AUSTRALIAN-INTERNATIONAL

MODEL SOLAR CAR

CHALLENGE

2007
REGULATIONS

Sections 1 to 7

Administration of the Event

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.

MISSION STATEMENT.

To promote and develop interest and expertise in using solar and renewable energies by school students throughout the world by using active learning processes in addressing real challenges. By so doing, 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 energy usage, both by more efficient use of old technologies and appropriate introduction of renewables.

OVERVIEW

This is a race for model solar cars built by school age students which compete over a 100 metre figure "8" circuit. Two cars race at a time guided by parallel guide channels attached to the track surface. Time trials are held with the speeds used to "seed" the cars, i.e. allocate them to groups in such a way that the faster cars should not compete against each other in the earlier rounds. A "round robin" involving 3 preliminary rounds in which each car races three other designated cars, will begin the competition. At the end of these rounds, the cars with the greatest number of wins are allocated into groups which compete in an elimination competition in which the winners continue to the next round, the losers are eliminated and race no further. This process of elimination continues until a winner is decided by being the only undefeated car. Final rounds may consist of a number of "heats" in which each car may win one heat. However, the winner will be the car which wins the most heats.

Administration of the Event.

CONTENTS.

CONTENTS (ctd).

1. INTRODUCTION

1.1 Event name
The event shall be known as the "Australian-International Model Solar Car Challenge" (AIMSCC) and is conducted annually. This, along with boat races, will form a part of the Australia-International Model Solar Challenge.

1.2 Committee
The Executive Committee of the Australian-International Model Solar Challenge is a voluntary committee consisting of State Coordinators and other invited interested persons and referred to herein as the Committee. The roles of the Committee include establishing the regulations for the year and organising the Australian event to which nominated teams from other countries will be invited. The Committee will also promote the event throughout Australia and world-wide to the best of their ability and within the available resources.

1.3 Aim
The aim of the event is to encourage student teamwork, enterprise and learning using an action based learning model as students work together to research science and engineering principles relating to solar energy, photovoltaic cells and optimisation of energy efficiency, by designing, constructing, testing and racing model solar cars.

1.4 Spirit of Intent
The Challenge is designed for students to learn. Teachers, parents or other adult advisers are encouraged to teach the students the appropriate scientific and technical principles, but the design and manufacture must be predominantly that of the students. Some components may need to be made for the car using equipment unavailable to the students, but they must understand the working of their car and must be able to make all necessary adjustments or repairs on the weekend of the race. So that the competition remains financially accessible to as many schools as possible the Committee has framed these regulations so the cost and power to weight ratio of the photovoltaic panel is similar for all entries.

1.5 Allocation of Points.
To promote student learning, a trophy will be awarded to the team which scores the highest number of points based on their posters (discussed in 3.6) and an interview by a judging panel appointed by the AIMSC committee made up of representatives of 3 states. The interviews will evaluate the level of the whole team's understanding of their design, their car's manufacture and testing. The poster and interview also require the students to exhibit understanding of the relevance of solar energy to reducing greenhouse gas emissions. The interview will be conducted on the Saturday of the event in conjunction with scrutineering. Points will be awarded to the car performance, poster and interviews on the following basis:

Car performance	5 points per knockout round won - maximum points 20
Poster	maximum points 20
Interview (involving all team members)	maximum points 30

1.6 Competitors
The competition is open to invited Australian schools or other organizations for school aged students to secondary level, approved by the Committee, based on their performance in state or regional competitions. Invitations will also be issued to teams nominated by the organisers of affiliated competitions held in other countries who have national or regional events. Invitations may also be issued to individual teams where there is no national competition. All teams entering this event will need to meet the regulations listed below.

1.7 Statement of involvement
Cars entered in any given year should be substantially the work of students in that year. Forms confirming that the work is that of students and not teachers or parents will need to be signed by the students and coordinators and submitted to the organizers prior to the start of the event.

1.8 Correspondence
All correspondence should be addressed to:
Mr Mark Needham
AIMSCC Executive Officer
22 Harding Street,
Glengowrie SA 5044
Tel (08) 8295 5986 Fax (08) 8295 8584 Mobile 041 610 4490
Email: markneed@chariot.net.au

2. INTERPRETATION OF THE REGULATIONS

2.1 AIMSCC make decisions
The AIMSCC event officials are empowered to make a decision on any case not covered or clarified by these regulations. In the case of dissent from an AIMSCC official's ruling, the dissenting team may be excluded from the competition.

