# JUNIOR SOLAR SPRINT

## OVERVIEW

Junior Solar Sprint (JSS), an Army Educational Outreach Program (AEOP), provides a hands-on opportunity for students to apply science, technology, engineering, and mathematics (STEM) concepts, creativity, teamwork, and problem-solving skills as they design, construct, and race a solar-powered car.

☑ Junior Solar Sprint (JSS) is an Army Educational Outreach Program (AEOP). Information about AEOP opportunities can be found at www.usaeop.com.

## ELIGIBILITY

Participants are limited to one (1) team per chapter, one (1) entry per team. JSS teams must consist of two to four (2-4) students. Students may be part of a registered Technology Student Association chapter and compete, or they may be a group that competes at an approved Army host site.

## TIME LIMITS

Entries (including the model car) must be started and completed during the current school year. Syllabi for two (2) weeks, four (4) weeks, and eight (8) weeks are available in the Educational Resources link found on the JSS website at www.jrsolarsprint.org

## ATTIRE

TSA competition attire, as described in the National TSA Dress Code section of this guide, is required.

## PROCEDURE

A. At the event, participants check in their entries for specification approval at the required time and place.

B. Entries will be evaluated in four (4) areas: 1) display, 2) portfolio, 3) artisanship and engineering of the model, and 4) model's racing performance.

C. Evaluation of the racing performance will consist of two (2) components: 1) time trials, and 2) semifinalist racing of the top sixteen (16) time trial winners.

D. All models meeting safety and performance criteria will be given up to three (3) time trials. The fastest time of these time trials will determine the sixteen (16) top semifinalist cars to

☑ If a car is deemed unsafe, it will not be allowed to run in the time trials or the semifinalist races. If the model is safe, but does not meet the required specifications, it will be allowed to run in the time trials but not the semifinalist races.

☑ An array of support materials, such as correlations to STEM standards, a glossary of terms, course outlines, and lesson plans can be found at www.jrsolarsprint.org

be raced. Cars that are disqualified for any reason will not be permitted to participate in the semifinalist races.

E. The top sixteen (16) cars compete in a single or double elimination racing process. The process will be determined by the event coordinator.

F. The four (4) evaluated areas will be used to determine final standings (see criteria for assessment and racing performance on the official rating form).

**It is essential that students and advisors routinely check the TSA website (www.tsaweb.org) for updated information about TSA general rules and competitive event guidelines. This information is found on the website under Competitions/ Competition Updates. When students participate in any TSA competitive event, they are responsible for knowing of all updates, changes, and clarifications related to that event.**

## REGULATIONS

### Documentation

A. Documentation materials (comprising a "portfolio") are required and should be placed and secured in a clear front report cover. (Click here for a sample.) The report cover must include the following single-sided, 8½" x 11" pages, in this order:

1. Title page with the event title, conference city and state, the year, and the team/chapter ID number; one (1) page
2. Table of contents; pages as needed
3. Project Log (available on JSS website) that indicates preparation for the competition, as noted by date, task, time involved, obstacles/issues encountered, modifications made, team member responsible, and any comments; pages as needed
4. Design drawings: drawings must show the model with a minimum of two (2) views; the drawings must be developed using standard engineering practices and procedures (including measurements/dimensions); the drawings may be produced using traditional drafting methods or CAD; rough sketches should be included; pages as needed.
5. Design details of the model, including model size, wheel size, gear ratio, specifications of the motor and solar collector used, etc; one (1) page
6. Components list; one (1) page
7. Design process description, including pre-testing notes of various configurations of the model and revision notes

