EnergyWhiz 2024
Junior Solar Sprint (JSS)
RULES

What is the JSS competition?

Junior Solar Sprint (JSS) is a national engineering challenge where students design, construct and race a model-sized, solar-powered vehicle. Teams must use a regulation kit containing a solar electric (photovoltaic) panel and motor, which energizes the vehicle that they design and build. The other parts of the car are made from materials of the team's choosing. Teams present their designs and evidence of their engineering process through a student-created (WordPress) web page, where they are reviewed by a panel of judges. Teams then bring their vehicles to EnergyWhiz to compete in the 20 meter, wire-guided sprint race. Cars are judged on design, innovation, and performance.

Who May Compete

JSS is open to teams of two (2) to four (4) students in grades four (4) through eight (8).

The competition is divided into two divisions. Teams of mixed grade levels will compete in the division of the highest grade level student.

- Green Division - 4th - 6th grade.
- Blue Division - 7th and 8th grade.

NOTE: Schools or clubs that have registered more than three JSS teams per division may be requested to select up to three of their teams to represent their organization at the racing component of JSS. This may be necessary depending on the number of overall teams enrolled given the limited number of tracks and prime sun hours available for racing solar cars within a four-to-five-hour time frame.

Note: Because competitions run concurrently, individual students may only participate in two (2) competitions at EnergyWhiz as team members.

Important Dates

Events	Date
Project Webpages Due	April 3, 2024
Project Feedback Available to Coaches/Teachers	April 11, 2024
Web Pages Available for Public Viewing/Comments	April 15, 2024
Student/Team Names & Risk and Release Forms Due	April 17, 2024
EnergyWhiz Event at FSEC	April 20, 2024
National JSS competition at TSA Conference*, Orlando	June 26 – 30, 2024

The top performing JSS team at EnergyWhiz is invited to attend the **Technology Student Association (TSA)** Conference and compete in the National JSS event. All JSS teams must be registered (link to be provided) prior to competing at EnergyWhiz to be eligible.

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Requirements

Hybrid Vehicle Design and Construction

The vehicle must be designed to be a hybrid, with the ability to switch from solar power to battery power in the event of inclement weather or overcast skies.

	Vehicle Size
	The **dimensions** of a Junior Solar Sprint car **cannot exceed**: • Width: 30 cm • Length: 60 cm • Height: 30 cm
	Solar Panel and Motor
	JSS Kit: Each entry begins construction with a JSS kit available from Solar Made or Pitsco. The basic JSS kit contains a three-volt (3V) photovoltaic (PV) panel and matching motor. • The solar panel and motor **may not** be modified. Any modification to the solar panel or motor will result in disqualification. • 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 or from FSEC and be the model of motor originally supplied with the solar panel. • One solar panel and motor are permitted per car.
	Battery Holder
	• The vehicle must include a battery holder mounted on the vehicle that is capable of holding two AA batteries. • A switch or other easy to operate mechanism that can change where the power is coming from (from solar panel to motor to battery power to motor) is required. See Inclement Weather section for information on when batteries will be used. • No batteries will be carried on the vehicle unless directed by the race officials on the day of the event.
	Passenger/Payload (Ping-pong ball)
	• Each vehicle must be designed to carry or hold a metaphorical passenger or payload. • The passenger/payload is represented by a standard, unmodified table tennis ball (aka ping-pong ball) of approximately 40mm in diameter. • The ball may not be glued, taped, permanently affixed or wedged into the vehicle. • The car design must allow for the purposeful removal of the ball (passenger/payload) with minimal effort. If the passenger or payload is dislodged during the course of a time trial or race, it is considered a DNF (did not finish).

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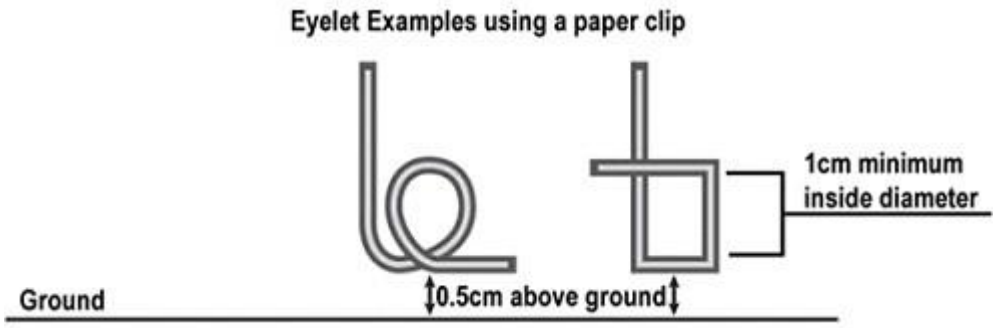
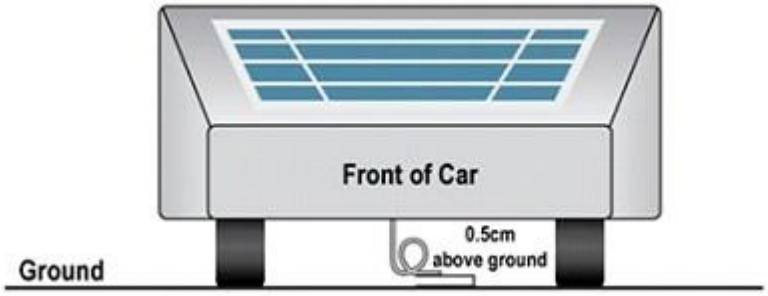
Car Components and Steering Device:

