



Regulations for 2015

Model Solar Boats

The Event will be held in Adelaide, South Australia,
on the weekend of the 24th and 25th of October 2015.

Additional information will be published on the web site
www.modelsolaraustralia.org

MISSION STATEMENT

To develop and encourage an interest in 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.

OVERVIEW

This is a race for model solar boat built by students in studying at primary or secondary levels up to and including Year 12 level or its equivalent. A "round robin," in which boats race against other designated boats, will begin the competition. This round robin is conducted in one pool between 2 (two) or 3 (three) competitors. The format of the racing is a first past the post style where the winner is the first boat to reach the finish line.

Based on the results of the "round robin", boats are allocated into groups which then compete in an elimination competition, the winners of each round continue to the next and the losers are eliminated. This process of elimination continues until a winner is decided by being the only undefeated boat.

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1 INTRODUCTION

1.1 Event Name

The Event shall be known as the Australian-International Model Solar Boat Challenge (“AIMSBC”) and is run annually. This, along with car races, will form the Australia-International Model Solar Challenge (“AIMSC”).

1.2 Overview

The AIMSC Event, includes races for solar powered cars and boats. The organising body of these events, hereafter known as the Committee, believe that the skills necessary to build a competitive boat are appropriate for younger students and give a learning experience which can lead on in later years to designing entries for the advanced division. The boat races provide both a less demanding and less expensive opportunity for students in a real world technology based, problem solving activity.

1.3 Spirit of Intent

The Challenge is designed to provide students currently studying up to and including Year 12 secondary level, with an opportunity to learn, so it is very important that the design and building of the boat be mostly – or even better, completely - that of the students. We know that some components will need to be either purchased or made using equipment unavailable to most students. To make up for this, it is important that students should be able to show some understanding of the processes which were or could have been used for the making of these non-standard components.

The students are expected to understand the workings of their boat and to be able - without outside assistance - to make any and all necessary adjustments or repairs over the course of the Event.

Teachers, mentors, parents and/or other adult advisors are encouraged to teach the students the correct scientific and technical principles; however they are not allowed to undertake any of the physical work on the boat themselves.

In the past, there have been occasions where adults have done the work instead of the students, which can significantly advantage the team involved; this is inappropriate, unfair and is not allowed. As the main object of the experience is for the students to learn how to do it themselves, adult help only interferes with this goal and the Committee take this problem very seriously. Adults seen to be acting inappropriately will be given one warning before penalties will be applied to the team involved. Any further breaches will attract penalties, beginning with 100gm of extra ballast and ending with disqualification from the Event.

1.4 Competitors

The competition is open to applicants from Australian schools and other organizations for students currently studying up to and including Year 12 secondary level, as approved and invited by the Committee. International invitations may also be issued as decided by the Committee. All teams entering this event must comply with the regulations

1.5 Aim

The aim of the challenge is to encourage exploration of solar energy through design and construction of working models powered by the sun shining on solar cells.

The objective of the Model Boat Challenge is to develop a craft that will most effectively travel along a guide line suspended above the water's surface and race against other like crafts, travelling from one end to the other of pool, in the shortest possible time. Two (2) or three (3) boats will race each other in the pool at the same time to determine a winner.

So that the competition remains financially accessible to as many organisations as possible the Committee has framed these regulations to use low cost photovoltaic panels of limited size and limited power output.

1.6 Eligibility and Divisions

The competition is run in two divisions.

1.6.1 Junior Division

Open only to primary schools or student groups up to and including year 6 level.

1.6.2 Advanced Division

Open to Primary or Secondary students up to and including year 12 level.

1.7 Statement of Involvement

Boats entered in any given year must be the work of students in that year. Hulls will be photographed and marked at each year's event so that they cannot be re-entered in subsequent years.

1.8 Correspondence

International correspondence should be addressed to:

Mr. Paul Wellington
Chairman AIMSC
PO Box 108
Darling 3145
Victoria, Australia
Tel. 613 9885 7828 Mob. 613 419 871 033
Email paulwellington@modelsolar-vic.net

Australian correspondence should be addressed to:

Australian International Model Solar Challenge
PO Box 108
Darling 3145
Victoria
Australia
Email: nationals@modelsolar.org.au

Queries about entry information for the 2015 National competition should be addressed to:

2015 Event Coordinator
Email: nationals@modelsolar.org.au

2 INTERPRETATION OF THE REGULATIONS

These regulations have been agreed to by the organising Committee for the AIMSBC Event. The Committee of each state may modify the regulations for their own State Level Event, but all decisions at the national/international Event will be based on the information contained in the latest version of this document and any other specified documents. Selected members of the AIMSC Committee will form an Adjudication Sub-Committee at the National Event and will make any required clarifications or decisions for any situation that arises that is not covered by these rules.