about the model design throughout the process; pages as needed

8. Sections of the portfolio may be organized by dividers.

B. The model car must meet the following specifications:

## Model Car

1. The model must accurately reflect the design process outlined in the online resources.
2. A decorated shoebox must be used as a display stand during judging of the model car. The portfolio must be placed with the model car. The display (model, shoebox, portfolio) must fit in an area 15" deep x 3' wide x 4' high.
3. The materials used to construct the model car must cost less than $50. Original receipts for all materials purchased must be put in an envelope and placed in the portfolio. If using recycled materials, documentation must show how these items were obtained. Recycled materials are not included in the $50 maximum. The total cost of construction materials must be clearly written on the outside of the envelope. Model cars that exceed this construction cost limit will be disqualified from the competition.
4. The Ray Catcher Sprint Kit sold by PITSCO is the solar panel/motor kit that is recommended, but not required, to be used in the competition. Solar panels cannot be shaved, drilled, or delaminated. Only the motor supplied in the kit can be used. Motors cannot be re-wound or disassembled. If an evaluation group convened by the event coordinator determines that the solar panel and/or motor have been modified, the car and team will be disqualified from the competition.
5. One (1) solar panel (limited to a maximum output of 3.2 W), and one (1) motor (limited to a maximum 3.0 VDC) are allowed per car. Reflectors, supports, and power leads can be added to these components as needed, but they must fit within the required dimensions cited in section B.6. Energy-enhancing devices, such as mirrors, must be firmly attached to the vehicle. The remainder of the vehicle can be innovative in design and materials.
6. The vehicle must be structurally sound without the solar panel attached. The solar panel cannot be used as the chassis, or body of the car. The axles and wheels cannot be directly attached to the solar panel. The model car must, with the solar panel attached, not exceed the following dimensions: 30 cm (11¾ inches) wide by 60 cm (23⅝ inches) long by 30 cm (11¾ inches) high (as measured from the surface the car is resting upon to the highest point of

☑ The Junior Solar Sprint kit is sold by PITSCO:

http://www.pitsco.com/Ray_Catcher_Sprint_Kit

the car with all its components attached); this includes when the car is positioned during the time trials and races.

7. The team is encouraged to decorate the body of the car, but a clearly visible 3 cm square space must be available on the car to attach an assigned car number for the race.
8. If it is determined that the vehicles will be raced using solar power, the sun's light is the only energy source that can be used to power the vehicle. Batteries, capacitors, flywheels, or any other energy storage devices are prohibited.
9. If the sun's energy is judged insufficient by the event coordinator, a battery pack and two (2) AA 1.5 V batteries will be furnished for each team. Only the provided batteries are permitted to power the model, therefore, the model's motor power leads must be readily accessible for easy attachment to a battery pack.

C. A student-designed attachment device, such as an eyelet or screw eye must be attached to the car to accommodate the easy attachment and removal of a guide wire for steering. A guide wire, such as fishing line, will be no more than 1.5 cm from the surface of the track. It will go through the attachment device (such as an eyelet) attached to the car and serve as a steering mechanism to keep the car in its lane, without disconnecting the guide wire. Both ends of the guide wire will be fixed to the track. This is the only allowable method of steering the car. No radio control is permitted in the car. Lane changing or lane crossing will result in a Did Not Finish (DNF) standing. A car whose race is impacted by an out of control vehicle will be allowed an opportunity to run the race again. A car that lacks steering control and interferes with other cars in other lanes will not be allowed to race again.

## Time Trials and Semifinalist Racing

A. The race lane must be 60 cm wide and 20 m long. The track will be a hard flat surface, such as a tennis court or a smooth surfaced running track.

B. The time trial/race specifications are as follows:

1. Tables will be set up for teams to make adjustments and minor repairs to cars just prior to each time trial and the semifinalist heats. Teams that are "next up" to be timed or raced are given priority to use the tables. Teams must supply their own tools.
2. Time trials and semifinalist races will not be delayed to permit adjustments or repairs to cars. No adjustments or repairs are permitted once a time trial or race begins.

3. At race time, each car will be placed behind the starting line with all of its wheels in contact with the ground and covered by an opaque sheet covering that does not touch the solar panel. The opaque sheet will be removed at the start of the race, allowing the vehicle to collect solar power and start driving.
4. No more than two (2) team members will be allowed in the start area.
5. Releasing a car before the official start, or pushing a car during its release will result in a Did Not Finish (DNF) for that race.
6. All cars will be started when the official signal is given. Each car will have up to three (3) time trials, unless otherwise determined by the event coordinator. The fastest time of the time trials will determine the sixteen (16) cars to be raced. If, for any reason, a car is not able to participate in the time trials, or race at its scheduled time, it may be disqualified.
7. The judges will note the official time for each time trial. At the time designated, if a car does not start the time trial, OR if during the time trial it does not finish, it will be noted as a Did Not Finish (DNF).
8. At least one (1), but no more than two (2) members must wait at the finish line to catch the vehicle for each timed trial. Team members are responsible for finding someone to catch their vehicle if another team member is unavailable.
9. No one, including team members and spectators, may accompany or touch the vehicle on the track during a timed trial or semifinalist race. Vehicles stalled on the track can be retrieved after the end of the trial or race has been declared by the lead judge. A violation of this rule will result in disqualification of the offending team.
10. After each timed trial or race, the vehicle and team member must remain at the finish line until the time is recorded for the vehicle.
11. Challenges must be made before the next timed trial or race begins. Any challenges must come from team members who are actively competing, not the coach/advisor, parent, or coordinator. All challenges need to be directed to the lead judge. The decisions of the judges are final.
12. Only competing students and race officials may be in the race area. All other spectators, including coaches/advisors, parents, coordinators, and non-competing students, must remain in the designated spectator area throughout the duration of races. Teams will be disqualified if a spectator, including a coach/advisor or parent, interferes with a race. This includes a coach/advisor or parent helping team members get their car on/off the guide wire.

