



## 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 evaluators. The semifinalist presentation will be in the format of a poster session (the poster will be contained in a display).

## ELIGIBILITY


Entries are limited to three (3) teams, of three (3) or more members, per state. Three (3) team members must participate in the semifinalist interview.

## TIME LIMITS

- A. Entries must be started and completed during the current school year.
- B. Semifinalist teams will be given ten (10) minutes to present and defend their proposals to judges. Evaluators 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.
- C. The LEAP interview will be conducted as part of the semifinalist presentation/interview and will last a maximum of five (5) additional minutes.

## LEAP LEADERSHIP RESUME/INTERVIEW

A Team LEAP Leadership Resume is required for this event and must be submitted when participants arrive at the event at

 Read the General Rules and Regulations section in the front of this guide for information that applies to all of TSA's competitive events.



## Examples of Models

### Mathematical models

can take the form of applied formulas, statistical models, data-generated charts, and graphs. **Graphic models** can be sketches, drawings, and photographs or images. **Physical models** can be lab experiments or physical items made of paper, wood, metal, plastic, etc., that represent, or “model,” a concept, or thing. Participants are expected to use mathematical and graphical models in their work. Physical models must be developed and scaled to fit inside the display area.

a designated event time. Semifinalists will respond to interview questions related to their submitted LEAP Resume for a maximum of five (5) minutes.

### ATTIRE

Competition attire, as described in the [National TSA Dress Code](#) section of this guide, is required for this event.

### PROCEDURE

- A. Participants check in their entries (portfolio, display, poster, physical model or visual representation, and LEAP Leadership Resume) at the time and place stated in the conference program. No more than two (2) team members set up the display.
- B. Entries are reviewed by evaluators. Neither students nor advisors are present at this time.
- C. 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.
- D. 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.
- E. The semifinalist LEAP interview will take place as part of the semifinalist presentation/interview and will last a maximum of five (5) additional minutes per team.

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

### REGULATIONS


- A. All work must be completed during the current school year and be the exclusive work of the team members.
- B. 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.



- C. 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.
- D. Documentation materials (comprising "a portfolio") are required and should be secured in a [clear front report cover](#). The report cover must include the following single-sided, 8 ½" x 11" pages, in this order:
  - 1. Title page with the challenge listed, event title, the conference city and state, and the year; one (1) page
  - 2. Table of contents; pages as needed
  - 3. Definition of the challenge/problem; one (1) page
  - 4. 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
  - 5. 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
  - 6. 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
  - 7. Page(s) titled "References and Resources" that cite books, interviews, professional journals, websites, etc., using Modern Language Association (MLA) style; pages as needed
- E. The size of the display may not exceed 15" deep x 3' wide x 4' high.
- F. A poster is required. The height and width of the poster must be within the limits of the display.
- G. A physical model (or prototype) is required and it must remain within the display limits at all times (including during judging).
- H. If the display or physical model requires power, it must be powered by dry cell(s) or photo-voltaic cells. The power supply must fit inside the display area. All power must be off once the team has completed set-up. Complete instructions must be provided for the judge to press one(1) button or flip one (1) switch to turn on the power supply for judging.

 **The Display**

The portfolio, poster, and physical model must fit inside the display area.

 A model or prototype can be in the form of an animated visual representation.



- I. **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.**
- J. Each team must be prepared to send three (3) representatives to a semifinalist poster presentation and interview.
- K. During the semifinalist presentation and interview, each team will be given ten (10) minutes to present and defend its entry to the judges. Evaluators 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.
- L. During the presentation/interview teams will be expected to use their posters to enhance and explain their proposed solution to the challenge and problem addressed.
- M. LEAP Leadership Resume (see Forms Appendix or TSA website)/Interview — Teams document, in the LEAP leadership resume (see resume template), the leadership skills that the team has developed and demonstrated while working on this event. Semifinalists will respond to questions about the content of their resume as part of their presentation and/or interview. The LEAP Leadership Resume/Interview guidelines and other resources can be found on the [TSA website](#).

### EVALUATION

Evaluation is based on the portfolio, display, poster, LEAP requirements, and presentation/interview (semifinalists only). Please refer to the official rating form for more information.



### STEM INTEGRATION

This event aligns with the STEM educational standards noted below. Please refer to the STEM Integration section of this guide for more information.

