

Junior Solar Sprint Rules for Innovation Games

Each team of 2-4 members is responsible for designing and building a solar-powered race car. The basic solar car kit consists of a motor and solar panel. The chassis, wheels and transmission are made from any other materials as determined by the team. Cars are judged on design, innovation and performance. Each team's effort is focused toward the final event – a 20 meter, wire-guided sprint race.

Car Parameters

The dimensions of a Junior Solar Sprint car cannot exceed:

- 30 cm. in width
- 60 cm. in length
- 30 cm in height

Teams are not allowed to bolt the axles and wheels to the solar cell. Each vehicle must have a panel on the side which is large enough to display a 3cm x 3cm number decal, which will be provided by the race committee. Each entry begins construction with a **kit containing a 3V photovoltaic panel (Solar Made or Pitsco) and a motor matched to the PV panel.**

The solar panel may not be modified. The motor may not be modified (i.e. rewound, lightened, etc.). The specific motor supplied with the panel (in the kit) must be used. If a replacement motor is needed, it must be purchased from the company that supplied the panel and be the model of motor originally supplied with the panel. One solar cell and motor are permitted per car. Any modification to the solar panel or motor will result in disqualification. At least one wheel must be driven by the motor.

Each vehicle shall:

- carry a standard, unmodified table tennis ball (aka ping-pong ball) of approximately 40mm in diameter
- transport the ball (without losing it) down the entire track
- NOT glue, tape, or otherwise permanently affix the ball to the vehicle
- NOT wedge the ball between the chassis and solar panel
- be designed to allow for the purposeful removal of the ball with minimal effort

Each vehicle must include:

- a battery holder mounted that is capable of holding 2 AA batteries. In the event of a severely overcast day, rechargeable batteries that have been previously charged by solar energy will be supplied by the Florida Solar Energy Center (see Inclement Weather section below).
- a switch or other easy to operate method of 'switching on' the battery power at the starting line.

Construction

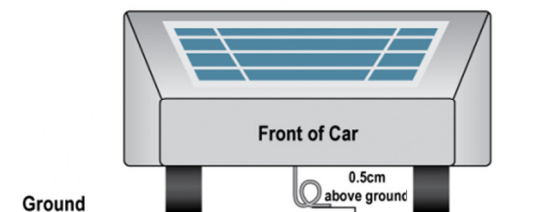
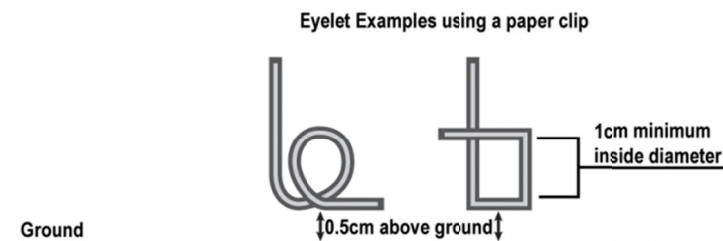
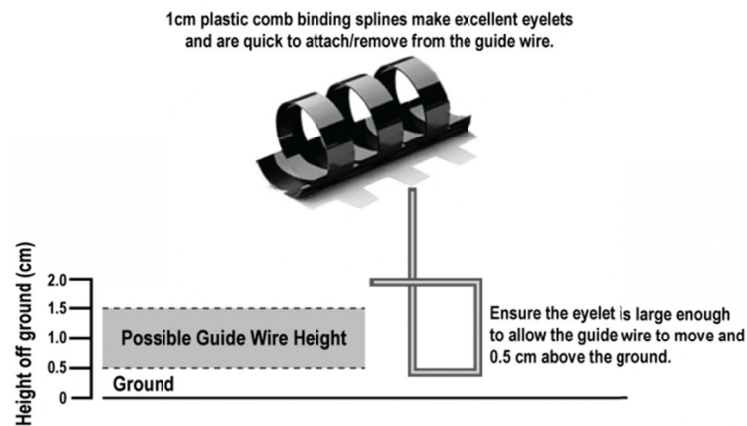
Each team, on their own, will provide the additional parts needed for the construction of the car:

- wheels
- axles
- wiring
- connectors
- gears
- eyelet

Individual decals may be affixed, and the body may be decorated at the teams' discretion, but a 3 cm. square space must be left free on each side and the bottom for the Sprint decal number. The material for the body of the car can be any type of light material. The vehicle must be safe to contestants and spectators (i.e. no sharp edges, projectiles, etc.). Any energy-enhancing devices, like mirrors, must be attached to the vehicle.

Steering

An eyelet (see examples below) must be attached to the bottom of the car (our example is on the bottom front of the chassis; any placement on the vehicle is okay). A guide wire, 1 cm.(+/- .5cm) from the surface of the track, will go through the eyelet, serve as the steering mechanism, and keep the car in its lane. The vehicle must be easily removable from the guide wire without disconnecting the guide wire. This is the only allowable method of steering the car. No radio control is permitted in Junior Solar Sprint cars. Lane changing/crossing will result in disqualification.



Failure to meet these expectations will result in disqualification.

Inspection and Design Review

All entries must pass an initial inspection (see initial inspection checklist) to be qualified to compete. Each car that passes initial inspection is then qualified for design review by designated officials.

A design notebook is required to be submitted with the vehicle as part of the design review process. The design notebook should contain notes on the design process, important points of the car's design and decisions made by the team to arrive at the final product. The design notebook does not have to be a finished, 'polished' document, but rather a collection of notes, sketches and test results of the design in progress.

