

## OVERVIEW

Teams will design and build a mechanical device to solve the problem statement for the identified theme. Through device functionality, presentation, and documentation, the team members demonstrate in detail their knowledge of mechanical engineering and the application of their research as a design element or inspiration for their mechanical device, while observing the current year's theme. The theme will be posted on the [TSA website](#) under Competitions/Themes and Problems. Teams demonstrate and promote their work in a timed presentation.

## ELIGIBILITY

One (1) team of three to six (3-6) members per chapter is allowed to participate; one (1) entry per team.

## TIME LIMITS

1. Pre-built structures must be started and completed during the current school year.
2. The mechanical device must be checked-in and its functionality demonstrated during the preliminary round. Teams will be allowed:
  - Three (3) minutes to set up for the demonstration
  - Five (5) minutes for the actual demonstration
  - Three (3) minutes for resetting the device to the starting point
  - Time violation: a deduction of five (5) points will be incurred for exceeding any time limit and teams will be stopped 1 minute after the given time if exceeded
3. Semifinalist interviews lasting no more than ten (10) minutes are based on the mechanical device design process, and will not be open to the public.

## LEAP

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

## ATTIRE

TSA competition attire is required.

## PROCEDURE

### PRE-CONFERENCE

1. Teams must:
  - a. Identify and understand the use of subsystems within a larger system
  - b. Research and identify an engineering design process chosen that influenced the design of your static entry
  - c. Research and gather information about the uses and purposes of simple machines
  - d. Brainstorm ideas for possible solutions
  - e. Design and construct a mechanical system that can be used to solve the problem
  - f. Prepare an oral presentation to further explain the team's research and solution

### PRELIMINARY ROUND

1. Participants check-in at the time and place indicated in the conference program, with no more than three (3) team members at event check-in:
  - a. One (1) prototype of a mechanical device
  - b. Documentation materials (comprising a "portfolio")
  - c. A hard copy of the team LEAP Response with no report cover, separated from the portfolio
2. Upon check-in, entries are independently reviewed for safety hazards only.
3. Each team will sign up for a time to test the device.
4. Participants proceed to the place indicated in the conference program at the assigned time to sign up for demonstration time and submit the device and documentation.
5. Participants demonstrate the mechanical aspects of their device at the assigned time.
6. Judges evaluate the entry and its components.
7. A list of twelve (12) semifinalist teams (in random order) will be posted.

### SEMIFINAL ROUND

1. Semifinalists participate in an on-site interview.
2. The LEAP Response and documentation materials will be judged for semifinalist teams.
3. All entry materials must be picked up by no more than three (3) team members at the time and place stated in the conference program.
4. Ten (10) finalists will be announced during the conference awards ceremony.

### REGULATIONS AND REQUIREMENTS

#### PRELIMINARY ROUND

A. Documentation materials (comprising a “portfolio”) are required and must be secured in a clear front report cover (click [here](#) for a sample).

1. The report cover must include the following single-sided, 8½" x 11" pages, in this order:
  - a. Title page with the event title, the conference city and state, the year, and the team/chapter ID number; one (1) page
  - b. Identification and explanation of engineering design process; up to six (6) pages
  - c. Explanation of usage of simple machines in solution for design efforts
  - d. Bill of Materials
  - e. Photographic verification of work

B. Team 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](#).

C. Mechanical Device/Display

1. Mechanical Device must fit within the size requirement published in the current year’s problem/theme.
2. Must reflect and incorporate the theme, in addition to components of the engineering design process researched.

### EVALUATION

#### PRELIMINARY ROUND

1. The portfolio
2. The design and performance of the system, specifically as it relates to the research and theme.
3. The participant’s overall understanding of mechanical engineering and the engineering design process through the device demonstration.

#### SEMIFINAL ROUND

1. The content and quality of the interview and LEAP Response (semifinalists only).

Refer to the official rating form for more information.

### 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:

- Engineer
- Multimedia designer
- Product designer
- Small business owner

# MECHANICAL ENGINEERING

## 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
  - Device is present
  - Completed LEAP Response is present
  - ENTRY NOT EVALUATED

MECHANICAL DEVICE (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>Portfolio</b> (X1)	Portfolio is missing three (3) or more components, and it is unorganized; it is messy and of low quality.	Portfolio has most components, is somewhat organized, and exhibits some quality.	All components are included and there is clear evidence of quality and organization.	
<b>Engineering design process</b> (X2)	The description of the engineering design process is unclear, unconvincing, and lacks project details.	The description of the engineering design process includes some project details and explanation of steps in the design process.	The description of the engineering design process includes a full explanation of each step in the process; the description is defined, and detailed.	
<b>Mechanical device drawings</b> (X1)	Only one (1) drawing/sketch of the model is included with little to no labeling.	Two (2) or more drawings/sketches of the model are included and are labeled.	Detailed drawings/sketches of the entire device/model are provided and appropriately labeled.	
<b>Bill of Materials</b> (X1)	A Bill of Materials is included, but more than one (1) material is missing.	A Bill of Materials is included with one (1) material missing; Bill of Materials is generally organized.	A Bill of Materials is included; it includes all components and is organized.	
<b>Demonstration of device</b> (X3)	Device works with only two to three (2-3) modifications made beyond the starting point.	Device works with only one (1) modification made beyond the intended starting point.	Device works with no modifications made beyond the starting point.	
<b>MECHANICAL DEVICE SUBTOTAL (80 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: _____				
<b>PRELIMINARY SUBTOTAL (80 points)</b>				

Record scores  
in the column  
spaces below.