2.2 Use of AlMSCC regulations
While state and international model solar car challenge coordinators are encouraged to conduct their local events so as to observe the regulations pertaining to the AIMSCC event, the regulations for each local event are determined by the local Coordinator. It is, however, the responsibility of each team invited to participate in the AIMSCC event to adhere to the AlMSCC regulations, regardless of the regulations of any State or Overseas event in which they may have participated.

2.3 Unfair practices
If, during the event or at scrutineering, AIMSCC officials discover that an entrant or crew has deliberately violated these regulations to gain unfair advantage over other entries, or has departed from the spirit of the event, that team will be excluded from the competition.

3 ENTRIES

3.1 Number of Australian teams
The AIMSCC Executive Committee shall request each State Coordinator to invite up to four teams who have proved to be among the top entrants in their state event by criteria to be determined by each state coordinator. Additional entries may be invited at the discretion of the Committee.

3.2 Number of overseas teams
The AIMSCC Executive Committee shall request coordinators of events in other countries to invite one or more teams who have proved themselves to be among the top entrants in their event. Where a country does not have a national/regional event, the AIMSCC Executive Committee may invite one or more teams to represent that country, provided their entry conforms to these regulations.

3.3 Number in teams
Each team will be expected to comprise at least two students.

3.4 Team representation
Each entrant must represent his or her school or other organization accepted by the Committee. If two cars are entered from the same school, the seeding process will be implemented in such a way that they will not compete in the same group during the round robin competition. However, if successful, they will compete against each other before or during the quarter finals, ensuring that no school can win more than one of the major prizes.

3.5 Statement of work
All students must sign a form indicating that the design and construction was essentially their own work.

3.6 Posters required
All entries will be required to present a laminated or contact coated A2 Poster (size 420mm x 594mm – may be 2 A3 posters taped together) documenting the design and development of their car to the organizers prior to scrutineering. This record should document experiments and or 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	**Marks**
Headings readable from 5 metres	1
Writing readable from 2 metres	1
Summary of test results	5
Construction details	5
Presentation – photos, diagrams, drawings,	4
Greenhouse relevance	3
References, acknowledgements	1
Total	20

This poster will become the property of the organizers and may be used for promotion of the event, but will ultimately be returned by the State Coordinator.

3.7 Interviews.
An interviewing panel will interview all team members about the design and construction and testing of their car or its component parts. Each team will be allocated a time slot for their interview so as to minimize time wasted by queuing. Each student should be able to contribute to the answers. Questions could relate to a number of the following:

Wheel and bearing selection and rolling resistance
Effect of weight and tyres on rolling resistance
Design of steering mechanism
Design of chassis
Design of cockpit
Effect of cloud on solar intensity
Effect of solar intensity on panel performance
Explain how solar cells work
Explain the function of any electronic controls on their car
Discuss your team’s organization and decision making

3.8 Entry registration

Entrants must confirm their participation with the AIMSCC Executive Officer, Mr. Mark Needham, within 3 days of the state event. Potential overseas entrants should notify the executive officer of their intention to compete by October 1st. The invitations will be sent to the Coordinators before their event.

4. TRACK

4.1 Size and Shape

The outdoor track used in this event will be in a 'figure 8' configuration with a low bridge at the crossover point. The corners will feature curves with an approximate minimum radius of five metres. The track length is approximately 86 metres.

4.2 Slope

The uphill and downhill sections of the track at the crossover point will have a minimum clearance between tracks of 300mm. The slopes will range between 1:16 to approximately 1:8.

4.3 Construction

The track will have a smooth surface with two parallel guide tracks of PVC channel (see Diagram 1) such as 'UM20' or 'basket track' or similar, screwed to a plywood base. As the track is assembled in sections, in the past there have been minor misalignments which will be minimized by inserting joiners between adjacent channel ends. The Committee will endeavor to ensure minimal misalignments, both horizontally and vertically. If in the Committee's opinion, a car is inhibited in any race as a result of a serious track imperfection, that race shall be rerun as soon as possible. Entrants must realize that as the track is made in sections of light weight materials, there may be some undulation in the track. This will be minimized by the committee, but should be considered in the design process.

