary or secondary levels up to and including year 12 level or its equivalent. The cars compete on a “figure 8” track of approximately 100 metres length. It is a two-day Event, with the first day allocated for time trials and the second day as Race Day. Two cars race at the same time, guided by parallel guide channels attached to the track surface. Time trial results are used to “seed” cars for the Race Day. All cars are scrutinised before the start of each day, following the rules as set out later in the document. On Race Day cars race in pairs and the winner’s progress until the eight fastest cars are left. These eight cars then race in pairs in the best of 3 (three) or 5 (five) races, until the fastest car wins.*

## Section 1 to 7: Administration of the Event

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# 1 INTRODUCTION

## 1.1 Event Name

The Event shall be known as the Australian-International Model Solar Car Challenge (“AIMSCC”) and is run annually. This, along with boat races, will form the Australia-International Model Solar Challenge (“AIMSC”).

## 1.2 Spirit of Intent

The Challenge is designed to provide students currently studying up to and including Year 12 secondary level, with an opportunity to learn, so it is very important that the design and building of the car be mostly – or even better, completely - that of the students. We know that some components will need to be either purchased or made using equipment unavailable to most students. To make up for this, it is important that students should be able to show some understanding of the processes which were or could have been used for the making of these non-standard components.

The students are expected to understand the workings of their car and to be able - without outside assistance - to make any and all necessary adjustments or repairs over the course of the Event.

Teachers, mentors, parents and/or other adult advisors are encouraged to teach the students the correct scientific and technical principles; however they are not allowed to undertake any of the physical work on the car themselves.

In the past, there have been occasions where adults have done the work instead of the students, which can significantly advantage the team involved; this is inappropriate, unfair and is not allowed. As the main object of the experience is for the students to learn how to do it themselves, adult help only interferes with this goal and the Committee take this problem very seriously. Adults seen to be acting inappropriately will be given one warning before penalties will be applied to the team involved. Any further breaches will attract penalties, beginning with 200gm of extra ballast and ending with disqualification from the Event.

Special circumstances, such as car damage due to crashing should be reported immediately to the Adjudication Sub-Committee, who will consider the circumstances and may, if it is deemed appropriate, permit or even 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 a team interview. Points will be awarded for the car performance, the poster and team interviews on the following basis:

Car performance .....	maximum points 20
(5 points per knockout round won, this will apply to rounds 1 to5 and the Quarter Finals)	
Poster .....	maximum points 20
Interview (involving all team members) .....	maximum points 30
Total possible points score.....	70 points

## **1.4 Competitors**

The competition is open to applicants from Australian schools and other organizations for students currently studying up to and including Year 12 secondary level, as approved and invited by the Committee. International invitations may also be issued as decided by the Committee. All teams entering this event must comply with the regulations.

## **1.5 Correspondence**

International correspondence should be addressed to:

Mr. Paul Wellington  
Chairman AIMSC  
PO Box 108  
Darling 3145  
Victoria, Australia  
Tel. 613 9885 7828 Mob. 613 419 871 033  
Email paulwellington@modelsolar-vic.net

Australian correspondence should be addressed to:

Australian International Model Solar Challenge  
PO Box 108  
Darling 3145  
Victoria  
Australia  
  
Email: nationals@modelsolar.org.au

Queries about entry information for the 2015 National competition should be addressed to:

2015 Event Coordinator  
Email: nationals@modelsolar.org.au

## **2 INTERPRETATION OF THE REGULATIONS**

These regulations have been agreed to by the organising Committee for the AIMSCC Event. The Committee of each state may modify the regulations for their own State Level Event, but all decisions at the national/international Event will be based on the information contained in the latest version of this document and any other specified documents. Selected members of the National Committee will form an Adjudication Sub-Committee at the National Event and will make any required clarifications or decisions for any situation that arises that is not covered by these rules.