Science, Technology, Engineering, Mathematics

### TSA AND CAREERS

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

### CAREERS RELATED TO THIS EVENT

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

## ENGINEERING DESIGN EVENT COORDINATOR INSTRUCTIONS

### PERSONNEL

- A. Event coordinator
- B. Evaluators, two (2) or more
- C. Evaluators for semifinalists, two (2) or more

### MATERIALS

- A. Coordinator's packet, containing:
  - 1. Event guidelines, one (1) copy for the coordinator and for each evaluator
  - 2. TSA Event Coordinator Report
  - 3. List of evaluators/assistants
  - 4. Pre-populated flash drives for evaluators
  - 5. One (1) stopwatch per team of evaluators
  - 6. Results envelope
  - 7. Envelope for LEAP Leadership Resumes
  - 8. LEAP Interview Judging Protocol
- B. Table and chairs for semifinalist presentation

### RESPONSIBILITIES

- A. Upon arrival at the conference, report to the CRC room and check the contents of the coordinator's packet. Review the event guidelines and check to see that enough evaluators/assistants have been scheduled.
- B. Inspect the area(s) in which the event is being held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.
- C. Check in the entries and collect LEAP Leadership Resumes at the time stated in the conference program. Anyone reporting who is not on the coordinator's report may check in only after official notification is received from the CRC. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant's control. Requirements for attire do NOT apply during check-in.
- D. Place an entry number on each portfolio, poster, and model (if included). Secure the entries in the designated area.



- E. One (1) hour before the event is scheduled to begin, meet with evaluators/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
- F. Evaluators independently assess the entries and determine the twelve (12) semifinalists.
- G. For participants who violate the rules, the decision either to deduct 20% of the total possible points or to disqualify the entry must be discussed and verified with the evaluators, event coordinator, and a CRC manager.
- H. Submit the semifinalist results to the CRC for posting.
- I. The twelve (12) semifinalist teams report at the time and location stated in the conference program for their presentation/interview and LEAP interview. The LEAP interview will be conducted as part of the regular event presentation/interview and will last a maximum of five (5) additional minutes.
- J. Evaluators assess the semifinalist teams, determine the ranking of the ten (10) finalists, and discuss and break any ties.
- K. Review and submit the finalist results and all items/forms in the results envelope to the CRC room.
- L. Return all equipment to appropriate personnel.



Participant/Team ID# \_\_\_\_\_

# ENGINEERING DESIGN

**2017 & 2018 OFFICIAL RATING FORM**

**HIGH SCHOOL**

## 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 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.
- Physical model or prototype is present.
- Poster is present.
- Completed LEAP Leadership Resume is present.
- ENTRY NOT EVALUATED

## Portfolio (100 points)

CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
Evaluators: Using minimal (1-4 points), 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 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, etc.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.			
<b>Portfolio components</b> Regulation D (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>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>SUBTOTAL (100 points)</b>			

Record scores in the column spaces below.





Display (Poster and Models) (50 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>Aesthetics</b> (X1)	The poster design is unattractive in appearance and shows a lack of understanding of the graphic design principles.	The poster design is somewhat attractive and shows an adequate understanding of the use of graphic design principles.	The poster design is attractive in appearance, 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 and models do not enhance the essential components of the team's problem identification and solution.	The poster and models somewhat enhance the essential components of the team's problem identification and solution.	The poster and models greatly enhance the essential components of the team's problem identification and solution.
			<b>SUBTOTAL (50 points)</b>

Rules violations (a deduction of 20% of the total possible points in the sections above) 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: \_\_\_\_\_

Semifinalist Presentation/Interview (70 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>Poster presentation</b> (X3)	The presentation shows a lack of understanding and knowledge of the problem and the team's solution to it; not all team members participate in the presentation/interview.	All team members participate somewhat in the presentation/interview and show a general understanding and knowledge of the problem and the team's solution for it.	All team members participate equally in the presentation/interview and show 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 Leadership Resume/Interview</b> See Regulation M and instructions on TSA website (X2)	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 LEAP Be. Know. Do. criteria.	The team's efforts are adequately communicated, include some detail, are clear, and/or are generally convincing; identification and/or incorporation of the LEAP Be. Know. Do. criteria is adequate.	The team's efforts are adequately communicated, include some detail, are clear, and/or are generally convincing; identification and/or incorporation of the LEAP Be. Know. Do. criteria is adequate.
			<b>SUBTOTAL (70 points)</b>



Rules violations (a deduction of 20% of the total possible points in the semifinalist 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 (220 points)**

Comments:

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

Evaluator

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

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