TECHNICAL DESIGN

OVERVIEW

Applying leadership and 21st century skills, participants demonstrate their ability to use the technical design process to solve an engineering design problem on-site at the conference.

ELIGIBILITY

One (1) team of two (2) individuals per chapter may participate.

TIME LIMITS

Twenty-four (24) hours is allowed to solve the engineering design problem.

ATTIRE

TSA competition attire is required.

PROCEDURE

PRE-CONFERENCE

A. Participants review the TSA Honor Statement for Competitive Events found in the General Rules and listed in the individual competitive event rules.

PRELIMINARY ROUND

A. Teams report to the event area at the time and place stated in the conference program to receive the design brief and instructions about how to submit their solution to the problem as a portfolio PDF the next day. TSA competition attire is required to receive the design brief.

B. Teams follow the technical design process loop to solve the provided engineering design problem.

C. All work must be completed solely by the teams entered in this competition. No outside help is permitted.

D. Teams are responsible for submitting a portfolio PDF of their solution using the submission procedures provided by the event coordinator.

E. National TSA will not provide wireless Internet.

F. Entries are reviewed independently by the judges.

G. The top ten (10) finalists are announced at the awards ceremony.

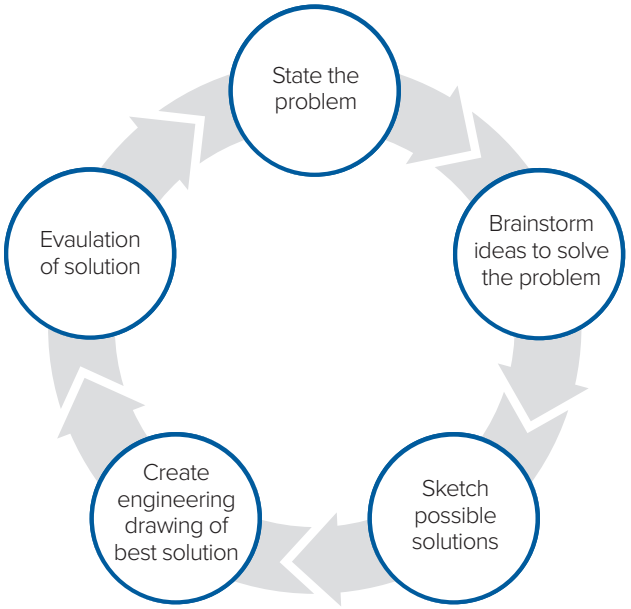

Figure 1: Technical design process loop

REGULATIONS AND REQUIREMENTS

Students will work to develop their leadership and 21st century skills in the process of preparing for and participating in this TSA competitive event. The development and application of those skills must be evident in their submission, demonstration, and/or communication pertaining to the entry.

PRELIMINARY ROUND

Design Preparation

A. Students prepare a portfolio that includes each step of the technical design process loop. (Figure 1).

B. Students develop a problem statement interpretation of the problem provided.

C. The portfolio should show a logical progression from one step of the loop to the next.

D. Documentation Portfolio:
   1. The documentation portfolio must be submitted as a multi-page PDF document with 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; one (1) page
      c. Team's interpretation of the problem, including a list of criteria and constraints set forth in the design brief; one (1) page
      d. Demonstrated use of a brainstorming technique of the team's choice (mind mapping, reverse engineering, word association, etc.), to develop ideas to solve the problem; brainstorming ideas should be documented; one (1) page
      e. At least three (3) hand-drawn sketches of different solution options to a given problem. Photo/scan/convert each to a PDF as necessary to insert into the portfolio PDF. One (1) page for each hand-drawn sketch; three (3) pages total
         i. Each hand-drawn solution must be developed based on the selected brainstorming technique.
         ii. Each hand-drawn sketch also must include a solution pro/con list written on each sketch to aid in selecting the best design;
         iii. Label the first solution "Solution Option 1," the second "Solution Option 2," and the third "Solution Option 3."
      f. Based on the pro/con list for each of the hand-drawn solutions to the problem, select the best solution and create an engineering drawing based on the solution; one (1) page.
      g. Using the engineering drawing of the final solution, write a paragraph that evaluates the final solution and answers the following question, "Does the final design meet all the elements set forth in the design brief?"; one (1) page.

E. A sample design brief is provided below to help students understand a typical engineering design problem for this event

Design Brief Sample

(This design brief is ONLY an example of the type of problem that participants may expect at the conference.)

Aircraft carriers are much shorter than a typical airport runway. How do aircraft mange to gain enough speed for takeoff over a much shorter distance? A catapult gives them the extra boost they need to take-off.

An elementary school teacher would like to use the basic principles of this technology to teach his/her students about kinetic and potential energy, but apply the same knowledge to launching a small paper airplane.

Design a hand-held paper airplane launcher that a classroom teacher can incorporate into a classroom lesson and have the students build as a class project.

Your solution must be able to be built by 5th grade students using materials and supplies that they can bring from home and incorporate a rubber band as the power source.

The solutions have a maximum length of 9", width of 8", and a height of 7".

The solution is contained in a documentation portfolio. A prototype or model is not allowed.

EVALUATION

A. Each element of the portfolio
B. The overall technical design process

Refer to the official rating form for more information.

TSA HONOR STATEMENT

All work must be created and completed by individual competitors or teams. Plagiarism, the use of Generative Artificial Intelligence (GenAI) software, copyright violation, cheating, and falsification of information are prohibited. Participants may NOT use any generative artificial intelligence (GenAI) tools (e.g. ChatGPT, Google Gemini, GitHub Copilot, etc.). Any attempt to gain an unfair advantage will not be tolerated. Competitors at any level of TSA competition understand and agree to abide by the TSA Honor Statement.