If, during the event or at scrutineering, AIMSCC officials discover that an entrant or member of a team has deliberately violated these regulations in order to gain an unfair advantage over other entries, or if the officials suspect that there has been a departure from the spirit of the Event, that team will not be eligible for any awards and will be unable to progress past the quarter finals.

### **3 ENTRIES**

#### **3.1 Number of Australian Teams**

The AIMSCC National Coordinator appointed for the Event shall request each State Coordinator to invite a maximum of four teams who have proven to be among the top entrants in their State Event. Additional entries from the State Events may also be invited by the Committee. Unless there are extenuating circumstances no more than 2 (two) cars from any one school should be invited to compete.

#### **3.2 Number of Overseas Teams**

The AIMSC Executive Committee may request coordinators of Events in other countries to invite one or more teams to participate. Overseas teams should begin the process of applying for an Australian visa at least 3 (three) months in advance (or even more, depending upon which country), of their planned arrival date.

#### **3.3 Team Members**

Each team must contain at least 1 (one) member that is only involved with that single car and no team will be permitted to enter more than 1 (one) car. There is no limit (within reason) to the number of students who can be in any team, but each entrant must represent his or her school or other organization accepted by the AIMSC Committee.

If circumstances prohibit all team members from attending the competition, the Committee may, upon request, appoint another team to operate the car.

**Please Note:** without team members to be physically present for the interview process, the team/car would not be eligible for a prize.

#### **3.4 Original Work**

All teams must be able to provide the scrutineers with evidence that the car is the original work of the team members in both design and construction, performed in the current year (2015) and not simply a restyling of any car from a previous year. This will include both the chassis and the body of the car. However, you are permitted to reuse: solar arrays, motors, drive systems, wheels, suspension, guide systems and other similar components. If any organisation 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 proven by the submission of a poster (**§3.6**) and discussions with delegated Committee members in an interview (**§3.7**).

#### **3.5 Statement of Work**

All team members must sign a declaration truthfully stating that the team is (at least mostly) responsible for the design and construction of the team's car.

### 3.6 Posters

Prior to scrutineering, all teams must present to the organisers a laminated or contact coated A2-sized Poster, documenting the design and development of their car (this is standard: all engineering projects require documentation and research is often presented as a poster). This record should document experiments and/or the 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	Points
Headings legible from 5 metres	1
Writing legible from 2 metres	1
Summary of test results	5
Construction details	5
Presentation – photos, diagrams, drawings, etc.	4
Greenhouse relevance	3
References, acknowledgements	1
Total	20

Once you submit it, this poster becomes the property of the AIMSC organisation and may be used for promotion of the Event, but may also be returned to the team by the State Coordinator after the Event.

### 3.7 Interviews

A panel, selected by the AIMSCC organisers, will interview all teams about the design, construction and testing of their car and/or its component parts. Each team member should be able to contribute to the answers given during the interview. Questions could be about any number of the following areas:

- 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 process.

### **3.8 Entry Registration**

Australian entrants must confirm their participation with their local Event Coordinator within one week of receiving their invitation to participate in this event. Potential overseas entrants must notify the AIMSC Chairman of their interest in competing by June 1<sup>st</sup> 2015, so that assistance with visas can be arranged. Invitations for the AIMSCC event will be sent to the State and Territory Coordinators for their local entrants. International invitations will be sent to the parties that have contacted the AIMSC chairman.

## 4 TRACK

**Please Note:** All track information detailed below is of a general nature.

The exact track to be used will be specified prior to the Event. It is highly likely that the track that belongs to the State hosting the Event will be used. For details of various state tracks, go to the respective model solar car web site for that state. **Competitors must not modify the track in any way at any time during the Event.**

During the racing several Track Marshals appointed by the AIMSCC will be in attendance and their directions are to be obeyed at all times. Use of the track without the supervision of the Marshals is not permitted.

