AIMSC Model Solar Car
2019 Regulations

Mission Statement

To develop and encourage an interest in Science, Technology, Engineering and Mathematics (STEM) and 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.

AIMSC Committee

The Australian-International Model Solar Challenge Committee is a voluntary body consisting of primarily of members from the local state event organisations and may include sponsors representatives, teachers, students and other invited interested persons, is hereafter referred to herein as the AIMSC Committee.

The AIMSC committee and volunteers will act as event Officials for the duration of the AIMSC event.

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1. Introduction

1.1. Overview

The Australian International Model Solar Challenge (AIMSC) is focused on providing first hand education to students based around Science, Technology, Engineering and Mathematics (STEM) with a focus on design, engineering and renewable energy.

The event is comprised of two main categories, the Model Solar Car event and the Model Solar Boat event. This document outlines the rules and regulations for the Model Solar Car event.

Students will design and build Model Solar Cars and race off against each other to determine who has produced the overall best designed, built and executed entry.

The Model Solar Car Champion will be determined by the teams combined score from the three competition portions: racing results, video presentation and engineering knowledge.

1.2. Spirit of Intent

The event has been designed to improve student learning and provide a practical experience in designing and building a renewable energy vehicle, to gain crucial understanding and development around the engineering process and the importance of renewable energy for a sustainable future; it also focuses on getting the teams to demonstrate, apply and effectively communicate their learnings.

It is important that the learning outcomes of the challenge are focussed on the students; as such while teacher and parent help is strongly encouraged and absolutely necessary, it is important that the 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.

1.3. Allocation of Points

Points allocated for each portion of the event are based off the importance of each section. Detailed explanations of the points for each area can be found in the relevant sections.

The 2019 Model Solar Car Champion will be the team that achieves the highest points score.

Video Presentation	30 points
Engineering Knowledge	30 points
Racing Result	40 points
Total	**100 points**

1.4. Competitors

The competition is open to applicants from schools, other organizations and private entries in Australia and from overseas. Competitors must be students currently studying up to and including Year 12 secondary level, as approved and invited by the AIMSC Committee. All teams entering this event must comply with the regulations.

1.5. Contact and Correspondence

All correspondence should be sent directly to the AIMSC committee

secretary@modelsolarchallenge.com.au

2. Interpretation of the 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.

While it is encouraged for students to push the boundary of what is within the rules and what is not, anything outside the Spirit of the Event will not be permitted.

The AIMSC Committee will judge each entry according to these regulations and will investigate anything brought to their attention. They will, within reason, penalise any teams who do not comply, and take any action they believe to be appropriate.

3. Entries

3.1. Invitation to Compete in AIMSC

The aim for the National event is to allow 32 teams to compete at the highest 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 you are seeking an invitation and do not have a local state event to compete in.

Potential overseas entrants must notify the AIMSC Committee of their interest in competing by 1 June 2019, to ensure that we are able to provide assistance with visas as needed.

Invitations for the AIMSC event will be sent to the regional coordinators for their local entrants.

International invitations will be sent to the parties that have contacted the AIMSC Committee.

3.2. Registration

Teams that have accepted their invitation to compete must register on the AIMSC website within 10 days of receiving their invitation. All registrations will close on 18 November 2019.

3.3. Original Work

Each team must design and build an original model solar vehicle each year, and not simply re-enter a vehicle from a previous 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 previous designs, the team must demonstrate some fundamental difference that sets their design apart from the rest.

Where a school has multiple entries, each car must be proven to be of different design, and not a slightly varied version of another teams.

Teams must ensure that their answers presented in the knowledge test are in their own words, and that their Video Presentation is created entirely by the team.

4. Video Presentation

As part of each entry to the Solar Challenge, each team must submit a 3-5 minute video presentation to the AIMSC Committee. This video shall outline the design and build of the car, along with the engineering fundamentals that make the team's car stand out from the rest.

The video must be submitted along with a media release consent form allowing the AIMSC Committee to use the video for promotional purposes, unless special circumstances prevent this.

The video must show the team and the car in action, but can incorporate still images, drawings, text or animations created by your team. Points will be also be awarded for outstanding editing and presentation.

Teams must ensure that they do not use content (e.g. music, graphics, animations or text) that are subject to copyright and are encouraged to create their own content entirely.

4.1. Video Content

A key aspect of any innovative engineering endeavour is being able to effectively communicate what you have done and how it stands out from predecessors and your peers. Sharing knowledge is the best way to move forward, and this video will enable teams to collaborate and grow together, while allowing new teams to understand the competition and gain invaluable insight into how to build a model solar car.