	Car Components:
	Vehicle/Team name Each team, on their own, will research and acquire the appropriate materials and parts needed to complete their car: • wheels • axles • car body/chassis • wiring • battery holder • connectors • gears • steering device/eyelet • passenger/payload (ping-pong ball) holder
	The body may be made of any material and decorated at the team's discretion. Individual decals may be affixed, but the vehicle must have a three (3) centimeter square space or area on each side and the bottom that is available for the vehicle's Sprint number decal, which is provided by the race committee.
	The vehicle must be safe (no jagged/sharp edges or projectiles).
	At least one wheel must be driven by the motor.
	Any energy enhancing devices, like mirrors, must be attached to the vehicle.
	Steering Device
	Steering Device: **All JSS cars are required to have a mechanism (eyelet) permanently affixed to their chassis that keeps the vehicle on the racetrack guidewire (monofilament line).** This guidewire hovers one (1) centimeter (+/- .5cm) above the surface of the racetrack. The guidewire helps to keep the vehicle in its lane. The goal is to affix the eyelet or steering mechanism strategically on the vehicle, so the car will travel in the most direct and efficient path to the finish line. The eyelet or steering device may be placed anywhere on the vehicle. This steering device must be able to be easily attached to the guidewire at the beginning of each heat by a team member and removed from the guidewire at the finish line by another team member. See some examples of eyelets on the next page. **Closed eyelets** are not permitted on JSS cars.
	Items not allowed / Disqualification
	The solar panel is not to be used as the vehicle's chassis. If the axles and wheels are connected directly to the solar panel, the vehicle will be disqualified.
	No radio control is permitted in Junior Solar Sprint cars.
	Closed eyelets are not permitted on JSS cars.

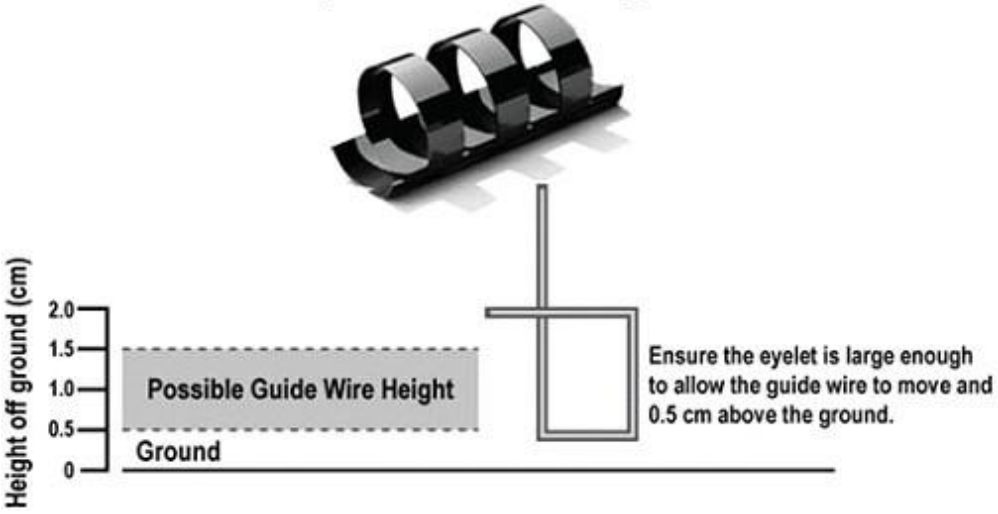
Failure to meet these expectations will result in disqualification.

Steering Device/Eyelet Examples





1cm plastic comb binding splines make excellent eyelets and are quick to attach/remove from the guide wire.



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Web Page

Each team will populate a web page on the EnergyWhiz site (using WordPress) showcasing their JSS vehicle. The web page will include basic team info, vehicle photos, notes on the design process, and a video describing important points of the car's design and decisions made by the team. This will be used to judge the vehicle's design and construction and will be viewed by students and the public.