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 Starting Procedure.)

4.5 Finish Position

All races will finish at a point on the flat section of the track 14 metres beyond the starting position.

4.6 Race Format

Unless varied at the Committee's discretion:-

Time trials will be held over 100metres (1 Full lap of the track plus the distance from the starting position to the finish position.)

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 to the finishing position.

Finals, and possibly some elimination races, will be held from the starting position and cover two full laps of the track plus the distance to the finishing position.

5. SCRUTINEERING

5.1 Race Ready

All competing teams shall be required to register upon arrival at the venue by a time to be announced when the invitations are issued. Cars must be in a condition ready to race when presented for scrutineering. Teams must not be accompanied by adults through scrutineering. If, however, a dispute arises, the team will be invited to call upon their supervisor to help resolve the dispute. Scrutineers have the right to examine each car at any time to ensure it conforms to these regulations

5.2 Failure

Any car failing to pass scrutineering by the end of time allowed may not be permitted to start the event. The scrutineers will make allowances for circumstances beyond the control of the students such as damage in transit. The scrutineers may allow any car which does not comply with these regulations to compete but may impose a weight penalty of 200gm minimum for each non-compliance. Any car failing to satisfy the scrutineers at any time during the competition may be excluded from further participation.

5.3 Panel power output.

Solar panels will have their output power measured by the scrutineers using a light box with an output of approximately 1 Sun. Details of a suitable light box are available as a separate document. Panels must be presented in their ready to race form. For curved panels the panel output will be determined by placing the panel generally parallel to the top of the light box. For further details of determining panel performance, see 8.6.

5.4 Check weighing.

During scrutineering, the weight of the solar array, any ballast, and the total weight of the car will be recorded. Immediately prior to each race, all cars will be re-weighed by the scrutineers. If the car weight varies from the recorded weight by more than +/-10gm the team will be required to explain the reason for the variation. If the scrutineers are not satisfied with the explanation then the car will be required to be restored to the original condition or else the car may be excluded from further competition.

6. SERVICING

6.1 Service area

An official service area will be set aside for student team members to carry out 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 hence only students are to conduct car adjustment and maintenance on race day.

6.2 Modifications

Students may modify cars during practice and between races, but the scrutineers may reassess cars at any time. However, cars as presented at scrutineering immediately prior to the commencement of the knockout racing must be used for all subsequent races. Allowable modifications to the cars between races specifically exclude the changing of solar panels, car bodies, chassis and driver compartments irrespective of light conditions. Repairs to these major components are allowed. Changing driving wheels, gears, motors, steering mechanisms and panel voltage will be permitted between races.

6.3 Service crews
For the duration of each race, up to three students from each team will be allowed in the scrutineering or track areas**.** The organizing Committee will provide adult supervision. Direction and/or physical assistance from adults at any time during the event is not permitted. It is recognised that during racing the student team members are under great psychological pressure, especially during the finals races, and may be confused as to the appropriate modification/repair to continue racing. The Committee will provide an independent person to facilitate the student team members to use their own knowledge as to the appropriate course of action.

6.4 Restricted areas
No person other than those nominated shall be allowed in the restricted area without permission of an AIMSCC official and must be accompanied by that official at all times whilst inside that area.

7. COMPETITION

7.1 Time trial
Following scrutineering, each car will be timed over a given distance on the designated track, for the purpose of seeding each car, to determine the groupings of teams who will compete in the 'round robin' section of the event.

7.2 Structure of the races.
The event shall be conducted with pairs of cars competing against each other over tracks of equal length (100 metres) in a series of 'round robin' and/or elimination races to be announced in the official schedule of events. Where results are to be determined by multiple heats, they will be scheduled so that all cars in the round will have completed their first heat prior to the start of the second set of heats, allowing some minutes to elapse between the first, second and third heats. Weather permitting, the quarter finals, semi-finals and finals will be held over 2 laps of the course, the total race distance will therefore become 186 metres.