The video should cover the following topics in detail, along with other interesting features that could gain the favour of the people marking.

- The Team – Introduce yourselves and your roles! Team slogan?
- 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? Special materials or techniques?
- Testing – How did you test your car? Will it be fast enough? Show us footage of testing and tell us what you have learnt from it!
- Something unique – About the team or the car!

4.2. Consent – Media Release

Each student who features in the video or attends the AIMSC event must submit a media release consent form signed by a parent or guardian upon registration. The videos may be used by the Committee for promotional or educational purposes, with the best entries displayed on our website.

If parents or guardians are not willing to consent, the team must submit their video without including that member(s) of the team in any footage. This will not impact marking as there are many creative ways you can include your team without needing to use their image.

Parents and teachers should review and approve all video submissions prior to the videos being submitted to the Committee, so it is suggested you seek permission from parents or guardians at the start of the project.

The media release consent form is available on the AIMSC website.

4.3. Video Submission

The video must be submitted as a soft copy, in avi or mp4 format, either:

1) On a USB at the start of scrutineering on the Saturday of AIMSC (videos submitted after 10am Saturday will not be marked; corrupt files will achieve a score of zero)
2) By file transfer / email in the week prior to the event

If teams choose not to submit a video, they will not score points for this portion of the event, which will exclude the team from being in the running for the championship.

4.4. Video Marking Criteria

The video presentation will be marked as per the below guidelines:

Team Collaboration	6 points
Design and Engineering	8 points
Knowledge and Understanding	8 points
Video Presentation	8 points

The video will be given a total mark out of 30, which will contribute to the teams overall score to determine the overall winner of the Challenge.

5. Engineering Knowledge

Each team will be required to complete an engineering knowledge test on the first day of the event, answering some technical questions about their car. This test will make up the 30 Engineering Knowledge marks.

The AIMSC Committee may also be asking questions during the event, each teams understanding of the car when explaining technical details to the Committee may also impact the teams Engineering Knowledge score if there is a major discrepancy between questions and the knowledge test results.

Teams may also be selected at random to conduct interviews on stage in front of the entire event, with the aim of demonstrating what they have learnt and how they have overcome some challenges during the design process.

6. Track and Racing

6.1. Tack Size & Shape

Depending on where the event is held and what track is available, it will be either a single-lane oval track, or a two-lane figure-8 track; it will be approximately 100m long. The track presented for the competition will be the same for every entrant, and as such cannot be modified in any way shape or form to suit any entrant.

6.2. Track Construction

The track surface will be mostly smooth with a rectangular guide rail in the centre of each lane. The guide rail will be 16-18mm wide, and 14-16mm high. It is advised that cars should design an adjustable guide system to suit multiple tracks and ensure enough clearance to not scrape on any part of the track.

As the track will be made in sections for ease of storage between events, it is normal to expect gaps or bumps of up to 3mm. Every effort will be made to minimise these imperfections; however imperfections are to be expected and must be taken into account when designing a car to win.

Further details of the track can be provided on request, full specifications of the guide rail and surface available in Figure 1.

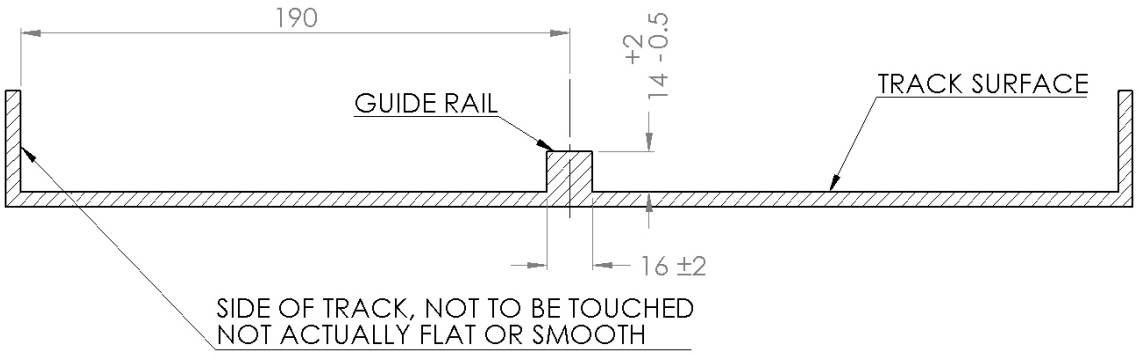

Figure 1 - Track Cross Section

6.3. Race Format

Racing may be conducted in a number of ways, as outlined below:

- Round Robin Knockout
- Swiss Perfect Tournament
- Time Trials
- Head to Head Knockout
- Pursuit Racing

Other methods may also be used to determine the fastest car and will be communicated effectively on the day of racing.