The web page must include:

1. Photo & Basic Info	
	Vehicle/Team name
	Name of the School
	First name(s) and **last initials** of students on the team (**no last names on the public page**)
	Grade level of each team member
	A close-up photo of the completed vehicle/car (use this as the *Featured Image* on your page). Be sure the project photo is clear/visible.
2. Design Documentation	
	Photos - a minimum of six (6) photos of the completed car showing: 1. Front 3. Right Side 5. Underside 2. Back 4. Left Side 6. Top
	Project Log - The entries in the project log document each team meeting or work session. This can be a list, a table or an informal paper document that is scanned and inserted in the web page as photos. Entries include: ○ Date ○ Task or tasks ○ Time spent on the task or tasks ○ Team members present (initials or first names – no last names) ○ Obstacles encountered (if any) ○ Modifications to the car design (if any).
	Design drawings (minimum of 2) that include measurements and dimensions.
	Finished car specifications that include: car size _____ wheel size _____ weight _____ gear ratio _____
	List of components used and their cost. Recycled and reused items should be included and listed as such. For example: Item: Balsa wood; Cost: $3.00; New/Reused/Recycled: New Item: Plastic soda bottle; Cost: $0; New/Reused/Recycled: Reused

3. Vehicle Performance Test - (minimum of 3) that include at least one test under battery power

Vehicle Test Information	Test 1	Test 2	Test 3
Solar or Battery Power			
Weather (Sunny, Cloudy, etc.,)			
Date and Time of day			
Distance Traveled			
Time Elapsed			
Speed (distance divided by time)			
Comments on performance			
Ideas for improving the car's performance (if any)			

4. Vehicle Features Video – (less than 5 minutes) to be included on your web page and hosted on our Vimeo site that includes one team member holding the vehicle while that team member or other members describe and explain the following:

	Features of the vehicle that make it special. The person holding the vehicle should point them out. Close-ups of these features are a must. Remember, the judges need to see them!
	Any unexpected outcome or discovery made by any team member as a result of the engineering, design building and testing process.
	How the vehicle performed when you tested it in the sunlight.
	Did you test the vehicle's performance under racing conditions (on a monofilament line)? Explain the results or why you did not test it on a monofilament line.

Teams are encouraged to use the judging criteria as a guide to what extras they may want to include in their web page. For example, the web page **<u>may</u>** include:

- extra photos of the design, building and testing process
- electric schematics of the car
- videos of test runs of the vehicle
- formulas or calculations used
- any items that the team feels will showcase their car or be helpful to the judges to pick them as the winning team!

During the week leading up to the event and during EnergyWhiz, all Junior Solar Sprint design pages will be available for viewing. Students are encouraged to share their web page address with family and friends, and to visit other team pages.

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Competition Day – Time to Race!

Note: Because competitions run concurrently, individual students may only participate in two (2) EnergyWhiz competitions as team members.

Check in - Vehicle Inspection (closes at 9:30 am)	
	The teacher or coach will check-in and receive an information packet containing: ○ Schedule ○ Stickers with assigned vehicle number to place on the team's car ○ Team back signs and safety pins to attach on the back of each team members' shirts ○ Step by step (procedural) directions for the day ○ Certificates of participation for each team member.
	Teams must submit their cars for initial inspection at event check-in.
	Vehicle inspection must be completed by 9:30. **Cars arriving late will not be allowed to race.**
	Once inspected, vehicles will be impounded until race time, so cars need to arrive at the event ready to race.
The Track (Set-up by FSEC)	
	The racetrack is set up on a hard, flat smooth surface 20 meters long and 60 centimeters wide.
	A non-slick vinyl surface will be used for the track lanes.
	A monofilament line attached to two wooden, weighted palettes on either end of one lane of the track is used to guide one vehicle down the race lane.
	Two of the monofilament lines are set up parallel to one another to create two race lanes.
The Starting Line - Procedure/Rules	
	One team member will hold a solar obstructer (shade device) provided by the race officials above their car's solar panel (shading it) and will remove it when the start signal is given.
	Teams will race against other teams in their division to determine the first, second, and third place winners.
	Team members may not push a vehicle to start it. It should move under sun power.
	Team members may not accompany the vehicle in its lane during the race.
During the Heat - Procedure/Rules	
	Team members may not change the vehicle's mechanical or electrical characteristics (e.g. shift a transmission) after the start of the heat.
	One team member may free the vehicle from wire binding or track imperfections should such problems occur.
	DNF (Did Not Finish) - called when a vehicle: • does not move off of the starting line for 15 seconds • stops before reaching the finish line • loses their passenger/payload (table tennis ball) prior to crossing the finish line • drives off the track

	• crosses over into another lane • comes off the guide wire • does not cross the finish line • is ruled by a race official as such or is disqualified.
	Vehicles are to be promptly removed from the track after each heat or when a DNF is called.
	If a car comes off the guide wire and interferes with another car, the loose car will receive a DNF for that run. The opposing car(s) will be given a win if it occurs during double elimination heats or will be allowed another chance to run if it happens during time trials.
Between Heats - Procedure/Rules	
	Repairs may be made to vehicles as necessary between heats as time allows.
	No extra time will be given for repairs.
	The race will not be paused for repairs to be completed.
The Finish Line - Procedure/Rules	
	One team member must be present at the finish line to stop the vehicle.
	The vehicle must remain in its lane at the finish line until the order of the racing vehicles has been established.

