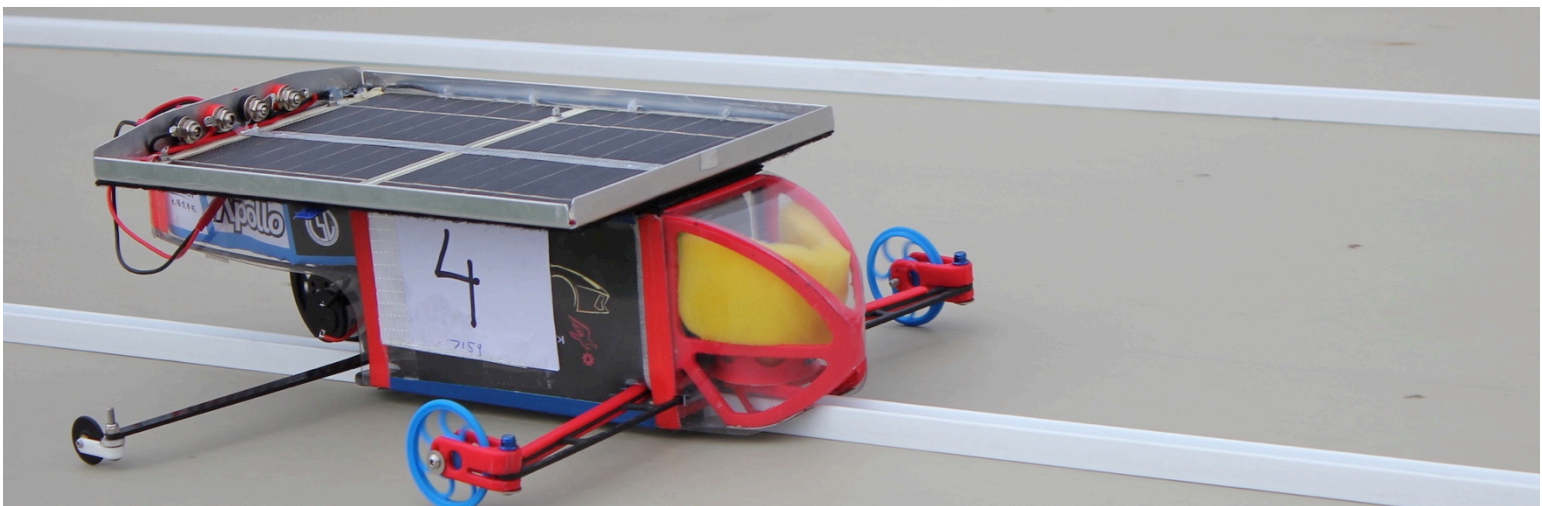




# Australian-International Model Solar Car Challenge

## 2021 Regulations

[www.modelsolarchallenge.com.au](http://www.modelsolarchallenge.com.au)



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## AIMSC Committee

The Australian-International Model Solar Challenge Committee is a voluntary body consisting primarily of members from the local state event organisations and will hereafter be referred to as the AIMSC Committee. The AIMSC Committee and volunteers will act as event officials for the duration of the AIMSC event.

## 1. Introduction

### 1.1. Overview

The Model Solar Car Challenge aims to deliver a first hand educational experience to students in the areas of Science, Technology, Engineering and Mathematics (STEM) with an emphasis on design, engineering and renewable energy.

The event has been designed to expand student learning and provide a practical experience in designing and building a functioning solar powered vehicle, to gain an understanding of the engineering processes involved and recognise the importance of renewable energy for a sustainable future. It also focuses on getting students to work together as a team and demonstrate, apply and effectively communicate their learnings.

Learning outcomes of the Challenge are to be focused on the students. Teacher, mentor and parent guidance is strongly encouraged but it's important that students complete all work themselves and are exposed to the full process of taking an idea from a simple sketch to a well-refined engineering masterpiece.

### 1.2. Competitors

The competition is open to entries from schools, other organisations and private entries in Australia and from overseas. Competitors must be students currently studying up to and including Year 12 secondary level.

### 1.3. Contact and Correspondence

All correspondence should be sent directly to the AIMSC Committee at [secretary@modelsolarchallenge.com.au](mailto:secretary@modelsolarchallenge.com.au)

## 2. Interpretation of Regulations

These regulations have been designed by the AIMSC Committee to operate in good faith. The nature of the event is to promote learning and encourage thinking outside the box, so everything is open for interpretation, but please check with the Committee if uncertain whether an interpretation may give an unfair advantage and be ruled against later on.