13. Judges may inspect cars at any time before, during, and after timed trials or semifinalist races.
14. Any additional rules, regulations, or guidelines established by the event coordinator must be followed.

## EVALUATION

Entries are evaluated on creativity and innovation, the display, documentation porfolio, the artisanship and engineering of the model solar car, and the model's racing performance. Please refer to the official rating form for more information.

## STEM INTEGRATION

This event has connections to the STEM areas noted below. Please refer to the STEM INTEGRATION section of this guide.

Science, Technology, Engineering, Mathematics

## COMMON CORE STATE STANDARDS (CCSS) INTEGRATION

Please refer to the Common Core State Standards (CCSS) Integration section of this guide for more information.

## LEADERSHIP SKILLS

Leadership skills promoted in this event:

- Communication: Team members communicate with each other to develop an entry. Use leadership activities: *Chefs in the Kitchen* and *Take Action*
- Creative thinking: Team members will develop a unique solar-powered car. Use leadership activities: *Be Prepared!* and *Open Minded*
- Evaluation: Students evaluate and change design elements of a solar-powered car. Use leadership activities: *Finish Line to Start Line* and *The Great "Evaluate"*

Additional leadership skills promoted in this event:

- Decision making
- Teamwork

## TSA AND CAREERS

This competition has connections to one or more of the career areas featured in the TSA AND CAREERS section of this guide. Use *The 16 Career Clusters* chart and the *TSA Competitions and Career Clusters* grid as resources for information about careers.

## CAREERS RELATED TO THIS EVENT

- Energy efficiency technician
- Mechanical engineer
- Solar engineer
- Solar panel installer
- Solar sales consultant

# JUNIOR SOLAR SPRINT COMPETITION
# PROJECT LOG

| Date | Task | Time involved | Team member responsible | Obstacles encountered | Modifications made | Comments |
|---|---|---|---|---|---|---|
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| 3 | | | | | | |
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| 5 | | | | | | |
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| 7 | | | | | | |

Advisor Signature: _____

# JUNIOR SOLAR SPRINT COORDINATOR INSTRUCTIONS

## PERSONNEL

C. Event coordinator

D. Evaluators, two (2) or more

E. Assistants, two (2) or more

## MATERIALS

A. Coordinator's packet containing:
   1. Event guidelines, one (1) copy for the coordinator and each evaluator
   2. TSA Event Coordinator Report
   3. Stick-on labels for identifying entries
   4. Race bracket form
   5. Results envelope with coordinator forms

B. Battery pack with clips soldered on and batteries (AA 1.5 V) (in the event that the sun provides insufficient energy), one (1) per entry plus spares on site

C. Monofilament fishing line for the track, four (4) pre-tied, two (2) on track, two (2) reserved per sixteen (16) participants

D. Race track set, including a starting gate and finish gate with digital timer

E. Spare stopwatches with back-ups

F. Padding for the finish gate

G. Tables for the display and evaluation of entries (cars and portfolios)

H. Table and chairs at the starting line for arranging and holding cars prior to the time trials

I. Table at the finish gate for the placement of cars after time trials

J. Ranking board for a display of time trials

K. Tables and chairs for event coordinator, evaluators, and official assistants

## RESPONSIBILITIES

A. Upon arrival at the event, inspect the area(s) in which the event will be held for appropriate set-up, including location for displays and evaluation of portfolios, racing site, chairs, tables, outlets, etc., and check the contents of the coordinator's packet. Review the event guidelines and check to see that enough evaluators have been scheduled.