SEMIFINAL LEAP RESPONSE/INTERVIEW (74 points)			
CRITERIA	Minimal performance	Adequate performance	Exemplary performance
	1-4 points	5-8 points	9-10 points
<b>Organization</b> (X1)	Participants seem unorganized and unprepared; an illogical explanation of the solution is given.	Participants are generally prepared; explanation of the solution is communicated and generally organized.	The presentation/interview is logical, well organized, and easy to follow; the solution is communicated in a concise manner.
<b>Knowledge</b> (X2)	Participants seem to have little understanding of the concepts in their project; answers to questions are vague.	Participants exhibit a general understanding of the concepts in their project.	Participants show clear evidence of a thorough understanding of the concepts in the project.
<b>Articulation</b> (X1)	The presentation/interview is full of illogical thoughts that lack clarity, and/or there is insufficient information provided that describes the project.	The presentation/interview is somewhat logical, easy-to-follow, and/or there is sufficient information provided that describes the project.	The presentation/interview is clear, concise, and there is ample information provided that describes the project.
<b>Delivery</b> (X1)	The team is verbose and/or uncertain; participants' posture, gestures, and lack of eye contact diminish the presentation/interview.	The team is somewhat well-spoken and clear; participants' posture, gestures, and eye contact are adequate.	The team is well-spoken and distinct; participants' posture, gestures and eye contact result in a polished, natural, and effective presentation/interview.
<b>Team participation</b> (X1)	The majority of the delivery is made by one (1) member of the team; the partner(s) are disengaged from the presentation.	All team members generally are engaged in the process, although one (1) member may take on more responsibility than others.	All team members are actively involved in the presentation and responses to interview questions; there is a shared responsibility among the team members.
<b>LEAP Response</b> (14 points; 10% of total event 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>SEMIFINAL LEAP RESPONSE/INTERVIEW SUBTOTAL (74 points)</b>			

**TIME DEDUCTIONS**

A five (5)-point deduction will be incurred for any time infraction.

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: \_\_\_\_\_

**SEMIFINAL SUBTOTAL (74 points)**

To arrive at the **TOTAL** score, add any subtotals and subtract rules violation points, as necessary. **TOTAL (154 points)**

Comments:

---

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

**JUDGE**

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



# MECHANICAL ENGINEERING EVENT COORDINATOR INSTRUCTIONS

## PERSONNEL

- A. Event coordinator
- B. Judges:
  1. Preliminary round, two (2) or more
  2. Semifinal round, two (2) or more
- C. Assistants, two to three (2-3)

## MATERIALS

- A. Coordinator's packet, containing:
  1. Event guidelines, one (1) copy for the coordinator and each judge
  2. TSA Event Coordinator Report
  3. List of judges/assistants
  4. Stick-on labels for identifying entries
  5. Results envelope with coordinator forms
- B. Display tables for entries
- C. Tables and chairs for event coordinator and judges
- D. Tables and chairs for team presentations, as needed
- E. Stopwatches

## RESPONSIBILITIES

### AT THE CONFERENCE

1. Attend the mandatory event 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 is being held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.

5. At least one (1) hour before the event is to begin meet with judges and assistants to review time limits, procedures, regulations, evaluation, and all other details related to the event. If questions arise that cannot be answered, speak to the event manager before the event begins.

### CHECK-IN

1. Check in the entries at the time stated in the conference program.
2. Check the entry for safety only.
3. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant's control.
4. In order to compete, participants must be on the entry list or must have approval of the CRC.
5. Requirements for attire do NOT apply during check-in, only on the first day of the conference.
6. Secure the entries in the designated area.
7. Each entry must include the participant's identification number in the upper right-hand corner of the entry.

### PRELIMINARY ROUND

1. Meet with judges to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
2. Prepare a list of interview questions (five to ten [5-10]) to be asked of all semifinalists.
3. 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.
4. Judges independently assess the entries to determine the twelve (12) semifinalists.

## MECHANICAL ENGINEERING

5. Submit the semifinalist results to the CRC room for posting.
6. Manage the pick-up of non-semifinalist entries.

### SEMIFINAL ROUND

1. Judges evaluate the LEAP Response.
2. Judges determine the ten (10) finalists and discuss and break any ties.
3. Submit the finalist results and all related forms in the results envelope to the CRC room.
4. If necessary, manage security and the removal of materials from the area.