

# JUNIOR SOLAR SPRINT



## OVERVIEW

Junior Solar Sprint (JSS), an Army Educational Outreach Program (AEOP), provides a hands-on opportunity for students in grades 5-8 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.

A wealth of resources for teachers to implement the JSS program is available in the [Educational Resources](#) link found on the AEOP [JSS website](#).

## ELIGIBILITY

One (1) team of two to four (2-4) students per chapter may participate; one (1) entry per team.

Participants must be:

- Part of a registered Technology Student Association chapter, or
- Part of a group that competes at an approved Army host site

## TIME LIMITS

All models meeting safety and performance criteria will be given up to two (2) time trials.

## LEAP

A team LEAP Response is required for this event and must be submitted at event check-in.

## ATTIRE

Participants may choose to wear either the TSA approved JSS T-shirt or the official TSA competition attire at the JSS time trials and semifinal event. T-shirts will be distributed to each participating team member in the JSS event.

## PROCEDURE

### PRE-CONFERENCE

1. Participants design and create their solar-powered car while working within the required specifications.

2. Participants record their design processes in a portfolio.
3. Participants prepare a display to showcase only:
  - a. The solar-powered model car
  - b. A decorated shoebox
  - c. The portfolio

### PRELIMINARY ROUND

1. Participants report to the time and place stated in the conference program and check in:
  - a. A solar-powered model car
  - b. The decorated shoebox
  - c. The portfolio
  - d. A hard copy of the LEAP Response with no report cover, separated from the portfolio
2. Entries are reviewed by judges to determine specification adherence and safety on the track.
3. All models meeting safety and performance criteria will be given up to two (2) time trials.
  - a. The fastest time of these time trials will determine the sixteen (16) top semifinalist cars to be raced.
  - b. Cars that are disqualified for any reason will not be permitted to participate in the semifinalist races.
4. Four (4) evaluated areas will be used to determine final standings (see criteria for assessment and racing performance on the official rating form).
5. A list of sixteen (16) semifinalists will be posted.

### SEMIFINAL ROUND

1. The semifinalist interview must include all team members.
2. The top sixteen (16) fastest cars from the time trials compete in a single or double elimination racing process. The process will be determined by the event coordinator.

3. The LEAP Response will be judged for semifinalist teams.
  - a. Teams document the leadership skills they have developed and demonstrated while working on this event, and on a non-competitive event leadership experience.
  - b. Find specific LEAP Response regulations in the LEAP Program section of this guide, and on the [TSA Website](#).
4. Ten (10) finalists (selected based on the elimination racing process) will be announced during the conference award ceremony.
  - e. Design details of the model, including model size, wheel size, gear ratio, specifications of the motor and solar collector used, etc; one (1) page
  - f. Components list; one (1) page (see the Supplied Components worksheet attached to this event)
  - g. 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
  - h. Sections of the portfolio may be organized by dividers

## REGULATIONS

### PRE-CONFERENCE

- 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).
  1. The report cover must include a label with the team ID and the following single-sided, 8½" x 11" pages, in this order:
    - a. Title page with the event title, conference city and state, the year, and the team/chapter ID number; one (1) page
    - b. Table of contents; pages as needed
    - c. Project Log (see the Competition Project Log attached to this event) 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
    - d. Design drawings; pages as needed
      - i. Must show the model with a minimum of two (2) views
      - ii. The drawings must be developed using standard engineering practices and procedures (including measurements/ dimensions)
      - iii. The drawings may be produced using traditional drafting methods or CAD
      - iv. Rough sketches should be included
- B. The display must include the model, decorated shoebox and portfolio only.
  1. The model must accurately reflect the design process outlined in the online resources found on the [AEOP JSS website](#).
  2. A decorated shoebox will be used as the display stand for the model car:
    - a. The shoebox must be decorated and reflect creativity.
    - b. The shoebox must have a label with a team ID.
  3. The portfolio must be placed with the model car.
- C. The solar powered model car:
  1. The model must accurately reflect the design process outlined in the online resources found on the [AEOP JSS website](#).
  2. The materials used to construct the model car must cost less than \$50.
  3. Original receipts for all materials purchased must be recorded in the Supplied Components List
  4. If using recycled materials, documentation must show how these items were obtained.
  5. Recycled materials are not included in the \$50 maximum.
  6. Model cars that exceed the \$50 construction cost limit will be disqualified from the competition.
  7. The vehicle must be structurally sound without the solar panel attached.