2.1 Students Must Do the Work

To maximize the learning experience, students are to design and construct the boats themselves, adults should not undertake any physical work on the boat, though some adult help to improve their skills is acceptable.

High level technical work on junior division boats (routing, welding, moulding, spray painting, etc.) is discouraged, as students will not normally have access to these skills. It is recognised that some components will need to be either purchased or made using equipment unavailable to students, however those competing in the advanced division should be able to show some understanding of the processes which were or could have been used for making these components.

All students must understand the working of their boat and be able, without outside assistance, to operate and make all necessary adjustments or repairs over the weekend of the race. Special circumstances should be reported to the Adjudication Sub-Committee, selected from boat scrutineers, starters and judges, who will consider the circumstances and may if deemed appropriate sanction or provide assistance.

2.2 Unfair Practices

In the past there have been instances of inappropriate adult input, which can significantly advantage the team involved. The AIMSC Committee views this problem very seriously. Any adults seen to be acting inappropriately will be given one warning before penalties will be applied to the team involved. Flagrant and repeated breaches will attract penalties commencing at the requirement to carry 100gm of ballast, progressing ultimately to disqualification.

If AIMSC 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.

Where the AIMSC Officials find that the boats from a single organisation are insufficiently unique from each other, all of the infringing boats will be ineligible to win a prize and will not progress past the Quarter Finals in that division.

2.3 AIMSC Rulings

The AIMSC 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 AIMSC official's ruling the issue may be referred to the Adjudication Sub-Committee. The ruling from the Adjudication Sub-Committee is final, if there is further dissent regarding this ruling then the dissenting team may be excluded from the competition.

3 ENTRIES

3.1 Number of Australian Teams

The AIMSC National Coordinator appointed for the Event shall request each State Coordinator to invite a maximum of four teams who have proven to be among the top entrants in their State Event. Additional entries from the State Events may also be invited by the Committee. Unless there are extenuating circumstances no more than 2 (two) boats from any one school should be invited to compete.

3.2 Number of Overseas Teams

The AIMSC Committee may request coordinators of Events in other countries to invite one or more teams to participate. Overseas teams should begin the process of applying for an Australian visa at least 3 (three) months in advance (or even more, depending upon which country), of their planned arrival date.

3.3 Team Members

Each team must contain at least 1 (one) member that is only involved with that single boat and no team will be permitted to enter more than 1 (one) boat. There is no limit (within reason) to the number of students who can be in any team, but each entrant must represent his or her school or other organization accepted by the AIMSC Committee.

If circumstances prohibit all team members from attending the competition, the Committee may, upon request, appoint another team to operate the boat.

3.4 Original Work

All teams must be able to provide the scrutineers with evidence that the boat is the original work of the team members in both design and construction, performed in the current year (2015) and not simply a restyling of any boat from a previous year. However, you are permitted to reuse: solar arrays, motors, drive systems, guide systems and other similar components. This work will be proven by the submission of a poster (§3.6)

3.5 Statement of Work

All team members must sign a declaration truthfully stating that the team is (at least mostly) responsible for the design and construction of the team's boat.

3.6 Posters

Students should document their work as in any quality design and build project. To be awarded any of the prizes, entries are required to present a laminated or contact coated A2 Poster (420mm x 594mm) documenting the design and development of their boat, prior to scrutineering, to the organizers. This record should document experiments and/or calculations and the design decisions made. Some discussion of the benefits or use of solar power for minimizing greenhouse gas emissions will be encouraged. Graphs, photos and design drawings will be marked favourably.

Every poster presented should include the school and boat and all the team member names. Teams may be interviewed to determine their technical understanding of and approach to the project. The committee will keep the best posters for exhibition at the national race and at other places where the event is publicized. All other posters should be collected at the end of the competition as any poster left behind and not required by the committee may be discarded at the completion of the Event.

All posters will be assessed using the following point score and topics:

Item	Points
Headings legible from 5 metres	1
Writing legible from 2 metres	1
Summary of test results	5
Construction details	5
Presentation – photos, diagrams, drawings, etc.	4
Greenhouse relevance	3
What you have learnt	5
References, acknowledgements	1
Total	25

The posters considered the best, those that achieve the highest total number of points, will be subsequently displayed and a prize awarded for the poster from both the junior and advanced divisions of the Event.