7.3 Timing
Each car will be timed over the course. The winning car will be determined by an electronic timing device initiated by a light/infra-red beam. The beam and detectors will be aligned either horizontally, approximately 50 mm above the track, or vertically within 10mm either side of the guide channel. It should be noted that in rare cases, the design of the winning car may introduce small errors in the recorded times of each car. In the event of an equipment failure, stopwatches operated by persons appointed by the Committee will be used. The race-day coordinator will adjudicate on any dispute as to the finishing position of any car and there can be no appeal against that decision.

7.4 Starting procedure
Cars will be presented at the start line within two minutes following the call for cars on the public address system. In the case of best of three or best of five heat races, cars will alternate between tracks. If the final race is needed (in best of 3 or 5 heat races) to determine the winner, the final race lanes shall be determined by a coin toss. The cars will be placed on the track in a ready to run state. Spraying cells with a coolant on the start line will not be allowed, as this can disadvantage the opposing car, and may lead ultimately to damage of the panel. When requested by the starter, a member of each team will place their car on the assigned track, on top of the hill and clear of the starting gate. Each car must have a solar panel cover in place. The starter will direct the team member to switch the car on. The starter or any other approved marshal may

require the team to demonstrate that the car will not drive with the panel covered. When satisfied, the starter will ask for the cars to be moved along the track to rest against the starting gate. The starter will then ask for the solar panel covers to be removed and the starting gate will be rotated away from the cars to start the race.

7.5 Stopping procedure.
Any stopping procedure may be used, at the discretion of the race organisers. Whatever procedure is used must not affect the other car in any way. If the officials consider that the other car has been affected to its detriment, then the offending car will forfeit that race.

7.6 Stability
If the car comes off the tracks it shall be deemed unstable and will not be re-started in that race unless the officials are satisfied that the problem was caused by a deficiency of the track. There shall be no handling of cars during the race other than by officials or by people nominated by officials. If both cars come off, the race will be awarded to the car which traveled the furthest. If a car comes off and obstructs the other lane, the second car shall be awarded the race if it reaches that point and collides with the car which first dislodged.

7.7 Poor light / adverse weather conditions
Whereas in the past there has been a stated minimum light level at which racing would be suspended, the quality of the cars has improved to such an extent, over recent years, that, at the discretion of the Committee, races may still be run in virtually any conditions. If light conditions do not enable the cars to complete the course, the car that travels the furthest, or, if two cars travel the same distance, the car which reaches that point first, will be judged the winner. Note, due to the geometry of the track, the car that appears to be in front may not actually have traveled 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, or is likely to move, for a maximum of 30 seconds. If a car stops for any reason, that car may be restarted under the marshal's discretion from any point on the track behind the stopping position, but the car must not be pushed to restart.

7.8 Practice and testing
Practice on the track will be allowed at any feasible time that marshals are in attendance.

7.9 Results
Final results will be decided after the provisional first four place winners have been rescrutineered and passed by the officials.

7.10 Prizes
Prizes will be presented to First, Second, Third and Fourth place getters. The major trophy will be awarded to the winning team. The second trophy will be awarded to the team which wins the total points aggregate. The presentation of prizes will be held as soon as possible after the completion 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 invitations are issued.

AUSTRALIAN-INTERNATIONAL

MODEL SOLAR CAR

CHALLENGE

2007
REGULATIONS

Section 8

Car Specification

Section 8 (this document) covers the car specifications
Sections 1 to 7 (a separate document) cover the administration of the event
N.B. All eight sections must be read as a single document.
Details of the design for a suitable light box are also available.

Section 8. Car Specification

CONTENTS.

8. CAR SPECIFICATION

8.1 No commercially built cars

Cars may not use any part of the chassis or body of any commercially available model car. This only refers to the structural frame, not to the drive train components such as gears, shafts, wheels, tyres, or to suspension and steering components. Unless specifically specified elsewhere in this document, other external body covering is at the discretion of the entrants.

8.2 Size Limit

When the car is racing in a straight line, the overall length of the car shall be no more than 650mm, the height of the car shall be no more than 180mm and the width of the car, wheels, axles and suspension included, shall be no more than 320mm.

8.3 Source of Power

The car is to be powered only by photovoltaic cells as approved by the AIMSCC Executive. Approved photovoltaic cells will be commercially available silicon cells (mono-crystalline, poly-crystalline or amorphous). Amorphous cells currently available are not recommended however, because of their low power to weight ratio. High output cells such as Gallium Arsenide cells, as determined by the high voltage output of such cells (>0.8V per cell), will not be allowed.