B. Check in the entries at the designated time.

C. Secure the entries in the designated area.

D. One (1) hour before the event is scheduled to begin, meet with evaluators/assistants/timers to review time limits, procedures, and regulations.

E. Position the Junior Solar Sprint portfolios and models for viewing by the evaluators, and assist them as necessary during judging.

F. Set up the race track prior to the time trials. Make necessary adjustments.

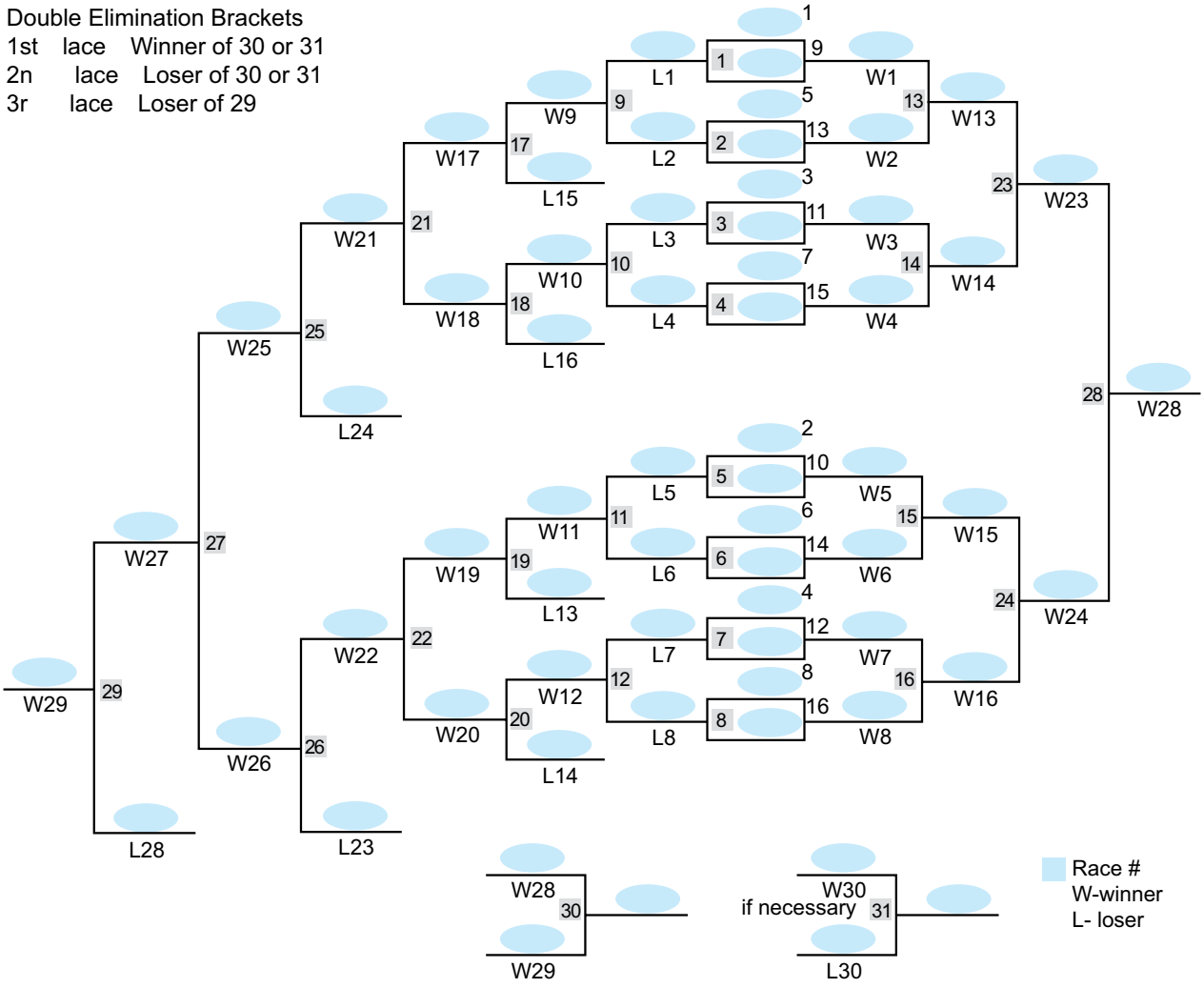
G. Permit all vehicles (that can be safely operated) to participate in time trials. Note: Vehicles that are disqualified will NOT be permitted to participate in the semifinalist races.

