TMSC

School Solar Challenge

www.tassolarchallenge.org

TASMANIAN MODEL SOLAR CAR CHALLENGE

2020 REGULATIONS

UTAS

ENGINEERS AUSTRALIA

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TMSC COMMITTEE

The Tasmanian Model Solar Challenge Committee is a voluntary body consisting primarily of University of Tasmania undergraduates, teachers, engineers and other past competitors and will hereafter be referred to as the TMSC. The TMSC is tasked with coordinating the Tasmanian division of the nation-wide Australian-International Model Solar Challenge.

1. INTRODUCTION

1.1. Overview

The Model Solar Car Challenge aims to deliver first hand education to students in the areas of Science, Technology, Engineering and Mathematics (STEM).

The event has been designed to broaden student learning and provide a practical experience in designing and building a physical real-world model, gain an understanding of the engineering processes involved, and to 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 ideas and learnings.

Teacher, mentor and parent guidance is strongly encouraged but it's important that students complete the work themselves and are exposed to the full process of taking an idea from a simple sketch to a working vehicle.

1.2. Interpretation of Regulations

The nature of the event is to promote learning and encourage thinking outside the box, so everything in these regulations is open for interpretation, but please check with the TMSC if uncertain about something or whether an interpretation may give an unfair advantage and be ruled against later on.

1.3. Contact and Correspondence

All correspondence should be emailed directly to the TMSC at www.tassolarchallenge.org/contact

2. ENTRIES

2.1. Competitors and Number of Entries

Competitors must be students currently studying up to and including Year 12 in Tasmania. The competition is open to an unlimited number of entries from schools, STEM organisations and private individuals. Multiple entries are permitted from a single team provided that at least one unique student can be assigned to each vehicle.

2.2. Original Work

Each team must design and build an original solar powered vehicle and not simply re-enter a car from a previous year. Teams are permitted adult assistance with more complex manufacturing processes, able to use commercially available components or reuse parts from a previous car, but the overall design and construction must be original and the work of the students alone.

3. COMPETITION

3.1. Track Type and Racing Format

Racing will take place on a specially constructed track with a smooth running surface. This will be either a 2-lane figure-8, with a low bridge at the crossover point, or a flat single-lane oval.

A start gate is located on the downhill slope of the figure-8 track and racing held over a single lap of approximately 100m in length. Competition on the oval track will take place as a pursuit race 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 and run for several laps.

The racing format will be decided by the TMSC and communicated to teams prior to the event. Early rounds are typically conducted as a series of round robin races and cars then ranked on their performance for a final knockout competition. Figure-8 races may be extended from a single lap to two laps in finals.

3.2. 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 track timing 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.

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 track officials immediately after their race. The TMSC will work together to resolve the issue and return their decision promptly. That decision will be final and cannot be appealed.

3.3. Engineering Knowledge

It's important not just to design and build something that works but also have a good understanding of the principles at play. As such, teams may be required to complete a handwritten knowledge questionnaire during the event. This will aim to test depth of student understanding and consist of several questions based around the car and solar energy.

3.4. Awards and National Selections

The event's major trophy is awarded to the winning team of the final knockout competition. Awards are also presented to the minor placegetters, fastest lap, top primary school entry and several other discretionary category recipients. Top entries are selected by the TMSC to progress on and represent the state at the Australian-International finals.

4. 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.

Teams presenting a car that does not fully comply with these rules will be allowed to make the necessary modifications until it does so. A car may be not be allowed to race if this isn't possible.

5. SERVICING

Vehicle modifications are allowed during the event but must remain within these regulations at all times. Cars may be checked and re-scrutineered at any time to ensure ongoing compliance. Teachers, parents and mentors may provide guidance but only students are permitted to carry out any adjustments or repairs on the cars themselves.

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 TMSC before being used during the competition, and the team must provide the relevant MSDS.

6. CAR SPECIFICATIONS

6.1. Test criteria

All specifications are assumed to be with the solar panel in place on the car on a straight, flat section of track.

6.2. Size limit

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

6.3. Cross-sectional Area

Cars will require a cross-sectional area of at least 150 sq cm, at some point, transverse to the direction of travel. This area may be any shape and include axles and panel supports, if they happen to be in the same plane, but no running gear like wheels, motors, guide rollers, electronic devices or the solar array. Teams will need to supply a diagram at scrutineering showing a calculation of this area.

6.4. Side Panels

The car must have two rigid side panel areas, one on each side, for attaching number stickers and sponsor logos. These need to be easily seen by spectators while the car is racing and can't be hidden behind wheels, motors, etc. Each side panel must have an area of at least 100mm long and 50mm high. The maximum curvature over this area can be no more than 20mm horizontally and 10mm vertically.

6.5. Wheels

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

6.6. Source of power

Cars must race with a solar array provided by the organisers 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.

6.7. 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 240g ± 15g and produce 5.5 +/- 0.1 Watts of power at standard test conditions (1000 W/m^2 irradiance, 1.5 air mass, 25°C).