## D. Solar paneling:

1. 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.
2. The Ray Catcher Sprint Kit sold by Pitsco ([www.pitsco.com/Ray-Catcher-Sprint-Kit](http://www.pitsco.com/Ray-Catcher-Sprint-Kit)) or the JSS Solar Panel sold by Solar Made ([www.solarmade.com/store/product/jss-kit](http://www.solarmade.com/store/product/jss-kit)) are the only panels that can be used in the competition.
3. Solar panels cannot be shaved, drilled, or delaminated.
4. Only the motor supplied in the kit can be used.
5. Motors cannot be re-wound or disassembled.
6. 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.
7. The solar panel cannot be used as the chassis, or body, of the car.
8. The axles and wheels cannot be directly attached to the solar panel.
9. Reflectors, supports, and power leads can be added to these components as needed, but they must fit within the required dimensions.
10. The model car must, with the solar panel attached, not exceed the following dimensions:
  - a. 60 cm (23 $\frac{5}{8}$  inches) length
  - b. 30 cm (11 $\frac{3}{4}$  inches) width
  - c. 30 cm (11 $\frac{3}{4}$  inches) height (as measured from the surface the car is resting upon to the highest point of the car, with all its components attached)
11. Each vehicle must include a mounted battery holder that is capable of holding two AA batteries. The battery holder needs a switch or another easy device to operate a method of 'switching on' the battery power at the starting line. For example, a Single Pole Double Throw (SPDT), center off switch, to change from solar panel to battery power would be appropriate.
12. Energy-enhancing devices, such as mirrors, must be firmly attached to the vehicle.

13. 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 display the team ID#.
  14. 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.
  15. If the sun's energy is judged insufficient by the event coordinator, two (2) AA 1.5 V batteries will be furnished for each team.
    - a. Only the provided batteries are permitted to power the model.
    - b. The model's motor power leads must be readily accessible for easy attachment to a battery pack.
- E. A student-designed attachment device must be part of the car to accommodate the easy attachment and removal of a guide wire for steering. A purchased screw eye or eye bolt is not considered a student designed attachment device.
1. A guide wire, such as fishing line, will be no more than  $\frac{5}{8}$  cm from the surface of the track.
  2. The wire will go through the attachment device on the car and serve as a steering mechanism to keep the car in its lane. **This must be done without disconnecting the guide wire.**
  3. Both ends of the guide wire will be fixed to the track. This is the only allowable method of steering the car.
  4. No radio control is permitted in the car.
  5. Lane changing or lane crossing will result in a Did Not Finish (DNF) standing.
  6. A car's race that is impacted by an out-of-control vehicle will be allowed an opportunity to run the race again.
  7. A car that lacks steering control and interferes with other cars in other lanes will not be allowed to race again.
- F. If a car is deemed unsafe, it will not be allowed to run in the time trials or the semifinalist races.

- G. 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.
- H. The remainder of the vehicle can be innovative in design and materials.