3.7 Entry Registration

Australian entrants must confirm their participation with their local Event Coordinator within one week of receiving their invitation to participate in this event. Potential overseas entrants must notify the AIMSC Chairman of their interest in competing by June 1st 2015, so that assistance with visas can be arranged. Invitations for the AIMSBC event will be sent to the State and Territory Coordinators for their local entrants. International invitations will be sent to the parties that have contacted the AIMSC chairman.

4 THE POOL

4.1 Size and Shape

The pool is rectangular in shape between 6 (six) and 10 (ten) metres long with a side wall of approximately 300mm. The height of the side walls permit for a minimum water depth of 70mm over the entire pool surface area.

4.2 Construction

Several layers of polyethylene plastic sheeting is wrapped around a metal support frame. The pool is divided into “lanes” over 350mm apart by using fine wires, strings or fishing lines fixed to supports at either end of the pool. These supports are stabilised so that the lines can be tensioned ensuring that they are 300mm ±25mm above the water surface level in the pool. There may be either 2 (two) or 3 (three) lines suspended above the pool, allowing 2 (two) or 3 (three) boats to participate in each race.

4.3 Starting Position

Boats will be assigned a lane on the day for each race in which they compete. Each boat will be placed in their assigned lane and placed on the starting line by a team member. Starting the race is either by the use of a starting gate or the manual release of the boat by the team member.

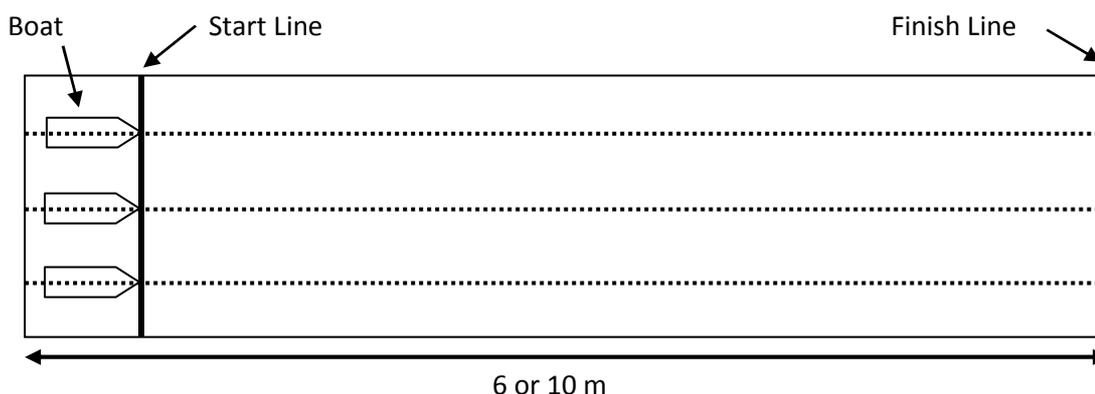


Figure 1: Layout of a pool configured for 3 (three) lanes with boats lined up at the start line

4.4 Finish Position

The winning boat will be the one which reaches the finish line first, as judged by the AIMSC Official at the finishing line. The order of finishing as judged by this AIMSC Official is final.

5 SCRUTINEERING

All boats will be scrutineered before racing to ensure that they meet the regulations of their chosen division. If the scrutineers require, boats which fail to meet the Junior Boat Regulations, will need to either be modified to conform to the regulations or race in the Advanced Division. Any boats which fail to meet key regulations such as cell type or area, will be required to carry a ballast penalty of up to 400gm, although flagrant and excessive breeches that are expected to result in an unfair advantage will result in disqualification.

5.1 Individual Design

Multiple boats entered by one school/group cannot be of an identical hull design – e.g. each entry from a school would not be allowed to use a hull vacuum formed using the same mould or made of fiberglass from 1 (one) mould. Advanced students using vacuum formed or other moulded hulls must have designed and substantially made the mould themselves.

Schools may not enter multiple boats with hulls which are deemed by the scrutineers to be so similar that they can only be discriminated by name, number, colour or decorative effects. Multiple boats will not be accepted from a single school if they are made of the same or similar materials and have similar shaped hulls of similar dimensions which are less than 10% different as judged by the Committee.

5.2 Commercial Components

No commercially available boat hulls or kits may be used. All entrants are to design and construct their boats in the year of the race.

It is expected that the only commercial component assemblies that would be used for the construction of a boat would be the Silicon solar array, an on/off switch, wiring/electronics (advanced division only), the motor(s) and the propulsion parts, i.e. shafts, bearing, propeller, impellor, paddle wheel, fan, etc...