The JSS Race Format

The race will be conducted in two phases: time trials and a head-to-head double elimination format competition for each division (Green Division, 4th- 6th and Blue Division, 7th & 8th)

1. Time Trials - starting time for each division's time trials will be posted the day of the race.	
	• Teams may run their vehicle on the track up to three times within the time allotted. • Teams report to the starting line whenever they are ready to run; car numbers will not be called during the time trials. • The vehicle's time will be recorded after each run. • A vehicle's best time out of all its runs is used to rank the vehicles.
	The Time trials will be offered every two minutes for a given time period. Once time is called by the judges, no more runs are allowed.
	The ten teams in each division with the fastest individual run times will move on to the head-to-head, double elimination competition.
2. Head-to-Head Competition - is a ten-team, double elimination race	
	A team must lose twice before being eliminated from this part of the competition. Teams who have lost one race are to remain in the area to wait for their next race to be called.
	Teams will race against other teams in their division to determine the first, second, and third place winners.

DECISIONS MADE BY THE RACE OFFICIALS ARE FINAL

What happens if racing conditions are unfavorable (inclement weather)?

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

Severely Overcast - If the solar irradiance averages less than 500 Wm2 during a 15 minute period (as measured by equipment at FSEC) just prior to the start of either the Time Trials or one of the head-to-head competitions, the race will be switched to battery power.
Teams will be provided with:

- (2) AA rechargeable batteries that have been charged and tested for charge level prior to distribution by the race officials
- a cover for the photovoltaic panel on the car.

Only the batteries supplied by FSEC may be used. Once a division race is changed to batteries, it will remain battery powered, regardless of increasing irradiance levels. (Note: a typical full sun day at solar noon in Florida is usually 1000 Wm2).

Rain/Thunderstorms - The race will be canceled if conditions are unsafe or if the track is unusable (too wet). If one division has 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. All cancelation decisions will be made by the JSS administrative team. Once a race is canceled, it will not be reinstated even if the weather clears.

Evaluation and Judging

JSS vehicle design and innovation will be reviewed online by multiple judges and provided with a score based on the rubrics that follow. Final review of all projects happens in-person at EnergyWhiz.

Best Design - 1st - 3rd Place Awards**:** Given to top three scoring teams in each division for best design.
Most Innovative - 1st – 3rd Place Awards: Given to top three scoring teams in each division for innovation.
Race Performance - 1st – 3rd Place Awards: Given to top three place teams at the end of the races.

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CATEGORY	BEST DESIGN	MAX POINTS
Chassis:	How well constructed is the frame? Were good design decisions used to improve the chassis or was it unaltered (merely a plain flat rectangular piece)?	15
Wheels / Axles:	How well are the wheels, axles, bearings/bushings designed, built and mounted? Are the axles parallel so that the car will run straight?	15
Steering Device:	Does the vehicle have a secure open eyelet or other such device to attach to the guidewire (monofilament line)? Was the vehicle tested on a guidewire?	13
Transmission:	How well mounted is the motor? Does the transmission (gears, belt, etc) effectively transmit power to the wheels?	15
Solar Array:	How well oriented is the solar panel for light reception? Is the car designed to improve the way the solar panel is positioned, attached, or collects sunlight?	15
Craftsmanship:	How well constructed is the car overall? Was care taken in the way the car was constructed? Is it sturdy?	12
Web page:	Does the contents of the team web page document the design, building and engineering process in a way that the viewer can see how the vehicle works and see the special features that the team incorporated in their design?	8
Video:	Is the video component of the webpage clear and understandable? Did the team fulfill the video requirements? Did they communicate effectively?	7
	Design SCORE	100

CATEGORY	MOST INNOVATIVE	MAX POINTS
Unique Design:	Does the car include elements that are unusual, unique, and not typical for a JSS car design?	17
Creativity / Artistic:	Has the team added artistic elements, decorations, personality, or fun creative elements to their vehicle?	17
Material use:	Has the team used unusual materials or materials in an innovative way?	17
Sustainability:	Did the students use recycled, re-used or earth-friendly materials?	17
Appearance:	Does the vehicle make a statement, convey a message or have a clear theme?	17
Web page:	How creative is the team web page? Is it enjoyable? Was there information provided about unusual choices made and why?	8
Video:	Did the team effectively explain what makes this vehicle special or innovative?	7
	Most Innovative SCORE	100

GOOD LUCK TO ALL JSS TEAMS!