### PRELIMINARY ROUND

#### Time Trials

- A. The race lane must be 60 cm wide and 20 m long.
- B. The track will be a hard flat surface, such as a tennis court or a smooth-surfaced running track.
- C. The time trial/race specifications are as follows:
  - 1. Tables will be set up for teams to make adjustments and minor repairs to cars prior to each time trial and the semifinalist heats.
    - a. Teams that are “next up” to be timed or raced are given priority to use the tables.
    - b. Teams must supply their own tools.
  - 2. Time trials and semifinalist races will not be delayed to permit adjustments or repairs to cars. If a repair is needed during time trials, a three (3)-minute time limit for repairs will be permitted.
  - 3. Prior to semifinals, teams will have an opportunity to perform up to two (2) trial races during a practice run session.
  - 4. At race time, each car will be placed with the most forward part of the vehicle set even with the starting line and all of its wheels in contact with the ground.
    - a. Each car will be covered completely by an opaque sheet covering that does not touch the solar panel.
    - b. 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. All cars will be started when the official signal is given.
  - a. Each car will have up to two (2) time trials, unless otherwise determined by the event coordinator.
  - b. The fastest time recorded will determine the sixteen (16) cars to race in the semifinal portion of the event.
  - c. 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.
- 6. The judges will note the official time for each time trial.
  - a. 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).
  - b. If a car has a false start, the entry will be given one (1) more opportunity to race.
- 7. One (1) team member 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.
- 8. 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.
- 9. No one, including team members and spectators, may accompany or touch the vehicle on the track during a timed trial or semifinalist race.
  - a. Vehicles stalled on the track can be retrieved after the end of the trial or the race has been declared by the lead judge.
  - b. A violation of this rule will result in disqualification of the offending team.
- 10. Challenges must be made before the next timed trial or race begins.
  - a. Any challenges must come from team members who are actively competing, not the coach/advisor, parent, or coordinator.
  - b. Any challenges need to be directed to the lead judge.
  - c. The decisions of the judges regarding challenges are final.

11. Only competing students and race officials may be in the race area.
  - a. Spectators, including coaches/advisors, parents, coordinators, and non-competing students, must remain in the designated spectator area throughout the duration of races.
  - b. 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.
12. Judges may inspect cars at any time before, during, and after timed trials or semifinalist races.
13. Any additional rules, regulations, or guidelines established by the event coordinator must be followed.

## SEMIFINAL ROUND

### Semifinalist Racing

- A. Regulations and procedures outlined in the preliminary round time trials are repeated for semifinalist racing.
- B. The semifinalist interview must include all team members.
- C. The LEAP Response:
  1. Teams document the leadership skills the team has developed and demonstrated while working on this event and on a non-competitive event leadership experience.
  2. Find the specific LEAP Response regulations in the LEAP Program section of this guide and on the [TSA website](#).
- D. Ten (10) finalists will be announced during the conference award ceremony.

## EVALUATION

### PRELIMINARY ROUND

1. The documentation portfolio
2. The artisanship and engineering of the model solar car

3. Creativity in the decoration of the shoebox
4. The model's racing performance
5. Time trials

### SEMIFINAL ROUND

1. The semifinalist interview, which includes all team members
2. The time trials regulations in the preliminary round also apply to the semifinal races. Semifinalist racing of the top sixteen (16) time trial winners, which will be conducted using a double elimination bracket. Teams will be ranked based on their fastest recorded time from time trials. Semifinal races will not be timed, however, the winner will be determined by the car that crosses the finish line first, barring any penalties.
3. The content and quality of the LEAP Response

Refer to the official rating form for more information.

## NOTES

- A. Junior Solar Sprint (JSS) is an Army Educational Outreach Program (AEOP) competition. Information about AEOP opportunities can be found at [www.usaeop.com](http://www.usaeop.com).
- B. 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.usaeop.com](http://www.usaeop.com).

## STEM INTEGRATION

This event has connections to the STEM areas of Science, Technology, Engineering, and Mathematics.

## CAREERS RELATED TO THIS EVENT

This competition connects to one (1) or more of the careers below:

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

# COMPETITION PROJECT LOG

## JUNIOR SOLAR SPRINT COMPETITION

Date	Task	Time involved	Team member responsible	Obstacles encountered	Modifications made	Comments
1.						
2.						
3.						
4.						
5.						
6.						
7.						

