TMSC

School Solar Challenge

www.tassolarchallenge.org

TASMANIAN MODEL SOLAR CAR CHALLENGE

2022 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 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.

1.2. Interpretation of Regulations

The nature of the event is to promote learning and encourage thinking outside the box. 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, 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.

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 generally 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. Earlier 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 or to complete a set number of laps. 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 then 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 primary and secondary school placegetters, fastest lap 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. Teams presenting a car that does not fully comply with these rules will need to make the necessary modifications or may otherwise not be allowed to race.

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 and mentors may provide guidance but only students are expected to carry out adjustments or repairs on the cars themselves.

Due to Health and Safety regulations, any substance classed as hazardous (solvents, liquefied gases, etc.) must be declared to and approved by the TMSC before being used during the competition. This does not include small quantities of commonly available lubricants and spray cans for the purposes of cleaning and/or lubricating bearings, etc.

6. CAR SPECIFICATIONS

6.1. 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 when racing.

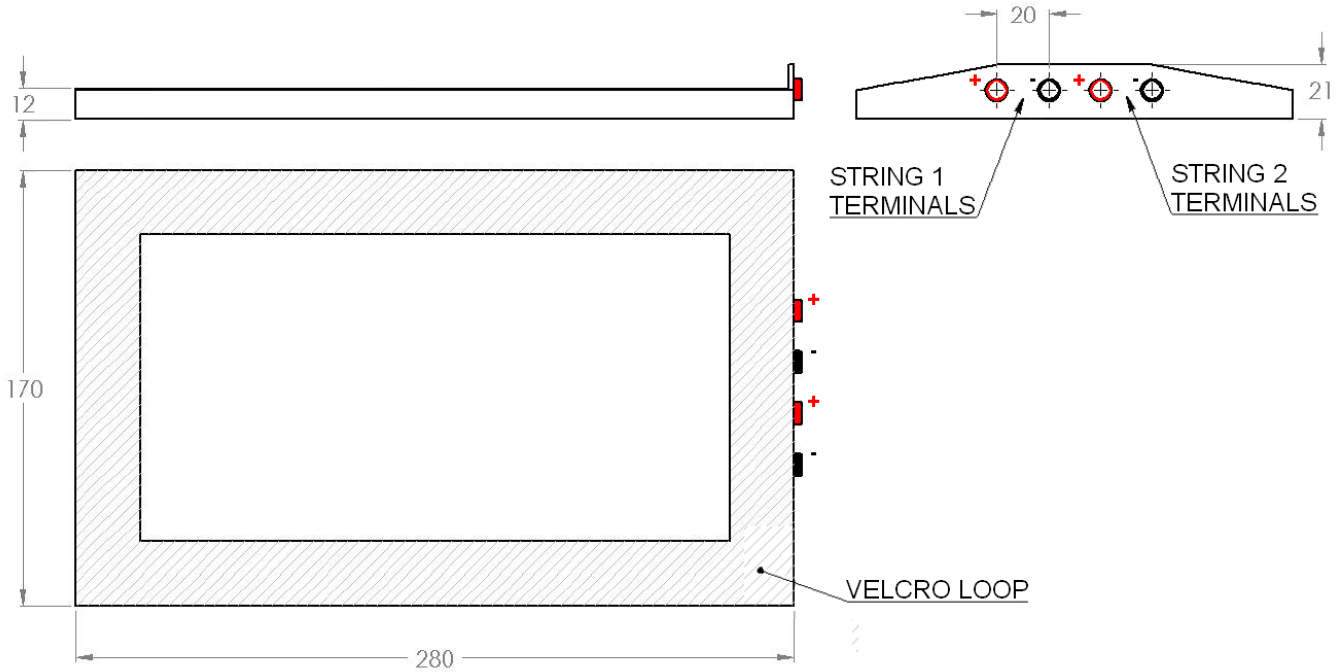
6.2. Source of Power

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

6.3. 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 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).

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

6.4. 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.

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

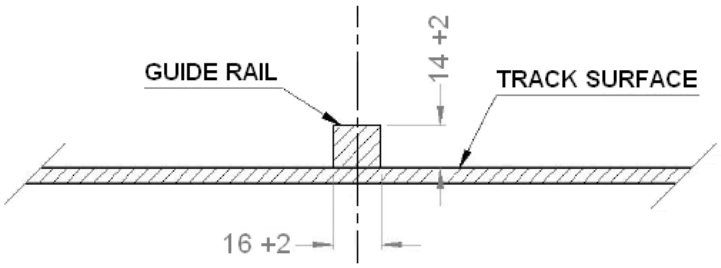
6.6. Motors
Cars may use any type of motor/s but specifications of the make and model must be made available to the TMSC.

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

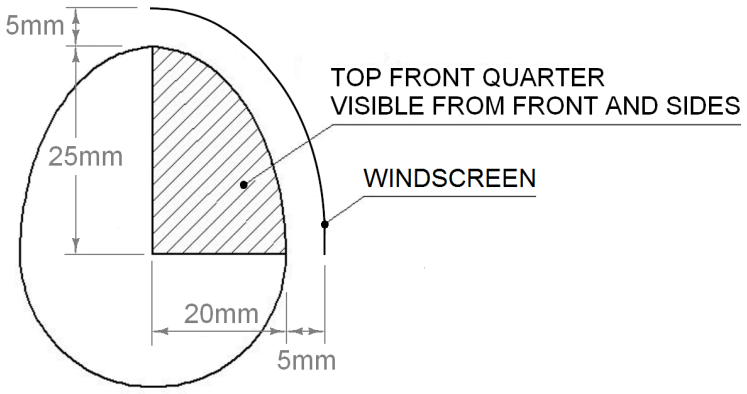
6.8. Cargo Area
Cars will require a fully enclosed space large enough to fit 15 table tennis balls of nominal 40mm diameter. The solar array may form the top of this enclosure. The balls do not need to be carried on board while racing but designs must allow for them to be easily added and removed in less than 1 minute during scrutineering. This space cannot be reshaped, collapsed or capable of having air pass through it for racing.

6.9. 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.

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 range from 3.5-5m in radius.



6.11. Driver & Passenger Compartment
Each car must have space for both a driver and passenger to navigate the track. The occupants will be regular ~50g eggs provided by the TMSC. The compartment must be sealed to prevent a broken egg from spilling on the track and the top half of the eggs have a transparent windscreen with 180° vision in the horizontal plane. Only the other egg may interrupt this field of view and both must have a clearance of at least a 5mm from the windscreen.



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, 100mm high, and ballasted to weigh 500 +/-10 grams. 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 subject to a number of such collisions during the course of an event, as designated on race day by the TMSC. Eggs may be checked for damage after each race and the win awarded to the other car if the faster car's driver or passenger suffers an injury (cracked or broken egg).