H. Evaluators determine the ten (10) finalists.

I. Submit the finalist results and all related forms in the results envelope to the CRC room.

J. At the designated time, return models and portfolios to student participants.

# RACE BRACKET FOR 16-CAR DOUBLE ELIMINATION



# JUNIOR SOLAR SPRINT COMPETITION TIME TRIALS

| Entry ID# | Time Trial 1 | Time Trial 2 | Time Trial 3 | Fastest Time | Rank |
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Participant/Team ID# _____

# JUNIOR SOLAR SPRINT

## 2016 & 2017 OFFICIAL RATING FORM — MIDDLE SCHOOL

### Display and Model (40 points)

The model is safe to participate in the time trials and, if deemed appropriate, the semifinalist races. ___Yes ___No
The model meets all required specifications. ___Yes ___No

| CRITERIA | Minimal performance 1-4 points | Adequate performance 5-8 points | Exemplary performance 9-10 points | Record scores in the column spaces below. |
|---|---|---|---|---|
| Evaluators: Using minimal (1–4), adequate (5–8 points), or exemplary (9–10 points) performance levels as a guideline, record the scores earned for the event criteria in the column spaces to the right. The X1 notation in the criteria column is a multiplier factor for determining the points earned. (Example: an "adequate" score of 7 for an X1 criterion=7 points.) | | | | |
| **Display** (X1) | The quality of the display is extremely poor and/or exceeds size requirements. | The display is adequately created and meets the size specifications. | The display is exemplary, includes eye-catching details, and meets the size specifications. | |
| **Model design** (X1) | The design of the solar model is poor and shows little effort. | The design of the solar model is adequate but not of exceptional quality. | The design of the solar model exhibits exceptional quality. | |
| **Model creativity/ originality** (X1) | The solar model car design lacks creativity and originality; little effort is apparent. | The solar model car design demonstrates an adequate level of creativity and originality. | The solar model car design shows exceptional creativity and originality. | |
| **Model construction** (X1) | The solar model car lacks quality of construction. | The solar model car demonstrates adequate quality of construction. | The solar model car demonstrates exceptional quality of construction. | |
| | | | **SUBTOTAL (40 points)** | |

### Documentation (50 points)

| CRITERIA | Minimal performance 1-4 points | Adequate performance 5-8 points | Exemplary performance 9-10 points | |
|---|---|---|---|---|
| **Portfolio components** See Regulation A (X1) | A number of portfolio components are missing. | Most of the portfolio components are included, but the portfolio lacks overall quality. | The portfolio includes all required components; it is neat and properly organized; effort and quality are evident. | |
| **Project Log** (X1) | The Project Log is lacking significant portions; it is messy and demonstrates lack of effort. | The Project Log is acceptable, with most information included. | The Project Log is complete and accurate; the presentation is neat and orderly; a great deal of effort is evident. | |
| **Design drawings** (X1) | Some drawings are missing and/ or drawings are of poor quality. | Drawings are acceptable; all required views are shown. | Drawings are accurate and complete; all required views are present; rough sketches are included. | |
| **Design details/ components list** (X1) | Several details of the model, such as model size, wheel size, and gear ratio are missing and/or are poor; the components list is very limited. | Most details of the model, such as model size, wheel size, and gear ratio are included; most components are included. | All details of the model, such as model size, wheel size, and gear ratio are present; all components are included. | |

| | | | | |
|---|---|---|---|---|
| **Design process description** (X1) | The design process description lacks detail and is poorly documented. | Most of the design process description is present. | All parts of the design process description are present. | |
| | | | **SUBTOTAL (50 points)** | |

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the evaluator, coordinator and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: _____

**Time Trials**
**For time trials record, please see page 226.**

**Race (55 points)**

| 1st | 2nd | 3rd | 4th | 5th & 6th | 7th & 8th | 9th - 12th | 13th – 16th |
|---|---|---|---|---|---|---|---|
| 55 points | 50 points | 45 points | 40 points | 35 points | 30 points | 25 points | 15 points |

**SUBTOTAL (55 points)**

Rules violations (a deduction of 20% of the total possible points for the above section) must be initialed by the evaluator, coordinator and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: _____

(To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary.) **TOTAL (145 points)**

Comments:

I certify these results to be true and accurate to the best of my knowledge.

Evaluator

Printed name: _____ Signature: _____