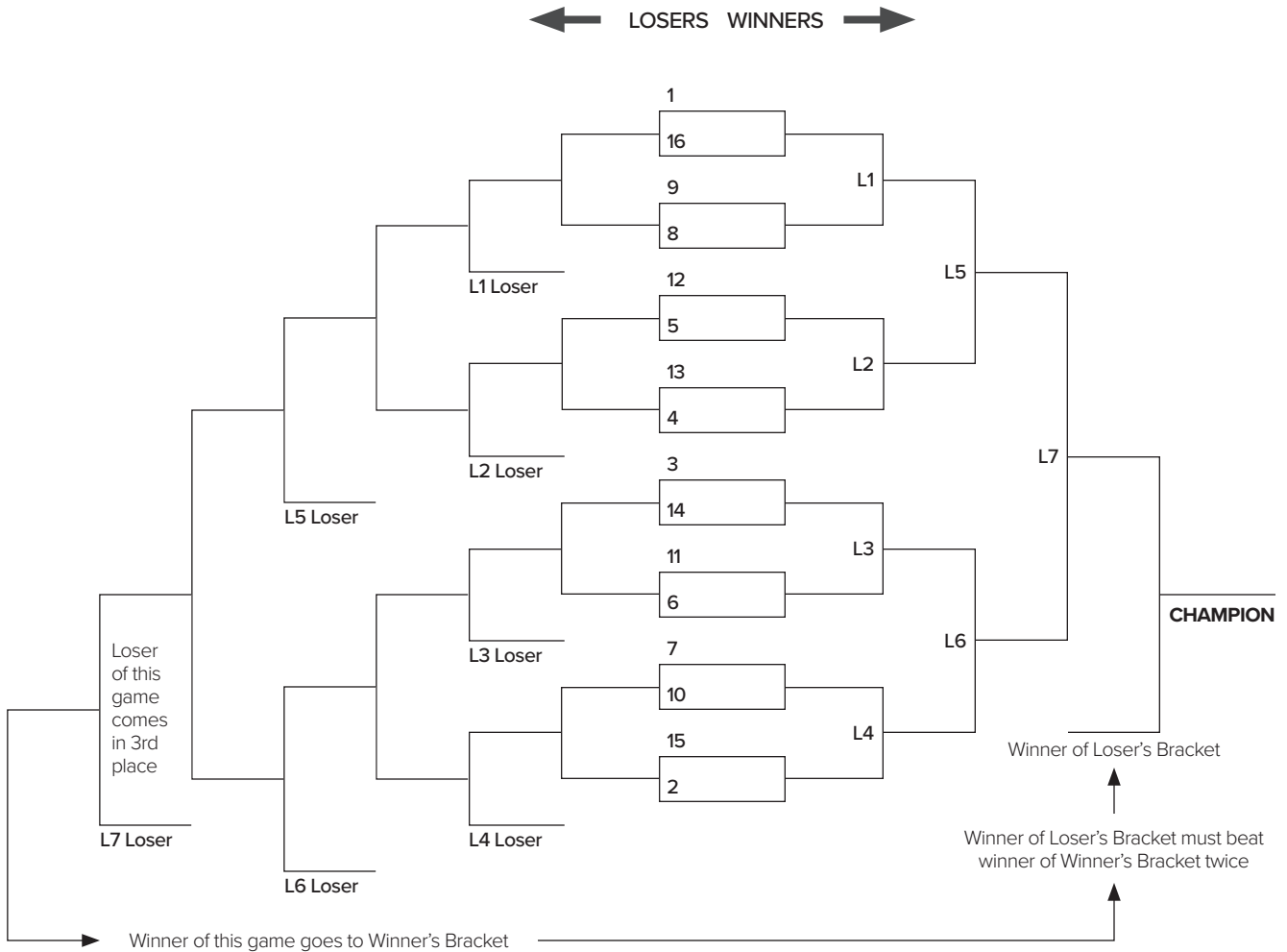
Advisor Signature: \_\_\_\_\_





# RACE BRACKET FOR 16-CAR DOUBLE ELIMINATION

Double Elimination Tournament Chart Seeded 16 player Field





# JUNIOR SOLAR SPRINT

## 2020 & 2021 OFFICIAL RATING FORM

### MIDDLE SCHOOL

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 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; an “adequate” score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