8.4 Power Limit

The maximum power delivered by the photovoltaic cells will be measured by the scrutineers using a light box delivering approximately one Sun equivalent.

The solar panels must be presented for light box testing with a maximum of 25 volts open circuit and 2.0 amps short circuit. Otherwise they will be assigned the value:

Power = (open circuit voltage) x (short circuit amps) x 0.8 watts.

As the power output of a silicon solar cell is greatly affected by temperature, the scrutineers will scan all panels with a non-contact thermometer immediately after power testing. The maximum panel temperature recorded will then be used to standardise the power output to the power expected at a temperature of 25^{o}C using the following formula.

$$P_{standardised} = P_{measured} + P_{measured} \times 0.004 \times (T - 25)$$

Where P = power in Watts and T is maximum panel temperature in ^{o}C

N.B. Any ballast required will be calculated using this standardised power rating.

Panels must register a total power of less than 12 watts. If an array built up from individual modules exceeds 12 watts, cells will have to be completely removed from the array until the panel generates a power of less than 12 watts. If a team wishes to modify a panel to produce a lower power for any reason then cells must be completely removed from the array. Simply bypassing or masking off cells will not be permitted under any circumstances.

Due to advances in solar cells, some standard commercial panels may exceed their nominal ratings. The scrutineers reserve the right to allow the use of any commercial panel with a nominal rating 12 watts or less provided the power rating obtained above does not exceed 14 watts. Evidence of the manufacturers nominal rating must be provided to the scrutineers.

8.5 No energy storage systems
No energy storage system, either electrical, mechanical or chemical, which assists in the performance of the car, will be permitted. Capacitors of less than 0.2 farad and inductors less than 1mH are allowed as part of the electrical system.

8.6 Solar Array and Support Structure
The solar cells connected together to provide the power which drives the car will be referred to as the array. That complete unit on which the photovoltaic cells (the array) are mounted is the array support structure. This structure must be fully removable and may form part of the car body, but must not form a part of the chassis, cabin or side panels as defined in 8.17, 8.22, and 8.19. The array support structure may carry the ON/OFF switch, and may allow for varying the voltage by means of a mechanical switch controlled by the team prior to the race start, but all other mechanical, electrical or electronic devices must be separate from the array support structure and supported by the chassis. The panel must be robust enough to enable handling by the scrutineers and officials. The organizers will accept no responsibility for any damage to the solar cells or the solar array due to normal scrutineering procedures. NB. Bare silicon cells are highly prone to breakage and are therefore discouraged.

Curved, stepped or multi-planed arrays should be able to be re-configured to within 20mm of a single plane for the purposes of power measurement. If this is not possible, the scrutineers reserve the right to calculate a maximum power value based on extrapolating measurements taken from one section of the array to the whole area.

8.7 Solar Array and Support Structure Removal
The array and its support structure must be easily removed from the car for weighing and the car must still be capable of free and stable movement along a flat surface with it removed.

8.8 Solar array wiring.
All wiring on the solar array must be visible to the scrutineers, so that wiring problems can be easily identified and problems resolved. All panels must be presented for scrutineering with a single pair of connections marked +ve and –ve and able to directly attach to the alligator clips on the power measuring equipment. Teams using panels of their own construction or modified commercial panels must provide a wiring diagram showing all cells, switches, plugs, sockets, etc., to assist in the scrutineering process**.** Where the panel has multiple outputs, teams must supply suitable open wiring, complete with diagrams, to provide scrutineers with the connections as described above.

Where different power readings are obtained using different switch settings, the highest value obtained shall be used. If the panel has multiple connections, the power will be measured on each connection and the values obtained added

8.9 Solar panel cover.
All teams should provide a suitable cover which will completely shade the active area of their solar array for use at the starting position. The use of the cover is to assist the officials detect and eliminate any hidden illegal storage devices. If teams do not provide a suitable cover, the organizers will provide a cover of their choosing. The organizers will not be responsible for any problems created by the use of this cover.

8.10 Array and array support structure weight.
The panel weight will be as per table C. This table and equation has been derived on the basis of extensive simulation data to make for a more even competition.