## 3. Entries

### 3.1. Invitation to Compete in the AIMSC

The aim of the AIMSC is to encourage teams to compete at the highest national level. Teams may attract an invitation to the event by performing well at their state event, or by invitation directly from the AIMSC Committee. Please contact the AIMSC Committee if seeking an invitation but do not have a local state event to compete in.

Teams that have accepted their invitation to compete must register on the AIMSC website within 10 days of receiving their invitation.

### 3.2. Original Work

Each team must design and build an original model solar vehicle, and not simply re-enter a car from a previous year's event. While some components may be reused, the chassis and body of the car must be totally original and be the work of the students alone. Where a car may be similar to a previous design, the team must demonstrate some fundamental difference that sets their entry apart.

Teams must ensure that their answers presented in the knowledge test are in their own words, and that the Video Presentation is of their own creation.

## 4. Competition Elements

### 4.1. Allocation of Points

The competition's two major trophies are awarded to the winning car and the overall points champion. Points are allocated based on performance in the following three areas of the Challenge.

Video Presentation	30 points
Engineering Knowledge	30 points
Racing Result	40 points
<hr/>	
Total	100 Points

### 4.2. Video Presentation - Communication

As part of each entry to the Solar Challenge, teams must submit a 3-5 minute video presentation. This video shall outline the management, design and build of the car, along with the engineering fundamentals. A key aspect of any innovative engineering endeavour is being able to effectively communicate what you have done and how it solves the problem that has been set out. Sharing knowledge is the best way to move forward.

The video should show the team and the car in action, but can incorporate still images, drawings, text or animations created by your team. Points will be awarded for editing and presentation. Teams must ensure that they do not use music, graphics, animations, text, etc. that is subject to copyright and are encouraged to create their own content. This is the communication component of the Challenge and the video should cover the following topics.

- The Team - Introduce yourselves and your roles.
- Renewable Energy - How does it work? What is the impact on the automotive industry?
- Design Phase - How the car was designed, what was the design process?
- Build Phase - How did you bring your car to life? Explain materials and techniques?
- Testing - How did you test your car? What you have learnt from it and the results.
- Something unique - About the team and/or the car

The video must be submitted in .avi or .mp4 format on a USB at the start of scrutineering on Day 1 of the event and may thereafter be used by the AIMSC for promotional purposes, unless special circumstances prevent this. Marking will be carried out as per the below guidelines:

Team intro and layout of video	5 points
Renewable Energy	5 points
Design and Engineering process	10 points
Knowledge and Understanding of your project	5 points
Video Presentation	5 points
<hr/>	
Total	30 Points

Teams choosing not to submit a video will not score any points for this portion of the event and be excluded from being in the running for overall event points champion.

### 4.3. Engineering Knowledge

Each team will be required to complete an engineering knowledge test on the first day of the event. This will consist of approximately 5 questions based around the car and solar energy. The questions will aim to test depth of understanding in a number of areas.

This test will make up the 30 Engineering Knowledge marks and teams will have approximately 3 hours to complete it alongside their racing. It will be hand written on a double-sided A4 sheet.

#### 4.4. Track Type and Racing Format

Racing will take place across two days on a specially constructed track. This will be either a 2-lane figure-8, with a low bridge at the crossover point, or a single-lane flat oval. Both types will feature curves with an approximate 5m radius.

A start gate is located on the downhill slope of the figure-8 track and racing typically held over a single lap of approximately 100m in length. Racing on the oval track will take place as a pursuit where cars start on opposite sides and travel in the same direction. Pursuit races may be started on the flat or a short removable downhill ramp.

The racing format will be decided by the Committee and communicated to teams prior to the event. Round robin rounds are typically held on Day 1 and cars then ranked on their performance for the final knockout competition on Day 2. Figure 8 races may be extended from a single lap to two laps in the finals.

#### 4.5. Winning Vehicle

On a two-lane track the winner shall be determined as the first to cross the finish line. In the case of a pursuit race, the winner shall be the first car to catch the opponent and make contact, or to complete a set number of laps. All this must be achieved without interfering with the opposing car or any official equipment.

If a car comes off the track at any point during a race then the opposing car shall be deemed the winner. If both cars fail to finish then the one that has travelled furthest will be awarded the win.

After the completion of racing each team will be awarded points according to their finishing position. These points will be added to each team's total and are given as follows.

1 <sup>st</sup> – Place	40 points
2 <sup>nd</sup> - Place	38 points
3 <sup>rd</sup> – Place	36 points
4 <sup>th</sup> – Place	34 points
5 <sup>th</sup> – 8 <sup>th</sup> Place	30 points
9 <sup>th</sup> – 16 <sup>th</sup> Place	25 points
17 <sup>th</sup> + Place	15 points

If a team believes they have been mistreated or lost due to an unfair incident or advantage for the opposing team they must report this to the AIMSC Committee immediately after their race. The AIMSC Committee will work together to resolve the issue and return their decision promptly. That decision will be final.