The design notebook should be secured in a binder cover or notebook, and **must contain**:

- **Title page** that includes the team name, school represented, and team member's names
- **Project log** which documents each team meeting or work session. Entries include: the date, task(s) worked on, time spent on this task, team members present (initials or first names are okay), obstacles encountered (if any), and modifications to car design (if any). This can be prepared in a table if desired.
- **Design drawings** (minimum of 2) that include measurements and dimensions.
- **Finished car specifications** that include: car size, weight, wheel size, gear ratio, and a list of the components used including the cost of each (include receipts—or copies—of items purchased). Recycled and reused components should be included and listed as such.
- **Test results** (minimum of 3), each test must include the weather (sunny, hazy, cloudy, etc.), distance traveled, time elapsed, speed (distance divided by time), comments on performance, and ideas to help improve performance
- **Photos** of the completed car or during stages in the construction of the car

The design notebook *may contain*:

- electrical schematics
- formulas and calculations used
- anything else the team wants to include for the Design Judges

All log book materials must be printed before arriving at the competition; no printers will be available the day of the competition for team use. Failure to turn in a design notebook will result in loss of points.

Race Parameters

Race Divisions:

The race will be conducted in two phases: time trials and a head-to-head competition for each division.

- The **Green Division** is composed of teams where the member in the highest grade is in the **4th through 6th grade**.
- The **Blue Division** is composed of teams where the member in the highest grade is in the **7th or 8th grade**.

Time Trials:

During the time trial phase of the race, teams have the opportunity to run their vehicle down the track up to three times. After each run, the vehicle's time will be recorded. A 'DNF' or 'Did Not Finish' will be recorded for vehicles that lose their table tennis ball, drive off the track, do not cross the finish line, or are otherwise disqualified.

Time trials will be offered every two minutes for a given period of time. Event times will be posted the day of the race; teams are encouraged to perform their runs as soon as possible. It is a team's responsibility to line up and run their vehicle (up to three times) within the time allotted. Any teams in line when the end of the time trial event is called by the judges will not be allowed to run. When 'Go' is called, vehicles that do not start moving before the other vehicle reaches the finish will be given a DNF and must be removed from the track immediately. If neither vehicle moves, the teams will be given 30 seconds after 'Go' is called before DNF's are given to both vehicles. Vehicles are then to be promptly removed from the track.

The ten teams in each division with the fastest individual run times will move on to the head-to-head competition.

Head-to-Head Competition:

The head-to-head competition is a ten-team, double elimination event; a team must lose twice before being eliminated from the competition. Teams will race against other teams in their division to determine the first, second, and third place winners.

The Track:

- The racetrack is 20 meters long and 60 centimeters wide.
- The track is set up on a hard, flat, smooth surface such as a tennis court.
- A non-slick vinyl surface will be used for the track lanes.

The Starting Line:

- One team member will attach their team's JSS vehicle onto the starting end of the steering line (monofilament) using the vehicle's eyelet.
- A shading device (solar obstructor) will be provided to hold over the vehicle until the starting signal is given.
- Once the starting signal is given, the solar obstructor is to be removed to allow sunlight to strike the vehicle's solar panel thus powering the vehicle's movement down the track.
- Team members may not push a vehicle to start it.
- Team members may not accompany the vehicle in its lane during the race.

During the Heat:

- One team member may free the vehicle from wire binding or track imperfections should such problems occur.
- Team members may not push the vehicle or give any other physical assistance.

- Team members may not change the vehicle's mechanical or electrical characteristics (e.g. shift a transmission) after the start of the heat.

Between Heats:

- Repairs may be made to vehicles as necessary between heats. However, no extra time will be given for repairs, and the race will not be paused for repairs to be completed.

The Finish Line:

- One team member must be present at the finish line to stop the vehicle, preventing any damage to it.
- The vehicle must remain in its lane at the finish line until the order of the race vehicles has been established.
- **Decisions made by the racing officials are final.**

Inclement Weather:

Partially Cloudy – Because weather in Florida is changeable, the race will not be postponed for partly cloudy or mostly cloudy weather. Teams should be prepared to race in all moderate weather conditions.

Severely Overcast – If the solar irradiance (amount of sunlight) averages less than 500 Wm^2 during a 15 minute period (as measured by equipment at the Florida Solar Energy Center) just prior to the **start** of either the Time Trials or one of the Head-to-Head Competitions, the race will be switched to a battery powered race. The Florida Solar Energy Center will loan the teams (2) AA rechargeable batteries that have been charged by solar and tested for charge level prior to distribution, as well as a 'shade' to cover the photovoltaic panel. Only the batteries supplied by FSEC may be used. From the time that the race is changed to batteries, it will remain battery powered and not switch back to solar, regardless of increasing irradiance levels. (Note: a typical full sun day at solar noon in Florida is usually 1000 Wm^2)

Rain/Thunderstorms – If the solar irradiance averages less than 500 Wm^2 during a 15 minute period plus the amount of rain occurring makes the track unusable or unsafe, the race will be canceled. If one division has already raced, then only the second division's race will be canceled. If only the time trials have been run, those times will be used to award the race winners. If the time trial portion has not been completed, then only design awards will be given and no race will occur. The decision whether or not to cancel the race portion will be made by the JSS administrative team, and from the time that the race is canceled, it will not be reinstated even if the weather clears.

Junior Solar Sprint Awards

First (1st), Second (2nd) and Third (3rd) Place Awards will be given for the top three vehicles in each division (Green and Blue).