POWER	WEIGHT
6W	600g
7W	775g
8W	950g
9W	1125gg
10W	1300g
11W	1475g
12W	1650g

Table C Panel power vs Ballast Weight.

(Table C is based on the standardised power outputs using the light box described in a separate document.)

The combined solar array and ballast weight is calculated using the formula:-

W (Panel weight) = 175(Standardised Panel Power [watts] - 6) + 600 Grams

Note. Any panel generating less than 6 watts will still need to have the minimum weight of 600gm. The Committee will provide scales to determine array and support structure weights, measured accurate to +/- 5 gm. e.g. a panel with an output measured at 8.3watts, will weigh between 997.5 and 1007.5 gm.

8.11 Ballast

Any additional weight required is to be carried as ballast when racing. To assist, teams should attempt to have approximately the correct amount of ballast when presenting for scrutineering. Ballast will not be provided by the scrutineers. Suitable ballast includes such things as lead sheeting, sand and fine gravel, nails, etc. Ballast must be suitably contained to prevent possible spillage onto the track.

8.12 ON/OFF switch

Each car must be fitted with an 'ON/OFF' switch to minimize car set-up time whilst at the starting gate. The switch must have the ON and OFF positions clearly marked and the switch must be in a location easily visible by the official starter when the car is on the start line (i.e. left hand side or on the top). If the switch is on top of the panel, it must not protrude more than 20mm above the panel surface so as not to alter the light box reading. It must be a commercially available switch which will electrically disconnect the solar array from the motor. Alligator clips or plug and socket connections, while allowed as part of the electrical circuit, may not be used as the ON/OFF switch.

8.13 Car wiring

Where possible all electrical wiring and electronic modules in the car must be reasonably visible. Teams will be required to explain any wiring going into sealed body areas. A simple block wiring diagram will be required.

8.14 Motors

There is no restriction to the type, size, or number of motors that may be fitted to the car. However, the motor manufacturer and/or part number must be made available to the scrutineer for assessment of energy storage systems.

8.15 Wheels
There is no limit as to the number, location, or the diameter of wheels. So as not to damage 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.

8.16 Steering
Each car must incorporate a means of steering along the guide channel of the track (as per Diagram 1).

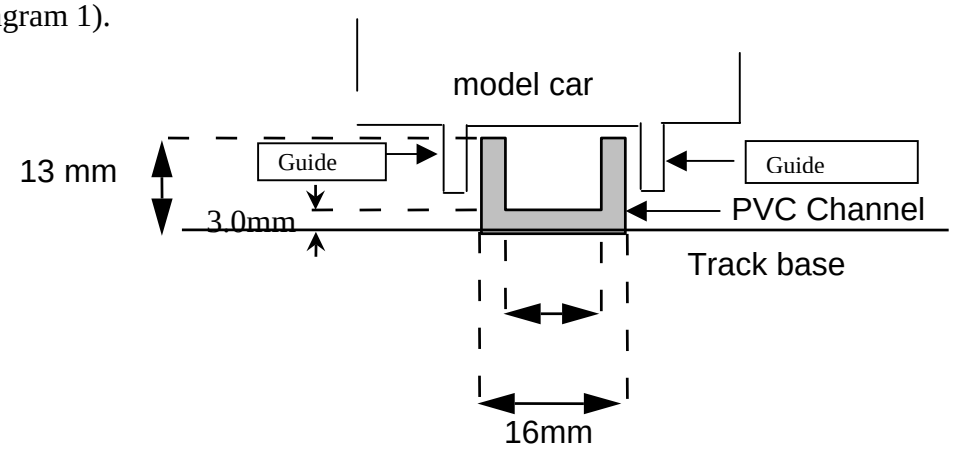


Diagram 1. - Two guides outside the channel.

Section 4.3 specifies any track variations that may be encountered. The steering mechanism must be via guides designed to run outside the channel. The guides need not be simple pins as shown above but rollers or wheels may be used. Use of an active (moving) steering system will be viewed favourably when choosing quality engineering design awards.

8.17 Chassis
The car must have a rigid chassis independent of the solar array and its support. The car must have all components, such as the driver's cabin, wheels, guides, motors, side panels and cargo area, etc, attached to the chassis. The driver's cabin, side panels, cargo area and any other bodywork may form part of the chassis.