The preferred method of racing is over a two-day event using the figure-8 track, to complete 5-6 rounds of Swiss Perfect Tournament. The second day will begin with 2-3 additional rounds of Swiss Perfect Tournament, followed by a 32 car knockout. After the top 8 teams have been determined, the race format may be adjusted from single lap races to 2 lap races.

The actual format for racing will be decided by the Committee on the day and communicated to the teams prior to the start of racing.

6.4. Winning Vehicle

On a two lane track the winner shall be determined by either the fastest time or 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 in any way shape or form.

If a car comes off the track at any point during the race that car will not be awarded the win; part of the race is to successfully complete the distance and come to a stop. In the case where both cars come off the track, the car which has travelled the furthest shall be awarded the win.

After the completion of racing each team will be awarded points as per below according to their finishing position. The points will be added to each teams total to determine the overall champion.

1st Place	40 points
2nd Place	38 points
3rd Place	35 points
4th Place	33 points
5th – 8th Place	30 points
9th – 16th Place	25 points
17th – 32nd Place	15 points

6.5. Starting/Stopping Procedure

Both cars competing in a race will be started and stopped in the designated zones and must not interfere with any official equipment or the other team.

The method of starting will be determined by the AIMSC Committee depending on the style of racing being conducted at the event.

Such methods could include a start gate being operated by an official, or a team member may be directed to release the car at the starting signal.

6.6. Poor sunlight

The race must go on! We don't always get favourable weather; however best efforts will be made to conduct races during good weather. Sometimes this cannot be avoided, so the cars will need to prove themselves under low sunlight conditions, maybe even in the rain.

6.7. Protests

If a team believes they have been mistreated or lost due to an unfair advantage for the opposing team they must report the incident 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 and no further action will be taken afterwards.

6.8. Practice and Testing

The track will be open for testing as often as possible, however only while an AIMSC Official is present.

6.9. Results

Results will be published in an easily accessible manner on the day of racing, and updated continuously throughout the day. Following the event results will be posted online along with photos of the event and details of each car.

7. Scrutineering

Upon arriving at the event each team must pass the Scrutineering Process prior to be allowed to use the track or participate in the event.

The team will need to submit their video presentation and car to pass scrutineering. Each car will be judged according to these rules while in race ready condition to ensure it fully complies with all the rules. Where a car does not meet any rules the team will be allowed to make modifications to the car to meet these requirements. In the case this is not possible, the car may not be allowed to race.

Each car may be checked by an AIMSC Official immediately before each race, prior to being issued panels, and may be checked after each race, or at any time during the competition.

8. Servicing

8.1. Service Area

To allow students space to work on their cars, a designated area will be setup to work on cars and allow for modifications and repairs. This will be a restricted area only for members of the teams, and as such teachers, parents and mentors will not be permitted in these areas. Team supervisors will be allocated space from which they can readily supervise teams, but will be separated from the servicing area.

8.2. Modifications

Modifications are allowed during the event, but must always comply with these regulations. Any car may be re-scrutineered at any time to ensure compliance to the regulations.

8.3. Hazardous Substances

Hazardous substances are strictly prohibited due to Health and Safety Regulations throughout all the competition. Any substance that may be classed as hazardous (eg 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.

9. Car Specifications

9.1. Test criteria

Each car built for racing in this challenge will need to comply with these specifications, which are assumed to be on a straight, flat section of track unless otherwise stated.

9.2. No commercially built cars

Cars must not be commercially available or made from a single pre-designed commercially available kit. The intent of the competition is for the team to design their car from scratch; this may involve

the use of commercially available components from kits or purchased separately put together to achieve the teams unique design.

9.3. Size limit

The car must fit in a box, 500mm long, 150mm high and 320mm wide.

The car must stay within 190mm of the centre of the guide rail, so that it doesn't crash into the car beside it or damage the track when racing. This will be tested by placing the car on a section of guiderail and demonstrating where the outermost points the car can reach.

9.4. Source of power

In all races the car must only use the solar array provided by the organisers and must operate only on the energy provided by this solar array during the course of the race.

The array provided will be configured to produce a power output of 5.5 + or – 0.1 watts at AM 1.5 conditions. The array provided by organisers will be a Scorpio Number 26 solar panel or similar mounted on an aluminium backing for protection see below for details.

The array will be provided to teams immediately before a race and collected immediately after, your car design must allow for installation and removal in less than 30 seconds.

