

## OVERVIEW

The National Academy of Engineering has identified fourteen (14) paramount current and emerging societal challenges that engineering can play a major role in solving. Through research and critical problem-solving, teams will develop a solution to a grand challenge posted on the national TSA website under Competition Themes/Problems.

The solution offered will be informed and designed by precise problem definition, thorough research, creativity, experimentation (when possible), and the development of documents and appropriate models (mathematical, graphical, and/or physical prototype/model). Semifinalist teams will present and defend their proposed solution to a panel of judges. The semifinalist presentation will be in the format of a poster session (the poster will be contained in a display).

## ELIGIBILITY

Three (3) teams of three to six (3-6) members per state may participate.

## TIME LIMITS

1. Semifinalist teams will be given ten (10) minutes to present and defend their proposals to judges.
2. Judges may ask questions during the team's presentation and may question each team for an additional five (5) minutes at the conclusion of the presentation.
3. The LEAP interview will be conducted as part of the semifinalist presentation/interview and will last a maximum of five (5) additional minutes.

## LEAP

A team LEAP Report is required for this event and must be submitted at event check-in (see LEAP Program).

## ATTIRE

TSA competition attire is required for this event.

## PROCEDURE

### PRELIMINARY ROUND

1. Teams check in their entries at the time and place stated in the conference program.
  - a. portfolio in pdf format on two [2] USB flash drives
  - b. poster
  - c. physical model display, or visual representation,
  - d. LEAP Report
2. No more than two (2) team members set up the display.
3. Portfolios will be evaluated to determine the top twenty-four (24) entries.
  - a. Only the top twenty-four (24) displays will then be evaluated to determine the twelve (12) semifinalists.
  - b. Neither students nor advisors are present at this time.
4. A list of twelve (12) semifinalists (in random order) will be posted.

### SEMIFINAL ROUND

1. Three (3) representatives from each semifinalist team report to the event area for the interview at the time and place stated in the conference program.
2. Each semifinalist team explains its research and solution for the challenge. Semifinalist teams will use a poster to assist in the defense and explanation of their proposed solution.
3. The semifinalist LEAP interview will take place as part of the semifinalist presentation/interview.
4. The top ten (10) finalists will be announced at the awards ceremony

## REGULATIONS

### PRELIMINARY ROUND

- A. Teams must demonstrate a firm understanding of the challenge and problem they are addressing. A team's entry must reflect thorough and serious research, as well as a creative and plausible solution.
- B. A team's solution must include likely impacts to the environment, economy, and society, as well as any important ethical considerations, and/or political ramifications.
- C. Documentation materials (comprising "a portfolio") are required and must be submitted on two (2) USB flash drives in PDF format, and include the following single sided 8½" x 11" pages, in this order:
  1. LEAP Report
  2. Title page with the challenge listed, event title, the conference city and state, and the year; one (1) page
  3. Table of contents; pages as needed
  4. Definition of the challenge/problem; one (1) page
  5. Explanation of importance: Explain why the problem is important to society and describe the necessary scientific and technical concepts, as well as current issues related to the challenge; two (2) pages
  6. Pages titled "Problem Solution": Present the solution for the identified problem, with support from scientific concepts and principles drawn from evidence. Mathematical and graphic models should be included as necessary, as well as photographs of any physical models developed; seven (7) pages, maximum
  7. Patent Application: to include specification, drawing, and oath or declaration (refer to [www.uspto.gov](http://www.uspto.gov))
  8. Plan of Work log that covers the life of the project including date, task, time involved, team member responsible, and comments (see Forms Appendix or TSA website); pages as needed
  9. Page(s) titled "References and Resources" that cite books, interviews, professional journals, websites, etc., using Modern Language Association (MLA) style; pages as needed

- D. The size of the display may not exceed 15" deep x 3' wide x 4' high.
- E. A free-standing poster is required. The height and width of the poster must be within the limits of the display.
- F. A physical model/s (or prototype/s) is/are required and must remain within the display limits at all times (including during judging).
- G. If the display or physical model/s or prototype/s require power, they must be powered by dry cell(s) or photo-voltaic cells.
  1. The power supply must fit inside the display area.
  2. All power must be off once the team has completed set-up.
  3. Complete instructions must be provided for the judges to press one (1) button or flip one (1) switch to turn on the power supply for judging.
- H. No harmful or illegal substances are permitted. No viruses, live plants, or animals are permitted. No dangerous processes, experiments, or physical models may be displayed or demonstrated.

### SEMIFINAL ROUND

- A. Each team must be prepared to send three (3) representatives to a semifinalist poster presentation and interview.
- B. During the semifinalist presentation and interview, each team will be given ten (10) minutes to present and defend its entry to the judges.
  1. Judges may ask questions during the team's presentation for purposes of improved clarity and understanding and may also ask questions for an additional five (5) minutes at the conclusion of the presentation.
  2. During the presentation/interview teams will be expected to use their posters to enhance and explain their proposed solution/s to the challenge and problem addressed.