### 5. Scrutineering

Upon arriving at the event each team must pass through Scrutineering with their vehicle. Cars will not be allowed on the track until they've been checked for compliance and fitted with a race number.

Each car will be judged according to these rules. Where a car does not meet these rules the team will be allowed to make the necessary modifications until it complies. A car may not be allowed to race if this isn't possible.

### 6. Servicing

To allow students space to work on their cars, designated areas will be set up to allow for modifications and repairs. This will be a restricted area for team members only. Teachers, parents and mentors will not be permitted in these areas but allocated a nearby space from which they can supervise their students.

Modifications are allowed during the event but must always comply with these regulations in full. Cars may be checked and re-scrutineered at any time to ensure ongoing compliance.

Hazardous substances are strictly prohibited due to Health and Safety Regulations. Any substance classed as hazardous (solvents, liquefied gases, etc.) must be approved by the AIMSC Committee before being used during the competition, and the team must provide the relevant MSDS.

## 7. CAR SPECIFICATIONS

### 7.1. Size Limit

The car must fit in a box, 500mm long, 150mm high and 320mm wide with the solar panel fitted in place. It must also stay within 190mm of the centre of the guide rail at all times to ensure there's no interference with the car beside it or any timing equipment.

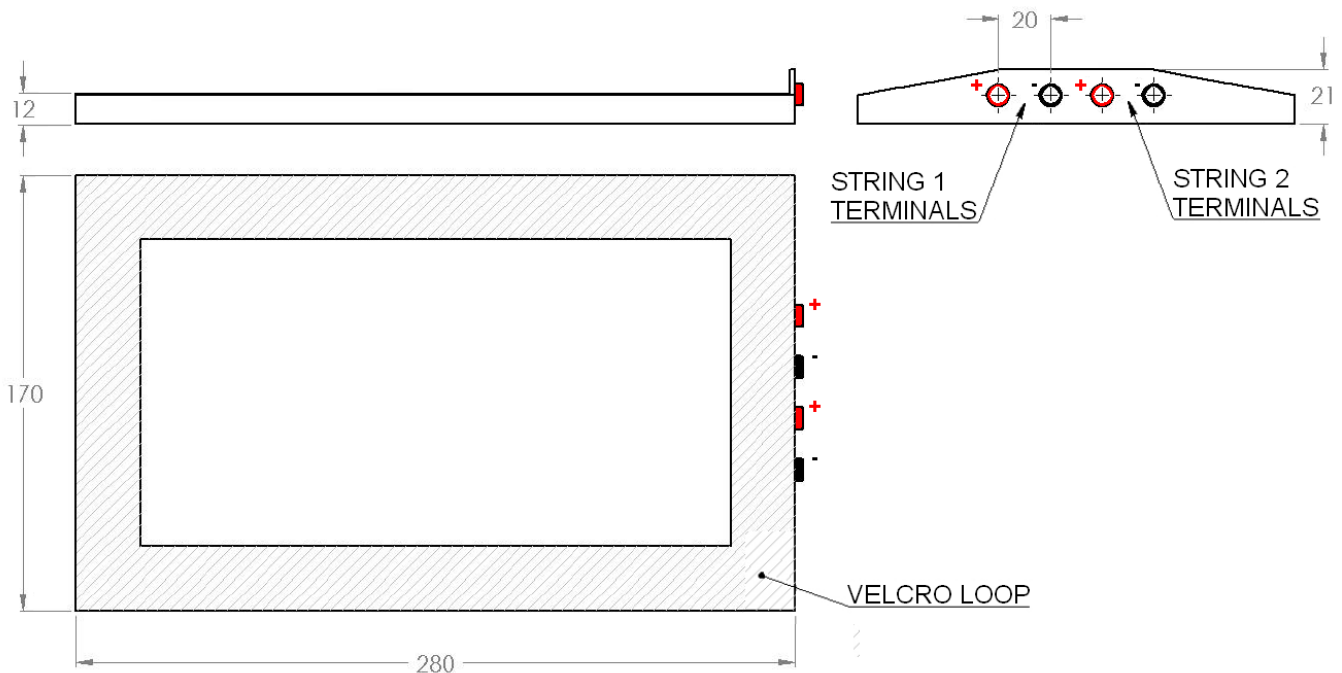
### 7.2. Source of Power

Cars must race with a solar array provided by the AIMSC and can only operate on the energy provided by this array during the course of a race. The array will be provided to teams immediately before each race and collected immediately after. Car design must allow for easy installation and removal in less than 1 minute. Practice must be conducted with a solar array provided by the team.