Practice will be conducted with a solar array provided by the competitor. It is suggested that this array have a maximum nominal power of 6 watts and similar to the panel provided for racing.

9.4.1. Standard Array Dimensions:

Overall dimensions, length 276mm to 280mm not including the terminals, width 165mm to 170mm maximum height of sides 21mm at terminal end, other sides 12 mm as per Figure 2.

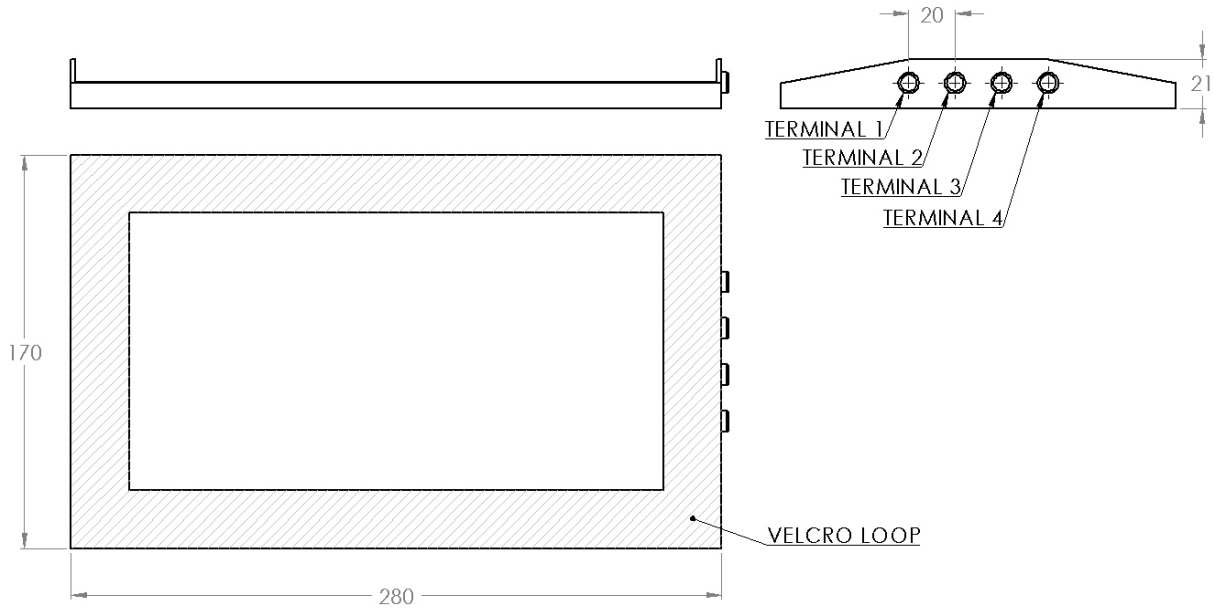

Figure 2 - Solar Panel Dimensions

Weight of the array is 240g ± 15g

9.4.1. Standard Array Mounting:

Velcro loop tape 25 mm wide is available all around the outer edge of the underside of the panel as shown in figure 2.

9.4.2. Standard Array Terminals:

Jaycar banana chassis sockets catalogue PS-0406 (red) PS-0408 (black) are mounted on one end.

The two sections of the panel have their positive and negative terminals brought out to these banana sockets allowing for connection in either series or parallel as desired by the competitors as per Figure 3.

The banana sockets are spaced at a nominal 20mm ± 2mm apart.

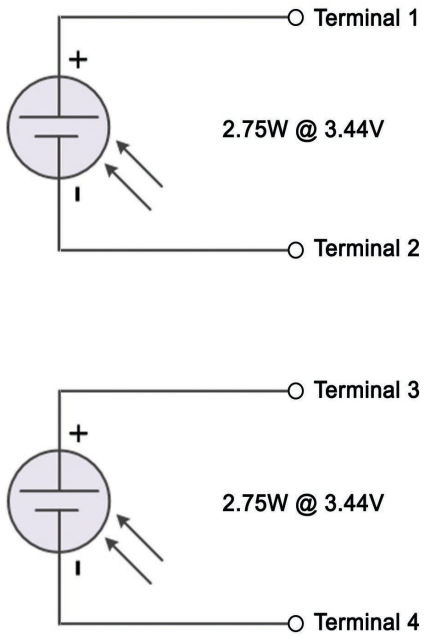

Figure 3 - Solar Panel Schematic

9.4.3. Standard Array Power:

Each array will be configured to produce 5.5 watts + or – 0.1 watts at AM 1.5 conditions when connected in series. Typical electrical output of the provided array at AM 1.5 25 Deg. C when connected in series.