The re-use of any of these allowed commercial components from a previous year's entrant for a new boat design is permitted.

6 SERVICING

6.1 Service Area

An official “service area”, shared with other divisions, is available for team members to conduct boat adjustment and maintenance. It is expected that only team members, independently of teacher, mentor or parent support, are performing repair or adjustments to their boat.

6.2 Hazardous Substances

Please Note. Due to mandatory health and safety requirements, the use of bulk solvents, (other than water) and liquefied gases of any sort, for any purpose whatsoever, is **STRICTLY PROHIBITED at all times and in all areas of the competition**. This means cooling solar panels with anything other than water ice will not be allowed at any time.

7 COMPETITION

7.1 Structure of the Races.

The races for each division will commence with a “round robin” competition. Each boat will have a number of races, the results will be used to seed the boats for the subsequent “knockout” competition. In the “knockout” competition boats will race with either 2 (two) or 3 (three) boats to a pool (depending on total numbers of entries) with only the winner continuing to the next round. Boats may be run in either a North – South or a South – North direction at the discretion of the race coordinator. All races in any round will be run in the same direction. In the finals where the winner is determined in a best of 3 (three) race format, the boats will race in alternating lanes. Racing in the opposite direction may be used if necessary to resolve a dead heat.

7.2 Starting Procedure

Starting will be carried out either by use of a starting gate or by a team member releasing their boat as instructed by the starter.

7.2.1 Starting Gate

A starting gate made of 10mm square steel mesh provides a simple means of ensuring all boats are aligned on the starting line. The gate pivots forward and down into the pool, allowing the boats to start to race with the minimum of interference. If boats have very pointed bows, they may need to release the boat manually from behind the gate to ensure that they are not disadvantaged by the gate operation. Boats are recommended to have bows with at least a 25mm radius to avoid any complications on the starting gate.

7.2.2 Manual Release

The start will occur when competitors release the rear guide of their boat upon issuance of the “Release” command. The starter will voice the starting order, “Ready”, “Set” and “Release”, to start the race. This process will be slower than the use of a starting gate as the boats need to be aligned on the start line by the starter prior to giving the starting orders. Boats which are pushed or released early may be penalized if the starter so judges and requires the race to be repeated. If incorrect starting procedures are repeated, the offending boat may be disqualified.

7.3 Judging the Results

A finishing line judge will be appointed by the Committee to sit level with the end of the pool to observe and record which boats win and come second and third in each race. The race will finish only when the boat strikes the end wall of the pool.

The order of finishing as recorded the finishing line judge is final and is not open dispute. This includes any third party contesting the result due to information from “Photo Finish” and/or “Effect of Parallax” claims.

If the finishing line judge decides that they are unable to select between boats to assign the order of finishing, the race will be rerun with all boats starting in different lanes to the original race.

7.4 Mishaps

Some boats fail to finish the race, either by submerging, having insufficient power or their guides coming off the guide lines. If a boat interferes with another boat in a 3 (three) boat race, the judge and starter will confer to determine whether to rerun the race with all starters competing or only 2 (two) competitors, with the boat causing the interference being disqualified from that race. If there are multiple heats, the boat causing the interference will only lose that 1 (one) heat.

7.5 Practice and Testing

Practice in the pool will be allowed at any feasible time that an AIMSC Official is in attendance.

8 BOAT SPECIFICATIONS

To be eligible to compete boats must conform to all applicable specifications. The following details the specifications which are common to both the Junior and Advanced divisions. The additional specifications which apply to each division only are detailed separately in §8.1 and §8.2.

Please Note: Regardless of selected boat design it is strongly recommended that the boat should have a bow section with a minimum radius of 25mm. This is to ensure they do not become lodged in the 10mm square mesh of the starting gate. Hulls with a bow less than 25mm in radius shall use the manually release starting procedure regardless of start line configuration.

8.1 Common Specifications

8.1.1 Maximum Length

The maximum boat length including any front and rear projections, shall be 550mm to ensure that the boat fits behind the starting line (see Figure.1).

8.1.2 Maximum Width

The boat width (including the solar panel) must be no greater than 300mm at the widest point.

8.1.3 Maximum Guide Height

To enable boats to steer a straight line, they should be fitted with rods with open loops through which the above pool guide line will run. This line will be located as near as possible to $300\text{mm} \pm 25\text{mm}$ above the water. Other designs than the one shown below may be used.