### 4.1 Size and Shape

The track normally used in the Event will be in a “figure 8”, with a low bridge at the crossover point. The corners will feature curves, with an approximate minimum radius of 5 (five) metres. The track can be considered to be flat, as none of the tracks currently in use have been designed to accommodate 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 of 200mm between the lower and upper tracks. The slopes will range between 1:16 to approximately 1:8.

### 4.3 Construction

The track will have a predominantly smooth surface with two parallel guide rails (usually PVC U channel, such as “UM20” or “basket track” or similar), with nominal dimensions 16mm wide by 14mm high. As the track is assembled in sections, minor misalignments will exist; there will be some unavoidable mismatching at the 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).

### 4.5 Race Completion

A race is not considered complete until the car has entered the stopping zone (a section of straight “flat of track” after the corner which follows the finish line timing position), and has been safely removed from the track (See §7.5).

### 4.6 Race Format

Unless the AIMSC Committee’s decide otherwise, 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 needed to complete the race as defined in §7.5.

Again, unless the AIMSC Committee’s decide otherwise, based on the weather and available time, later stages of the knockout races may be staged over 2 (two) laps.

## 5 SCRUTINEERING

### 5.1 Race Ready

All competing teams are required to register upon arrival at the Event venue by the time stated on their invitation. Cars must be in race-ready condition when presented for scrutineering. Scrutineers have the right to examine each car at any time during the Event to ensure it conforms to the regulations as set out in §8.

### 5.2 Failure

Any car failing to pass scrutineering by the end of the scrutineering period may not be allowed to start the Event; or the scrutineers may decide to apply a penalty in the form of additional ballast. Minor infractions of the regulations will typically attract a 50gm additional weight penalty, with penalties increasing to 200gm for more significant breaches of the regulations. The size of the penalty will be decided between the Chief Scrutineer and the Scrutineering Team. If it is decided by the scrutineers that the infraction gives the car a significant advantage and that carrying extra ballast isn't enough to "level the playing field", the car will be excluded from the Event.

The scrutineers will make allowances for circumstances beyond the control of the team, such as damage in transit.

### 5.3 Array Power Output

Solar arrays will have their output power measured by the scrutineers using a sun simulator (a light box with a controlled output). Arrays must be presented in ready-to-race condition. For further details of determining array performance see, §8. Each team must bring for testing the one array that they intend to use for all time trials and races; that array alone will be measured by the scrutineers. The team must then use this array, unmodified, for all time trials and races. See also §6.3 regarding damaged arrays. The scrutineers reserve the right to retest any array at any time during the Event.

### 5.4 Pre/Post Race Checks

During scrutineering, the weight of the solar array, any ballast and the total weight of the car will be recorded. Immediately prior to and/or after each race, all cars will be re-weighed. If the car weight is different from the recorded weight, the team will be required to explain the reason for the weight difference. If, after a race, the array plus ballast weight is found to be underweight, or the cargo was not carried, the car will forfeit that race.

For cars racing without electronics, visual confirmation that no electronics are in use will be required. The car design must allow for this inspection to be done quickly and easily (See §8.6).

## 6 SERVICING

### 6.1 Service Area

An official “Service Area” will be set aside for team members to carry out any 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 therefore only students are permitted to perform car adjustments and/or maintenance.

### 6.2 Modifications

Students may modify cars between races; 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 array, the car body and the chassis, irrespective of light conditions. However, repairs to these major components are allowed. **Modifications to solar arrays are specifically prohibited and any repairs to solar arrays must be reassessed by the scrutineers.**

### 6.3 Faulty and Damaged Solar Arrays

After scrutineering, teams may be allowed to change or modify their car’s solar array, if the original array is damaged or becomes faulty. Any and all array changes must be approved by the Chief Scrutineer before any work is undertaken. Repaired and/or replacement arrays will require the same examination, testing and ballasting routine as was performed during the earlier scrutineering.