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

9.5. ON/OFF switch

Each car must be fitted with an ‘ON/OFF’ switch and labelled clearly! as we can’t have any cars running off without supervision.

9.6. Car wiring

All wiring should be mostly visible for ease of repair and to help the understanding of the AMISC committee. Finding a short circuit inside the chassis can be a bit difficult at times.

9.7. Motors

Cars may use any type of motor and as many as desired, but the specifications of the motor must be provided to the AIMSC committee.

9.8. Wheels

To reduce damage to the track, knife-edge wheels are not allowed. Each wheel must be at least 1mm wide or have a radius of 0.6mm on the running surface.

9.9. Steering

Each car must incorporate a means of steering around the track, based on the guide rail specification in section 6.2. These should be adjustable to some extent, as every track is different.

9.10. Driver & Windscreen

Each car will have space for a driver to navigate the track. The occupant will be a regular ~50g egg provided by the Committee. To see where they are going, the driver must have a windscreen with 180° vision in the horizontal plane and 90° upwards the forward vertical plane. This must apply for the top half of the egg as per Figure 4.

The windscreen may include up to two opaque supports, each up to 5mm in width within drivers field of vision, however they must remain at least 10mm from the driver.

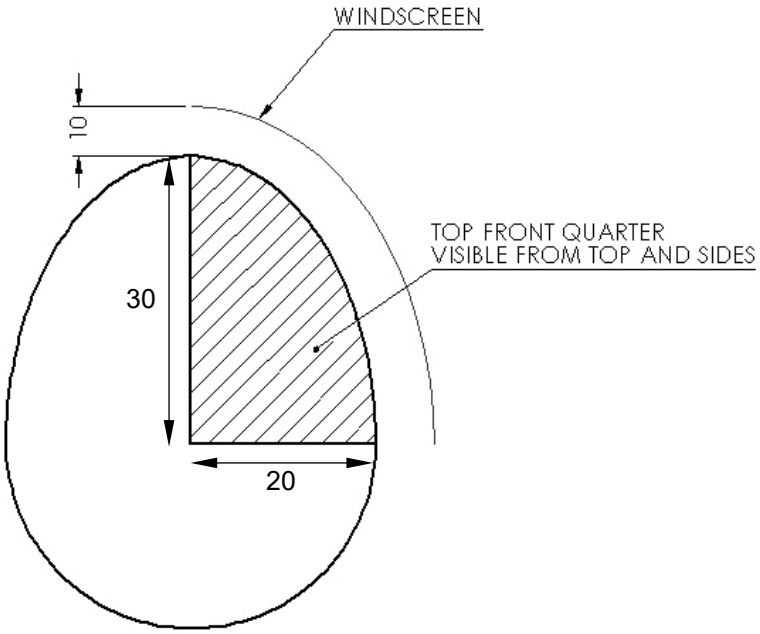

Figure 4 - Driver

In the case of adverse weather, the driver would prefer to remain dry, so the cabin must be totally sealed from the elements to prevent water getting inside – or broken egg on the track! The cabin must not be closer than 10mm to any part of the driver, so they have room to move and climb in and out of the seat.

During the race, if the driver suffers an injury (any damage at all) that team will lose the race. Eggs will be checked after each race. It will be the team's responsibility to provide medical attention to the eggs (clean up the mess!).

9.11. Cargo

A car without boot space isn't very practical, so every solar car needs to carry a standard size tennis ball, as would be used at the Australian Open. Teams will need to provide their own tennis ball of any brand, it must be undeformed and unmodified and in good enough condition to play a tennis match after the racing. The tennis ball must be easily removable in under a minute at scrutineering and during race inspections.

9.12. Use of electronic devices

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

9.13. Side Panels

The car must have two rigid side panels, one of each side of the car, for attaching numbers and sponsors logos. These must be easily seen by spectators while the car is racing (can't be hidden behind wheels or motors) and they must be flat. Each side panel must fit a sticker 150mm long and 80mm high. The sticker may not be trimmed by competitors.

9.14. Bumper Bar

While we try to avoid crashes, these things do happen from time to time, and solar racing on a pursuit track means the cars will hit each other, sometimes very heavily! Teams should consider this while building the car and think about what could get damaged if it was involved in a crash.

9.15. Autonomous Operation

After the race has started the car must be fully autonomous and not receive any kind of signal or input from any source.

9.16. Structural Integrity

The car must be reasonably tough, so it does not get damaged while being handled during scrutineering or any other time. While race cars do tend to be extremely light weight and designed for the conditions, these solar cars are versatile and need to withstand the tough conditions of the Australian sun.