### C. The LEAP Report

1. Teams document the leadership skills they have developed and demonstrated while working on this event, and on a non-competitive event leadership experience.
2. Teams will respond to questions about the content of the LEAP Report as part of the LEAP interview, which will last a maximum of five (5) minutes.
3. Specific LEAP Report regulations can be found in the LEAP Program section of this guide and on the TSA website.

## EVALUATION

### PRELIMINARY ROUND

1. Portfolios, which will be evaluated to determine the top twenty-four (24) entries. Only the top twenty-four (24) displays will then be evaluated to determine the twelve (12) semifinalists.
2. The model or prototype display
3. The poster

### SEMIFINAL ROUND

1. Event-specific presentation/interview
2. The content and quality of the LEAP Report and interview

Refer to the official rating form for more information.

## STEM INTEGRATION

This event aligns with the STEM educational standards of Science, Technology, Engineering, and Mathematics.

## CAREERS RELATED TO THIS EVENT

- Civil engineer
- Environmental scientist
- Health and safety specialist
- Manufacturing consultant
- Mechanical engineer

# ENGINEERING DESIGN

## 2019 & 2020 OFFICIAL RATING FORM

### HIGH 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 (two [2] USB flash drives)
- Meets size constraints.
- Physical model or prototype is present.
- Free-standing poster is present.
- Completed LEAP Report is present.
- ENTRY NOT EVALUATED

DOCUMENTATION (120 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>Portfolio components</b> (X1)	Portfolio is unorganized and/or is missing three or more components.	Portfolio has most components and is generally organized.	Portfolio has all required components and is well organized.	
<b>Problem definition</b> (X1)	The problem is not clearly written or defined; the problem does not fall within the grand challenge selected.	The problem is somewhat clearly written and defined.	The problem is clearly written, concise, and well defined; the problem falls within the grand challenge selected.	
<b>Explanation of importance</b> (X2)	There is little evidence of research; there is a lack of understanding of the issues cited.	There is some evidence of research; an adequate understanding of the issues is present.	Thorough research is clearly evident with a firm understanding of the issues established.	
<b>Problem solution</b> (X4)	A very brief explanation of the final solution is presented; there is a lack of creativity; descriptions are weak.	An adequate description of the solution is presented and supported by some amount of research and evidence; the solution is somewhat creative.	The solution is supported by the research gathered and scientific and engineering evidence; the solution is plausible and creative.	
<b>Patent application</b> (X2)	The patent application is incomplete, poorly worded, or missing.	The patent application is complete, but adequately worded, with somewhat effective drawings.	The patent application is complete and effective in presenting the inventor's product design.	
<b>Plan of Work log</b> (X1)	The log is poorly organized and/or incomplete.	The log is adequately detailed, organized, and contains most of the required components.	The log is very well done and contains all the required components.	
<b>References and resources</b> (X1)	There are few references listed, and/or references listed show little relevance to the project's goal.	There are a sufficient number and quality of references listed.	Many quality references are listed, reflecting research in the areas covered.	
<b>DOCUMENTATION SUBTOTAL (120 points)</b>				

DISPLAY (POSTER AND MODELS) (50 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>Aesthetics</b> (X1)	The poster design is unattractive in appearance and shows a lack of understanding of graphic design principles.	The poster design is somewhat attractive and shows an adequate understanding of the use of graphic design principles.	The poster is of professional quality with an exemplary use of graphic design principles.	
<b>Use of mathematical models, graphic models, and/or physical models (if included)</b> (X1)	Models are confusing and do not represent and/or support the proposed problem solution.	Models provide adequate representation and support of the proposed problem solution.	Models provide excellent representation and support of the proposed problem solution.	
<b>Overall impact</b> (X3)	The poster information and models do not detail or enhance the essential components of the team's problem identification and solution.	The poster information and models somewhat detail and enhance the essential components of the team's problem identification and solution.	The poster information and models greatly detail and enhance the essential components of the team's problem identification and solution.	
<b>DISPLAY 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 SUBTOTAL (170 points)**

SEMIFINAL PRESENTATION/INTERVIEW (127 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>Organization</b> (X1)	Team seems unprepared and unorganized for the presentation/ interview, with an illogical explanation of the project.	Team is prepared for the interview and is somewhat organized in its presentation to judges; team's presentation thesis is, for the most part, logical and/or clear.	Team's presentation/interview with judges is well organized; the interview is concise and logical, with a clear explanation of the development of the project.	
<b>Knowledge</b> (X1)	Team members seem to have little understanding of the concepts in their project; vague interview answers are provided.	Team members have a generalized understanding of the concepts discussed and answer questions adequately.	Evidence is clear that team members have a thorough understanding of the concepts discussed; they answer questions thoroughly.	
<b>Articulation</b> (X1)	The presentation and interview provide an unclear, unorganized, and or illogical description of the project.	The presentation and interview offer a somewhat logical and easy-to-understand project description.	The presentation/interview provides a clear, concise, and easy-to-follow description of the project.	
<b>Delivery</b> (X1)	The team is verbose and/or uncertain in its presentation/ interview; participants' posture, gestures, and lack of eye contact diminish the delivery.	The team is somewhat well-spoken and clear in its presentation/ interview; participants' posture, gestures, and eye contact result in an acceptable delivery.	The team is well-spoken and distinct in its presentation/ interview; participants' posture, gestures, and eye contact result in a polished, natural, and effective delivery.	