If it is determined that a student violated the TSA Honor Statement, a rules violation of twenty percent (20%) will be incurred.

STEM INTEGRATION

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

LEADERSHIP AND 21ST CENTURY SKILLS

This event provides opportunity for students to build and develop leadership and 21st century skills including but not limited to – Communication, Collaboration/Social Skills, Initiative, Problem Solving/Risk Taking, Critical Thinking, Perseverance/Grit, Creativity, Relationship Building/Teamwork, Dependability/Integrity, and Flexibility/Adaptability

CAREERS RELATED TO THIS EVENT

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

- Designer
- Engineer
- Quality assurance engineer
- Engineering manager
- Creative consultant

Participant/Team ID# _____

TECHNICAL DESIGN

2026 & 2027 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
☐ ENTRY NOT EVALUATED

SOLUTION (100 points)				
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	Record scores in the column spaces below.
	1-4 points	5-8 points	9-10 points	
Portfolio Components (X1)	Portfolio is unorganized and/or is missing three (3) or more components.	Portfolio is missing one (1) or two (2) components and/or is loosely organized.	Portfolio has all required components in order and is well organized.	
Interpretation of Problem (X1)	Interpretation of the problem is vague, with few or no criteria/constraints included in the description; statement is difficult to understand.	Interpretation of the problem, criteria, and constraints are included and generally identified.	Interpretation of the problem is well-developed and further investigates the included criteria/constraints.	
Brainstorming Technique (X1)	There is no clear evidence of the use of brainstorming to interpret the design of the problem.	Use of brainstorming (which incorporates the problem statement, criteria, and constraints to solve problem) is apparent.	Exceptional and organized use of brainstorming (which incorporates each element of the design brief) is evident.	
Solution Option 1 (X1)	Sketch is sloppy and poorly constructed, and/or it appears to be included as an afterthought to the design; there is no design pro/con list, or it is incomplete.	Sketch is generally well drawn and includes the pro/con list; evidence of the final design is illustrated in the sketch.	Sketch is of exceptional quality and includes a creative pro/con list; clear transformation from the sketch to the final design is evident.	
Solution Option 2 (X1)	Sketch is sloppy and poorly constructed, and/or it appears to be included as an afterthought to the design; there is no design pro/con list, or it is incomplete.	Sketch is generally well drawn and includes pro/con list; evidence of the final design is illustrated in the sketch.	Sketch is of exceptional quality and includes a creative pro/con list; clear transformation from the sketch to the final design is evident.	
Solution Option 3 (X1)	Sketch is sloppy and poorly constructed, and/or it appears to be included as an afterthought to the design; there is no design pro/con list, or it is incomplete.	Sketch is generally well drawn and includes a pro/con list; evidence of the final design is illustrated in the sketch.	Sketch is of exceptional quality and includes a creative pro/con list; clear transformation from the sketch to the final design is evident.	
Final Solution (X2)	Solution conveys a sloppy design, and/or does not incorporate key elements in the design brief, and/or drafting techniques are not proper.	Solution incorporates most elements laid out in the design brief; drawing uses proper drafting techniques and methods.	Solution exudes creativity and addresses all design brief elements; proper drafting techniques are used in the design.	

SOLUTION (100 points) – continued				
Evaluation of Design (X2)	Evaluation is poorly written; it is a reiteration of the design brief elements, with little or no examination of the finished design.	Evaluation satisfactorily answers the question "Does the final design meet all the elements set forth in the design brief?"	Evaluation response is creative and unbiased; it is well written and answers the posed question completely.	
			SOLUTION SUBTOTAL (100 points)	

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: _____

To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary. **TOTAL** (100 points)

Comments:

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

JUDGE

Printed name: _____ Signature: _____

TECHNICAL DESIGN
EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

A. Event coordinator

B. Judges, 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

B. One (1) copy of the technical design problem (in design brief format) for each team and judge

C. Tables and chairs for the judges

D. Computer with software capable of viewing PDF files is needed for each judge

E. Extension cords (25' minimum length), as needed

RESPONSIBILITIES

AT THE CONFERENCE

A. Attend the mandatory event coordinator's meeting at the designated time and location.

B. Report to the CRC room and check the contents of the coordinator's packet.

C. Review the event guidelines and check to see that enough personnel have been scheduled.

D. Inspect the area or room 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.

E. At least one (1) hour before the judging of solutions is scheduled to begin, meet with judges to review the procedures, regulations, evaluation, and any other details associated with the event. If questions arise that cannot be answered, speak to the event manager before the event begins.

F. Ensure the judges have access to the online judging system.

EVENT CHECK-IN AND DESIGN PROBLEM DISTRIBUTION

A. Meet with all teams at the time and location scheduled in the conference program.

B. Distribute a copy of the technical design problem to each team.

C. Ensure that all participants understand the event requirements, as well as the time and place to submit their entry.

D. Begin entry check-in at the time and place stated in the conference program.

PRELIMINARY ROUND

A. Ensure that the judges have access to the portfolio PDFs submitted electronically.

B. Judges independently review each entry with neither students nor advisors present.

   1. The event is judged in sections with two (2) judges per section.
   2. The top twelve (12) entries will be reviewed by a second set of two (2) judges using the same rubric, but a blank new rubric. For example, if three (3) sections are used, the top (4) from each section will advance. If six (6) sections are used, the top two (2) from each section will advance.

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

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

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

D. If necessary, manage security and the removal of materials from the event area.