#### Go/No Go Specifications

- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

- Portfolio is present
- Model car with solar panel is present
- A decorated shoebox
- The model is safe to participate in the time trials and, if deemed appropriate, the semifinalist races.
- The model meets all required specifications
- Completed LEAP Response is present

DISPLAY AND MODEL (80 points)				Record scores in the column spaces below.
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
<b>Display/Decorated Shoebox</b> (X2)	The quality of the display is extremely poor and/or exceeds size requirements; the shoebox is not decorated and there is no creativity.	The display is adequately created and meets the size specifications; the shoebox is decorated and creative.	The display is exemplary, includes eye-catching details, and meets the size specifications; the shoebox is creatively decorated and shows exceptional originality.	
<b>Model design</b> (X2)	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.	
<b>Model creativity/originality</b> (X2)	The solar model car design lacks creativity and originality; little effort is apparent; car is exact replica of purchased kit.	The solar model car design demonstrates an adequate level of creativity and originality; at least one (1) modification has been made to the car.	The solar model car design shows exceptional creativity, originality, artisanship, and engineering.	
<b>Model construction</b> (X2)	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.	
<b>DISPLAY AND MODEL SUBTOTAL (80 points)</b>				

Record scores  
in the column  
spaces below.

DOCUMENTATION (50 points)			
CRITERIA	Minimal performance	Adequate performance	Exemplary performance
	1-4 points	5-8 points	9-10 points
<b>Portfolio components</b> 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.
<b>Project Log</b> (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.
<b>Design drawings</b> (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.
<b>Design details/ components list</b> (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.
<b>Design process description</b> (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.
<b>DOCUMENTATION SUBTOTAL (50 points)</b>			

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

Indicate the rule violated: \_\_\_\_\_

**PRELIMINARY TOTAL (130 points)**

RACE (60 points)							
1st	2nd	3rd	4th	5th & 6th	7th & 8th	9th-12th	13th – 16th
60 Points	55 Points	50 Points	45 Points	40 Points	35 Points	30 Points	25 Points
<b>RACE SUBTOTAL (60 points)</b>							

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

Indicate the rule violated: \_\_\_\_\_

Record scores in the column spaces below.

<b>LEAP RESPONSE/INTERVIEW (39 points)</b>			
<b>CRITERIA</b>	Minimal performance	Adequate performance	Exemplary performance
	1-4 points	5-8 points	9-10 points
<b>Car builder interview</b> (X3)	The student shows very limited knowledge of (and has difficulty articulating) how the car was produced or decisions made during the production; the student exhibits a basic understanding of design elements and functionality, and the rationale is inconsistent or absent.	The student demonstrates some knowledge of the dragster production and has adequate knowledge of some processes or reasoning behind the vehicle design.	The student shows competence and knowledge related to the design and production of the vehicle; the student is able to articulate "reasoning" behind the decisions made.
<b>LEAP Response</b> (9 points; 10% of total semifinal points)	The team's efforts are not clearly communicated, lack detail, and are unconvincing; few, if any, attempts are made to identify and incorporate the SLC Practices.	The team's efforts are adequately communicated, include some detail, are clear, and are generally convincing; identification and incorporation of the SLC Practices are satisfactory.	The team's efforts are clearly communicated, fully-detailed, and convincing; identification and incorporation of the SLC Practices are excellent.
<b>LEAP RESPONSE/INTERVIEW SUBTOTAL (39 points)</b>			