<b>SEMIFINAL PRESENTATION/INTERVIEW (127 points) – continued</b>				
<b>Team participation</b> (X1)	Only one person in the group communicates with judges; there is little or no participation from other team members.	Team members all participate to some extent and seem to understand the concepts.	Team members seem to fully understand the concepts and share an equal role in the interview.	
<b>Poster presentation</b> (X3)	The presentation shows a lack of understanding and knowledge of the problem and the team's solution to it.	The presentation gives a general understanding and knowledge of the problem and the team's solution for it.	The presentation shows a great understanding and articulation of the problem and the team's solution for it; team members make excellent use of the poster to feature or explain complex information.	
<b>Responses to judges' questions</b> (X2)	The team's answers to questions reflect a lack of understanding and sophistication; only one or two team members contribute.	The team's answers to questions reflect an adequate degree of understanding and sophistication; team members all participate somewhat.	The team's answers to questions reflect a high degree of understanding and sophistication; team members participate equally.	
<b>LEAP Report/ Interview</b> (27 points; 10% of total event points)	The team's efforts are not clearly communicated, lack detail, and/ or are unconvincing; few, if any, attempts are made to identify and/or incorporate the SLC Practices and Behaviors.	The team's efforts are adequately communicated, include some detail, are clear, and/or are generally convincing; identification and/or incorporation of the SLC Practices and Behaviors is adequate.	The team's efforts are clearly communicated, fully-detailed, and convincing; identification and/or incorporation of the SLC Practices and Behaviors is excellent.	
<b>SEMIFINAL PRESENTATION/INTERVIEW SUBTOTAL (127 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 SUBTOTAL (127 points)**

**To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary. TOTAL (297 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: \_\_\_\_\_

# ENGINEERING DESIGN EVENT COORDINATOR INSTRUCTIONS

## PERSONNEL

- A. Event coordinator
- B. Judges:
  1. Preliminary round, two (2) or more
  2. Semifinal round, two (2) or more

## MATERIALS

- A. Coordinator's packet, containing:
  1. Event guidelines, one (1) copy for the coordinator and for each judge
  2. TSA Event Coordinator Report
  3. Stick on labels for entries
  4. Envelopes for portfolio flash drives
  5. List of judge/assistants
  6. Pre-populated flash drives for judge
  7. One (1) stopwatch per team of judge
  8. Results envelope
  9. Envelope for LEAP Reports
  10. LEAP Interview Judging Protocol
- B. Table and chairs for semifinalist presentation

## RESPONSIBILITIES

### AT THE CONFERENCE

1. Attend the mandatory coordinator's meeting at the designated time and location.
2. Report to the CRC room and obtain the coordinator's packet; check the contents.
3. Review the event guidelines and check to see that enough judges and assistants have been scheduled.
4. Inspect the area in which the portfolios are being placed for appropriate set-up including sufficient number and size of tables.
5. At least one (1) hour before the event is scheduled to begin, meet with judges/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.

### EVENT CHECK-IN

1. Check in the entries at the time stated in the conference program.
2. Anyone reporting who is not on the entry list may check in only after official notification is received from the CRC.
3. Late entries are considered on a case-by-case basis and only when the delay is caused by events beyond participant control.
4. Place an entry number on each portfolio (USB flash drive), poster, and model (if included).
5. Secure the entries in the designated area.

### PRELIMINARY ROUND

1. Judges independently review and assess all portfolios to determine the top twenty-four (24) entries.
2. Only the top twenty-four (24) displays will then be evaluated to determine the twelve (12) semifinalists.
3. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either:
  - a. To deduct twenty percent (20%) of the total possible points in this round or
  - b. To disqualify the entry
  - c. The event coordinator, judges and CRC manager must initial either of these actions on the rating form.
4. Judges determine the twelve (12) semifinalists.
5. Review and submit the semifinalist results and all related items/forms in the results envelope to the CRC room for posting.
6. Create semifinalist sign-up sheet for each team's final presentation.

### SEMIFINAL ROUND

1. Inspect the area in which the presentations/ interviews are to take place. Ensure that there is a table and seating for the interviews.
2. At least one (1) hour before the event is to begin, meet with semifinalist judges to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
3. The twelve (12) semifinalist teams report at the time and location stated in the conference program for their presentation/interview and LEAP interview.
4. The LEAP interview will be conducted as part of the regular event presentation/interview and will last a maximum of five (5) additional minutes.
5. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either:
  - a. To deduct twenty percent (20%) of the total possible points in this round or
  - b. To disqualify the entry
  - c. The event coordinator, judges and CRC manager must initial either of these actions on the rating form.
6. Judges determine the ten (10) finalists and discuss and break any ties. (Determine the procedure for breaking ties before the onsite competition begins.)
7. Review and submit the finalist results and all related forms in the results envelope to the CRC room.
8. If necessary, manage security and the removal of materials from the event area.