



Deakin University STEM Ed  
Conference. 2021

Designing and making a model solar  
boat. A STEM challenge. Workshop  
presented by Dr Wendy Jobling

**We acknowledge and pay respect to the traditional custodians of  
this land and to all Aboriginal and Torres Strait Islander  
people throughout Australia, and their Elders past, present and  
future.**



Under different circumstances we were going to investigate, design, build and test a very basic solar powered model boat. I did have some kits for you to use.

Due to Covid we can look at how you may do this with your students. Those who want to pursue this further can get help from the Victorian Model Solar Vehicle Challenge Committee.

Please see website.



# STEM and the challenge

'An established way to introduce STEM into your teaching MSVC has been running for 30 years and in that time thousands of students have designed, built, developed and raced solar vehicles. The task of building such a vehicle requires the use of maths, various technologies, engineering practice and the application of scientific knowledge (not to mention the method). It is such a rich project that covers every aspect of STEM (plus more). The fact that it has been running for 30 years, means you know it is a refined program that is valued by many teachers like you for how well it demonstrates STEM to their students. Get started with us if you want a clear path to introducing a solid STEM program to your teaching'.

<https://www.modelsolar.org.au/>





A short video to set the scene

<https://www.modelsolar.org.au/the-challenge/first-timers-click-here>

# Getting started boats

<https://www.scorpiotechnology.com.au/>

<https://www.scorpiotechnology.com.au/model-solar-challenge-components>

## SOLAR CHALLENGE - TECHNICAL GUIDE

### MODEL SOLAR BOAT CHALLENGES

KITS FOR INTRODUCING SOLAR (NON COMPETITIVE)	STARTER KITS FOR SOLAR CHALLENGE PROJECTS
INTRO SOLAR BOAT (SBTINT)	JUNIOR SOLAR BOAT KIT (SBTJUN)
	ADVANCED SOLAR BOAT KIT (SBTADV)

### TECHNICAL GUIDE - REQUIREMENTS TO DESIGN & BUILD A MODEL SOLAR BOAT

WHAT PARTS ARE REQUIRED?	WHAT TOOLS ARE NEEDED?*
1 x Solar panel and wiring 1 x Electric motor 1 x Propeller & propeller shaft, etc. 1 x Hull material(s) 1 x Switch (3 position) 1 x Solar Panel Power Controller (Low Volt)** 2 x Guide wire follower Various other components & sundry items. e.g. adhesives, cable ties, velcro (hook & loop)...	The basic tools needed to make a boat include: Side cutters and wire strippers Small hammer. Soldering iron and stand, solder Craft knife and scissors ....Ruler and pen / marker Cutting tools (e.g. Hacksaw, mini bolt cutters) Shaping tools for the hull (e.g. Hot wire cutter, rasp, flat file, sandpaper).

\*Always check your State's current Solar Challenge Regulations to ensure that you comply.

\*\*Advanced Division only.

### MODEL SOLAR BOAT - PROPELLERS & SHAFTS

**HOW DOES IT GO TOGETHER? WHAT CHOICES ARE THERE?** Our range of components starts with a basic economical set up when starting out, and extends to carbon fibre propeller shafts and Driveline bearings.



## The Design brief

<https://victoriancurriculum.vcaa.vic.edu.au/technologies/design-and-technologies/introduction/learning-in-design-and-technologies>



### Victorian Model Solar Vehicle Challenge 2021 Regulations for Junior Boats

**Eligibility:** The Junior Boat division is intended for primary school students, however, first year high school students can enter as long as the boat complies with the Junior rules and it is your first year of being in the event.

**Boat Size:** The boat shall be no more than 550mm long and 300mm wide.

**Blunt Nose:** The front of your boat should be blunt to avoid getting stuck in the 13mm holes in the starting gate mesh.

**Guides:** A thin line will be suspended 300mm +/- 25mm above the water, to guide your boat down the pool. You will be disqualified from the current race if you are the cause of a collision with another boat.

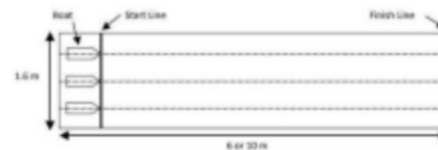
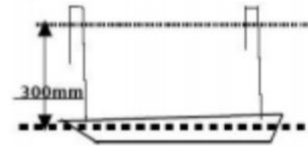
**Solar cells:** The boat is to be powered by commercially available silicon photovoltaic cells of up to 350 cm<sup>2</sup> active area.

No storage devices or batteries can be used.