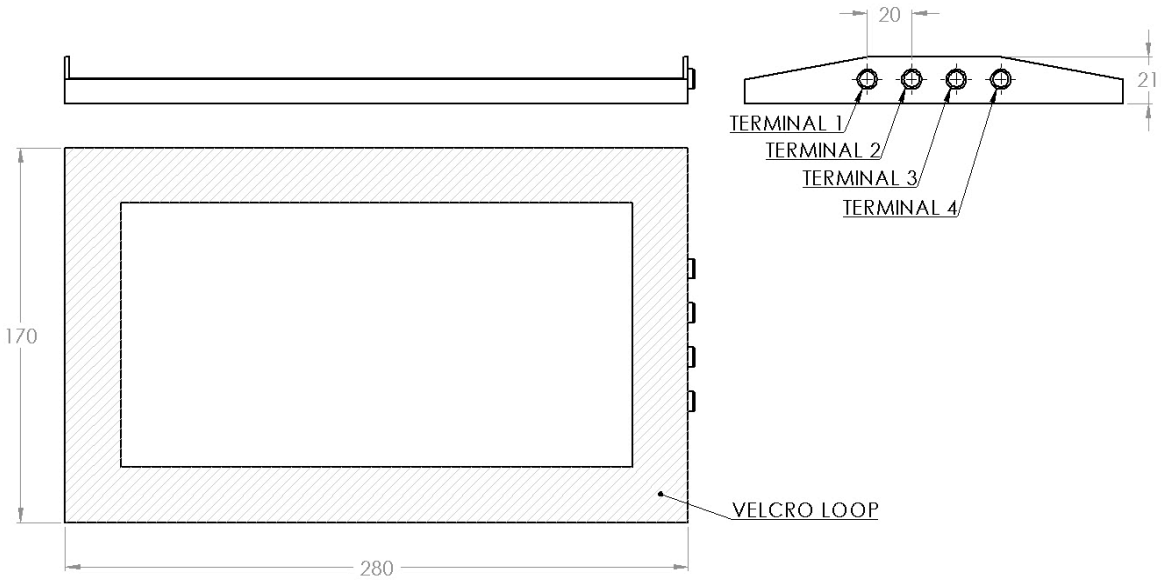

Figure 1 – Competition Array Dimensions (all dimensions in mm)

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.

Figure 2 - Array Terminals

Cars must connect up to the solar array using the four banana socket terminals mounted at one end and spaced 20mm ± 2mm apart. Arrays consist of two identical solar cell strings, each wired to a positive red (Jaycar PS-0406) and negative black (Jaycar PS-0408) banana socket, 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

6.8. ON/OFF switch
Each car must be fitted with an ON/OFF switch and labelled clearly.

6.9. Motors
Cars may use any type of motor, and as many as desired, but specifications of the make and model must be made available to the TMSC.

6.10. 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.

6.11. Steering
Cars must incorporate a means of steering around the track using the rectangular guide rail at the centre of each lane. This guide 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 range from 3.5-5m in radius.

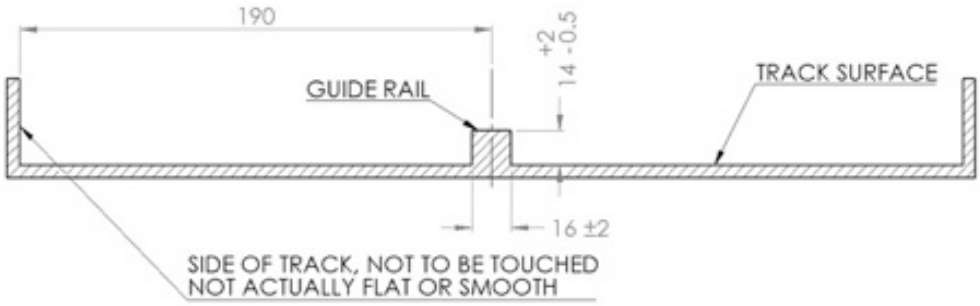

Figure 3 – Track Cross Section (all dimensions in mm)

6.12. Driver & Windscreen
Each car must have space for a driver to navigate the track. The occupant will be a regular ~50g egg provided by the Committee. To see where the car is going, the top half of the egg must have a transparent windscreen with 180° vision in the horizontal plane and 90° upwards of the forward vertical plane. This field of vision may include two struts, each up to 6mm in width.

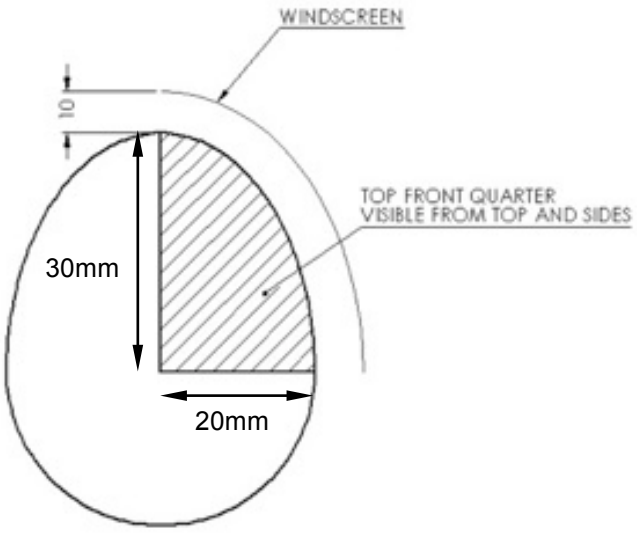

Figure 4 – Egg Driver (all dimensions in mm)

The windscreen must not be closer than 10mm to any part of the driver. The cabin must also be sealed to prevent water getting inside or a broken egg spilling on the track. Eggs may be checked for damage after each race. A win will be awarded to the other car if the winning driver suffers an injury (cracked or broken egg).