### 6.4 Restricted Areas

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

### 6.5 Hazardous Substances

**Note.** Due to Health and Safety Regulations, 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.** For this reason, cooling solar panels with anything other than water ice will not be allowed at any time during the Event. This does not include small quantities of common commercially available lubricants and spray cans for the purposes of cleaning and/or lubricating bearings etc.

## **7 COMPETITION**

### **7.1 Time Trials**

After scrutineering, each car will be timed over a single lap of the course for the purpose of “seeding” the car for the main Races. Each car will have the opportunity to run in several of these seeding time trials and seeding will use the fastest of the times recorded for each car.

### **7.2 Structure of the Races**

The event shall be conducted with pairs of cars competing against each other over equidistant courses in a series of round robin and/or elimination races. These races are announced in the official schedule of events provided. Where more than one car is entered from the same school or State, the seeding process will be done in such a way that they will not race each other during the first elimination round. However, if both cars are 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 (four) places.

### **7.3 Timing**

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

### **7.4 Starting Procedure**

Cars are called to the marshalling area a minimum of 2 (two) races ahead of their next scheduled race. If the car and its support team are not present at the starting gate within one minute of being called for the start of their race, the car will forfeit that race. In the case of best of three or best of five heat races, cars will alternate between track lanes. If a final race is needed (in best of 3 (three) or 5 (five) heat races) to determine the winner, the final race lane assignments will be decided by a coin toss. If cars are required to race in consecutive heats, at a team’s request a 2 (two) minute adjustment time will be allowed between heats. Failure to present at the starting line before the 2 (two) minutes are up may result in forfeiture of the race.

### **7.5 Stopping Procedure**

The race will not be considered 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 in the stopping zone (the first three straight sections of track after the corner following the timing equipment), to separate the stopping zones for each lane. A polystyrene block of approximately 250mm wide by 70mm high and 380mm long, weighing about 400gm will be placed at the beginning of the rigid barrier. Cars hit this block and continue till they stop within the zone. If the car is still moving at the end of the track separation barrier, the car can then be stopped by a member of its team.

Any interference with the stopping zone of the other lane by a car or team may result in forfeiture of the race.

## 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 AIMSCC officials are satisfied that the problem was caused by a serious problem with the track. There shall be no handling of cars during the race other than by officials or by people nominated by the officials. If both cars come off the track, the race will be awarded to the car which travelled the furthest distance on the track before derailing. 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 derailed first. If one car or team, in the opinion of the officials, causes damage to the other car that is likely to affect its performance, the offending car will forfeit that round. The damaged car team will be granted extra time and assistance to make whatever repairs might be necessary.

## 7.7 Poor Light/Adverse Weather Conditions

Depending on the decision made by the AIMSCC officials, races may still be run in virtually any weather conditions. If light conditions make it impossible for the cars to complete the course, the car that travels the furthest distance on the track, 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.

**Please 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 10 (ten) seconds. If a car stops for any reason, a Track Marshal has the right to decide to have that car restarted from any point on the track behind the stopping position, but the car must not be manually pushed to restart.

## 7.8 Protests

If a team believes that their car has been unfairly disadvantaged by another team, another vehicle, an AIMSCC official or by a serious 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 their Team Coordinator, will need to make a clear statement as to what they believe the issue was and how they believe it was caused. The Adjudication Sub-Committee will discuss the protest with other AIMSCC officials as they deem necessary and will deliver a decision within 5 (five) 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 Track Marshals are in attendance. **Use of the track without Track Marshal supervision is not permitted.**

## 7.10 Results

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

## **7.11 Prizes**

Prizes will be presented to cars that finish in First, Second, Third and Fourth places. The major trophy will be awarded to the team that finished in First place. The second trophy will be awarded to the team which wins the total points aggregate as discussed in §1.3, §3.6 and §3.7. The presentation of prizes will be held as soon as possible after the completion of the Final Race 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 the invitations to the Event are issued.