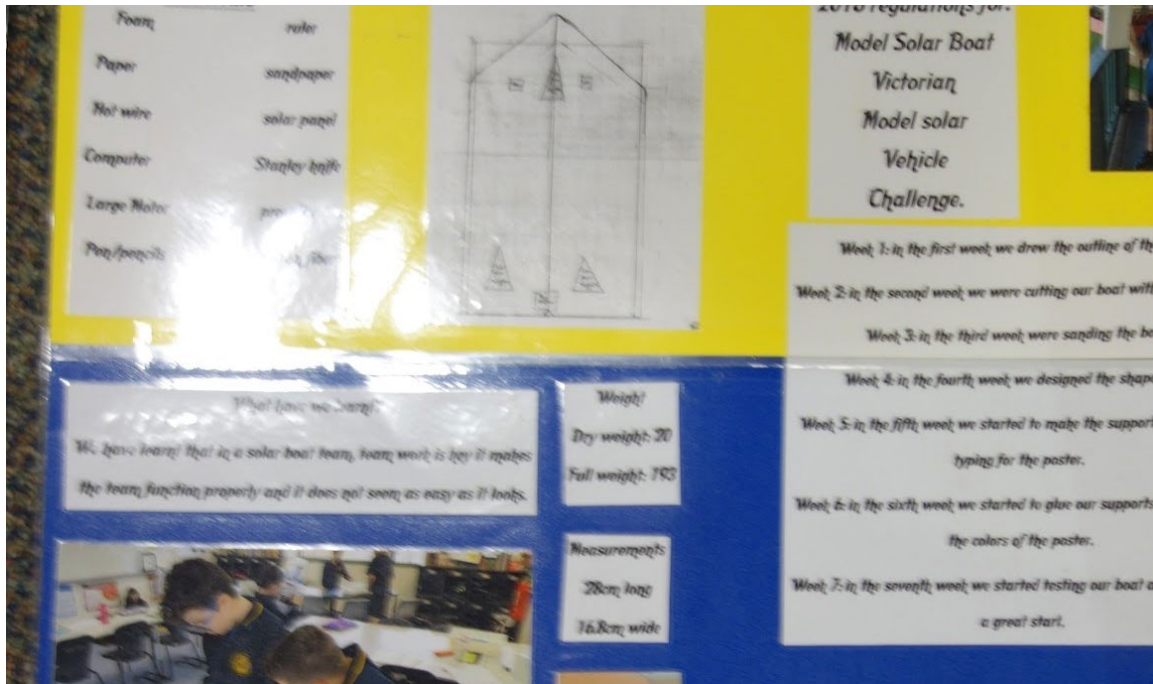
**Switch:** An ON/OFF switch should be included in the electrical circuit.

**Inspection:** The solar cells must be removable to reveal the inside of the boat and then secured firmly again.

**Electrical Connections:** It is suggested banana plugs are included in the electrical circuit to help make changeover of panels quicker. These plugs can be purchased from Scorpio Technology, Jaycar and Altronics etc. This is particularly



Opportunities for literacy links when students present posters or videos of the process.



<https://www.modelsolar.org.au/the-event/past-events>

See this year's competition

## The hull – materials and shape.

Essentially part of the **Investigating sub-strand** of the strand **Creating designed solutions** (Design and Technologies)

1. Read/investigate the regulations (Design brief)
2. Investigate suitable materials – preferably recycled
3. Also investigate hull shapes – do you want a planing hull or a displacement hull? (What is the difference? Advantages and disadvantages? (Planing hull – think of a surfboard on a wave. Fast but not very stable.

A displacement hull is designed to cut through the water with very little propulsion. Advantages: This boat hull **provides a stable, smooth ride by plowing through waves.**)

4. The guidance system
5. Investigate the solar panel, and how to create a circuit, including a switch.
6. Investigate the motor and propeller and how to incorporate these into the circuit.

<https://www.modelsolar.org.au/tech-support-old/design-guide-boat>





# Generating (Designing)

This where you can now sketch your design of the hull – I suggest a range of quick sketches that you can then select one to develop. (An opportunity for Digital Technologies – you may want to try Tinkercad (<https://www.tinkercad.com/> )

15 minutes



After designing students can then begin **Producing** after which comes testing (**Evaluating**) and then revisiting earlier stages to refine.

It is during the Evaluating stage that data relating to performance can be collected and analysed, e.g. different sized propellers (mathematics)

**Technologies context:**

**Engineering** principles and systems

<https://www.modelsolar.org.au/2021-the-event-in-covid>

Because of the restriction of COVID this year, we will have an online challenge. Much like we did last year in that lockdown.

This page will explain how the challenge will be run and how to enter.

### **A video presentation**

Students will submit a 3 minute video explaining their design efforts.

### **Elements of the video**

The video should explain:

- 1.The nature of the vehicle (car, boat, kit car) to be designed
- 2.The methods used by the student(s) to evolve the design - this things like the consideration of scientific theory, testing, problem definition, creativity and other methods the students became aware of
- 3.Imagery of the design - this could be CAD, a complete assembled vehicle in action, a prototype of the vehicle or anything else that shows the student(s) have attempted to realise the idea

### **Evaluation**

Videos will be assessed by a team of judges based on the sophistication of the design approach used by the student(s) as communicated by the video.

### **Submission**

Students can submit via [THIS FORM](#). Submissions close on 31 October at 24:00. You can edit your entry up until that time.



**Questions?**

**Thank you**

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