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

Indicate the rule violated: \_\_\_\_\_

**SEMIFINAL TOTAL (99 points)**

To arrive at the **FINAL TOTAL** score, subtract rules violation points, as necessary. **TOTAL SCORE (99 points)**

Comments:

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

**JUDGE**

Printed name: \_\_\_\_\_ Signature: \_\_\_\_\_

# JUNIOR SOLAR SPRINT EVENT COORDINATOR INSTRUCTIONS

## PERSONNEL

- A. Event coordinator
- B. Judges, six (6) or more
- C. Assistants, six (6) or more

## MATERIALS

- A. Coordinator's packet containing:
  - 1. Event guidelines, one (1) copy for the coordinator and each judge
  - 2. TSA Event Coordinator Report
  - 3. Stick-on labels for identifying entries
  - 4. Race bracket form
  - 5. Results envelope with coordinator forms
- B. Batteries (AA 1.5 V) (in the event that the sun provides insufficient energy), two (2) per entry plus spares on-site
- C. Braided fishing line for the track:
  - 1. Four (4) pre-tied
  - 2. Two (2) on track
- D. Race track set, including a starting gate and finish gate with digital timer
- E. Spare stopwatches for back-ups
- F. Padding for the finish gate
- G. Tables for the display and evaluation of entries (cars and portfolios)
- H. Lane Assignment Board to be used for a display of semifinals racing
- I. Tables and chairs for event coordinator, judges, and official assistants
- J. A large display for the final 16 bracket
- K. A gauge to measure line height at the beginning and end of the line

## RESPONSIBILITIES

### AT THE CONFERENCE

- 1. Attend the mandatory coordinator's meeting at the designated time and location.
- 2. Report to the CRC room and check the contents of the coordinator's packet.
- 3. Review the event guidelines and check to see that enough personnel have been scheduled.
- 4. Inspect the area(s) in which the event will be held for appropriate set-up, including location for displays and the evaluation of portfolios, racing site, chairs, tables, outlets, etc.

### PRELIMINARY ROUND

- 1. Participants report to the time and place stated in the conference program and check in:
  - a. The solar-powered model car and decorated shoebox
  - b. The portfolio
  - c. A hard copy of the LEAP Response with no report cover, separated from the portfolio
- 2. Secure the entries in the designated area.
- 3. At least one (1) hour before the event is scheduled to begin, meet with judges/assistants/timers to review time limits, procedures, and regulations.
- 4. Late participants and/or entries are considered on a case-by-case basis and only when lateness is caused by events beyond the participant's control.
- 5. In order to compete, participants must be on the entry list or must have approval of the CRC.
- 6. Position the Junior Solar Sprint portfolios and models for viewing by the judges, and assist them as necessary during judging.
- 7. Set up the race track prior to the time trials. Make necessary adjustments.
- 8. Permit all vehicles (that can be safely operated) to participate in time trials.
- 9. Vehicles that are disqualified will NOT be permitted to participate in the semifinalist races.

10. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and the CRC manager to determine either:

- To deduct twenty percent (20%) of the total possible points in this round
- To disqualify the entry

The event coordinator, judges and CRC manager must all initial either of the violations on the rating form.

11. Judges determine the sixteen (16) semifinalists.

12. Submit the semifinalist results to the CRC room.

### SEMIFINAL ROUND

1. Discuss rule violations (e.g. 20% deduction, disqualification) and have all relevant parties initial the rating form.
2. Repeat the race procedures from the preliminary round time trials to run the semifinal races.
3. Evaluate the LEAP Response for semifinalists.
4. Judges determine the ten (10) finalists, and break any ties for the top three (3) entries, as necessary.
5. Submit the finalist results and all related forms in the results envelope to the CRC room.
6. At the designated time, return models and portfolios to student participants.
7. Manage security for viewing and the removal of materials from the event area.