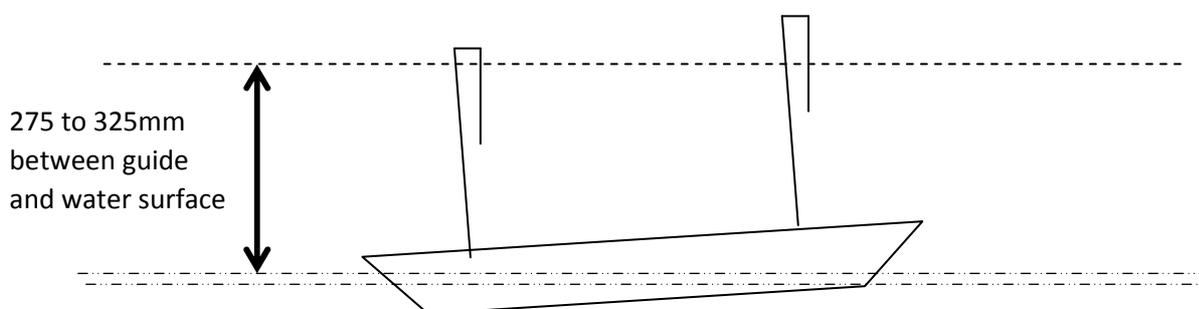


Figure 2: guide wire height and guide rod position

8.1.4 Solar Panels

Boats may be powered only by commercial silicon cells with a maximum active area of 350 square cm. The solar panels must be securely attached to the boat, so that they cannot fall into the water.

8.1.5 Other Energy Sources

No batteries or energy storage devices are allowed. However capacitors are allowed as part of an electronics system in the advanced division.

8.1.6 On/Off Switch

A functioning on/off switch must be installed between the solar panel and the motor.

8.1.7 Propulsion

There is no restriction on the use of underwater propellers, air propellers, paddle wheels, oars etc. for the selection of the boats propulsion system.

8.1.8 Identification

Each boat must have the school and boat name clearly visible to the starter and judges. Teams will be provided with a “flag” with the boat’s number and name this flag is to be affixed to the rear guide wire

8.2 Junior Division

8.2.1 Motor

Only one hobby type motor commercially available within Australia with a maximum recommended retail price of AUD \$7.00 is permitted. Motors from scrapped equipment such as VCR’s etc. are not permitted as we cannot verify their performance. Boats using such motors will be required to compete in the advanced division.

8.2.2 Hulls

Only hulls made from either recycled packaging (such as plastic drink bottles or cans etc.), polystyrene foam, cardboard or balsa wood (appropriately waterproofed) may be used. Moulded hulls, e.g. vacuum formed plastic and fiberglass hulls are not allowed in this division. Boats from the same organisation must have hulls that are deemed non-identical by the Committee (see **§2.2**).

8.2.3 Propulsion

Boats using in water propellers must use direct drive between motor and propeller. Gearboxes or other methods of changing the propeller speed relative to the motors rotor speed are not permitted in this division

8.2.4 Captain and Crew

A “captain” and 1 (one) “crew member” must be carried on the boat during racing and must be in position when the boat reaches the end of the pool. The figures must be at least 35mm high and 10mm wide and can be made of Lego™, other plastics, waterproofed cardboard, timber, pipe cleaners etc.

The captain and crew must be vertical and be protected from the sun by the solar panel or some other shielding above their heads. They must be able to “see” where the boat is going and at least 20mm of their height must be above the deck, i.e. visible from the side.

8.2.5 Non Conformance

Boats built by primary students which do not meet these restrictions will be permitted to compete by either carrying a minimum additional 100gm weight penalty or by electing to compete in the advanced division. The boat must also meet the regulations of the advanced division if that option is chosen.

8.3 Advanced Division

8.3.1 Motor

Any type or number of motors may be used.

8.3.2 Hulls

Any materials including vacuum formed plastic, fiberglass or carbon fibre hulls can be used. Boats from the same organisation must have hulls that are deemed non-identical by the Committee (see §2.2).

8.3.3 Propulsion

Any type or any number of propellers, impellers or other propulsion units may be used. Gearboxes or any type of speed varying system may be used between motor and the chosen propulsion component(s).

8.3.4 Electronics

Electronics and capacitors may be used, but the total capacitance on board the boat must not exceed 15,000 μF .

8.3.5 Cargo

All boats must carry a cargo of one empty, undistorted 375ml drink can (66mm diameter and 130mm long), which must be in place when the boat reaches the end of the pool.

8.3.6 Non Conformance

Boats which do not meet these restrictions will be permitted to compete by either carrying an additional weight penalty or if it is decided by the scrutineers that the infraction gives the boat a significant advantage and that carrying extra weight isn't enough to "level the playing field", the boat will be excluded from the Event.