8.18 Cargo area
The car must have an enclosed cargo space, with a floor and sides, attached to or as part of the chassis. The space must be located behind the driver's cabin. The solar array structure may form the top of the enclosure. The space must be sufficient to fit two standard 1 litre fresh milk cartons beneath the solar array when the array is in place on the car. The cartons will be full and unopened, and may not be altered or modified in any way. At least one of the cartons must be positioned transverse to the direction of travel. A standard fresh milk carton will be assumed to be approximately 235mm by 72mm by 72mm and it may be assumed that the sides of the cartons are flat and no provision needs to be made for normal bulging. With the solar array structure removed, the cargo space floor must be capable of supporting the two full cartons in any position and orientation, and the car must be capable of free and stable movement on a flat surface with those cartons in place.

N.B. The cartons are not required to be carried when racing.

8.19 Side Panels
The car must have two side panels capable of retaining their shape at all times for attaching numbers and sponsors logos. These must be easily seen by spectators while the car is racing.

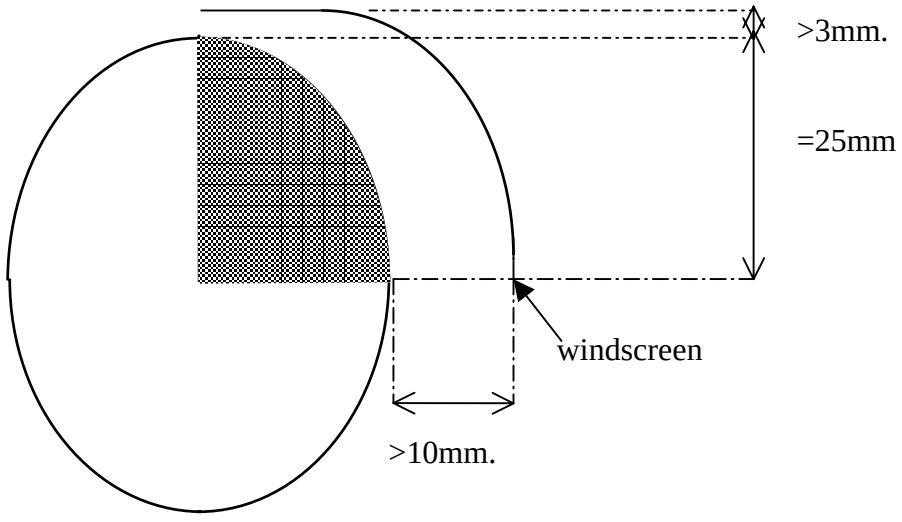
They will be located one on each side of the car. Each side panel must be capable of supporting a sticker 120mm long and 75mm high. The maximum curvature allowed will be 20mm vertically and 15mm horizontally.

8.20 School and Car Name
Each entry must have its school name (possibly abbreviated) and car name shown on the car in letters at least 10mm high and visible when racing. These can be attached to any part of the body, other than that area designated as the side panels described above.

8.21 Driver
To ensure that the cars guarantee driver safety, the driver of the car will be a large (60g) fresh egg supplied by the Committee. The egg must not be covered in a film or painted so as to increase its strength. In any race, a cracked, broken or dislodged egg will mean that the driver is injured, so the car will concede that race to its opponent. If an egg is damaged in one heat of a best of three or best of five final, a replacement egg will be provided for the remaining races. The use of any form of adhesive (blue tack, sticky tape, etc.) on the egg is prohibited

8.22 Drivers Cabin
Each car must have a fully enclosed cabin at the front of the car in which the egg sits vertically (see diagram 2). The cabin must be sealed when racing so that if the egg breaks nothing is spilt onto the track (such sealing may be adhesive tape). The cabin must also include a transparent (not translucent) windscreen conforming to details in diagram 2. Two frame members up to 4mm wide may be incorporated into the windscreen. To allow the driver to operate the controls there must be at least 10mm clear space between the driver and the windscreen over the 180^{o} arc of visibility specified and 3mm head room (see diagram 2). NB this means that nothing but air be between the egg and screen over this area.

Diagram 2



SIDE VIEW

The windscreen must have the clearances shown above and around the egg and allow the hatched area to be visible when viewed horizontally from straight ahead to any position 90^{o} either side of the centre line.