### 7.3. Solar Array Specifications

Competition arrays consist of a Scorpio Technology Number 26 solar panel mounted on an aluminium backing for protection. These have been standardised to weigh  $240\text{g} \pm 15\text{g}$  and produce  $5.5 \pm 0.1$  Watts of power at standard test conditions ( $1000\text{ W/m}^2$  irradiance, 1.5 air mass,  $25^\circ\text{C}$ ).

Arrays are approximately 276-280mm in length and 165-170mm in width. The height of the terminal end will be no more than 21mm and all other sides a maximum of 12mm. 25mm wide Velcro loop tape is available around the outer edge on the underside of the panel as a possible method of attachment to the car.



Arrays consist of two identical solar cell strings, each wired to a positive red (Jaycar PS-0406) and negative black (Jaycar PS-0408) 4mm banana socket terminal, and teams can connect these up in either series or parallel as desired. A typical electrical output of the two strings configured in series is given below:

Volts open circuit	8.64V
Volts at maximum power	6.88V
Current at maximum power	0.808A
Current short circuit	0.9A
Maximum power watts	5.56W

### 7.4. Cross-sectional Area

Cars will require a cross-sectional area of at least 150 sq cm in a plane transverse to the direction of travel. This area may be any shape but teams will need to supply a diagram showing a clear calculation at scrutineering.

### 7.5. Side Panels

Cars must have two rigid side panel areas of at least 100mm long and 50mm high, one on each side, for attaching number stickers that can be easily seen by spectators when racing. The curvature over this area can be no more than 20mm horizontally and 10mm vertically.

### 7.6. Motors

Cars may use any type of motor/s but specifications of the make and model must be made available to the AIMSC.

### 7.7. ON/OFF switch

Each car must be fitted with a commercially available ON/OFF switch.

### 6.8. Use of Electronic Devices

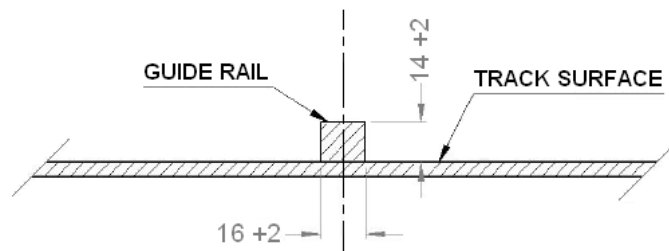
Electronics of any kind are allowed however any energy storage devices such as capacitors must be fully discharged before the start of each race.

### 6.9. Wheels

Wheels must be at least 2mm wide and have a radius of at least 1mm on the running surface. No knife-edge wheels.

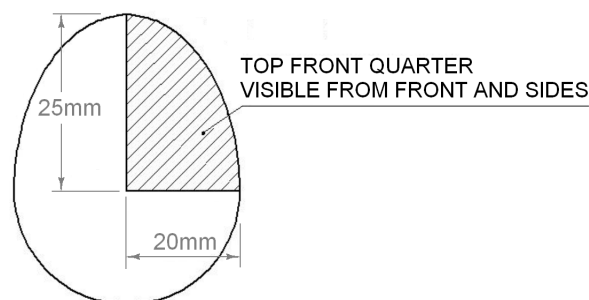
### 6.10. Steering

Cars must incorporate a means of steering around the track using the rectangular guide rail at the centre of each lane. This rail will be 16-18mm wide and 14-16mm high. It's advised that designs have an adjustable guide system to suit different tracks and overcome minor lane misalignments. Track curves will be approximately 5m in radius.



### 6.11. Driver Compartment

Each car must have space for a driver to navigate the track. This occupant will be a regular ~50g egg provided by the AIMSC. The driver compartment must be sealed to prevent a broken egg from spilling on the track, or getting on the solar array, and the top half of the egg have a transparent windscreen with 180° vision in the horizontal plane.



### 6.12. Stopping Block

Cars will need to be capable of withstanding a collision with a weighted styrene foam stopping block. The blocks, one for each car, will be placed on the track after the finish line and be approximately 400mm long, 250mm wide, 150mm high, and ballasted to weigh 650+/- 10gm. Blocks will have a groove of approximately 25 mm wide, and of similar depth, cut into the bottom to clear the guide rail and be free to slide along the track after impact. Cars may be subjected to a number of such collisions during the course of an event, as designated on race day by the AIMSC. Eggs may be checked for damage after each race and the win awarded to the other car if the winning driver suffers an injury (cracked or broken egg).