



TECHNICAL DESIGN

OVERVIEW

Participants demonstrate their ability to use the technical design process to solve an engineering design problem.

CHALLENGE

Participants will be given a design brief on site that includes a problem statement and specific criteria and constraints. Participants will utilize the technical design process to solve the problem.

ELIGIBILITY

Participants are limited to two (2) individuals per chapter.

TIME LIMITS

Participants will have twenty-four (24) hours to solve the engineering design problem.

ATTIRE

Casual TSA attire as described in the Competitive Events Attire is the minimum requirement.

PROCEDURE

- A. Participants report to the event area at the time and place stated in the conference program for the dissemination of the design brief and instructions about where and when to submit their solution to the problem the next day.
- B. Participants will follow the technical design process loop (see Figure 1) to solve the provided engineering design problem.
- C. Students will prepare a notebook that includes each step of the technical design process (Figure 1) in order, beginning with the problem statement. The notebook should show a logical progression from one step to the next.
- D. The notebook should be presented in a standard three (3)-ring binder with a clear front sleeve for a cover page. The cover page must include the event title, the conference city and state,

and the year. The inside of the binder must include single-sided, 8 ½" x 11" pages in the order below.

1. Title page, with the event title, conference city and state, and the year; one (1) page
2. Table of contents; one (1) page
3. Participant's interpretation of the problem, including a list of criteria and constraints set forth in the design brief; one (1) page
4. Demonstrated use of a brainstorming technique of the participant's choice (mind mapping, reverse engineering, word association, etc.) to develop ideas to solve the problem. Brainstorming ideas should be documented; one (1) page
5. At least three (3) hand-drawn sketches of different solutions to the given problem. Each hand-drawn solution should be developed based on the selected brainstorming technique. Each hand-drawn sketch also should include a solution pro/con list written on each sketch to aid in selecting the best design; one (1) page for each hand-drawn sketch, three (3) pages total
6. 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
7. Based on 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

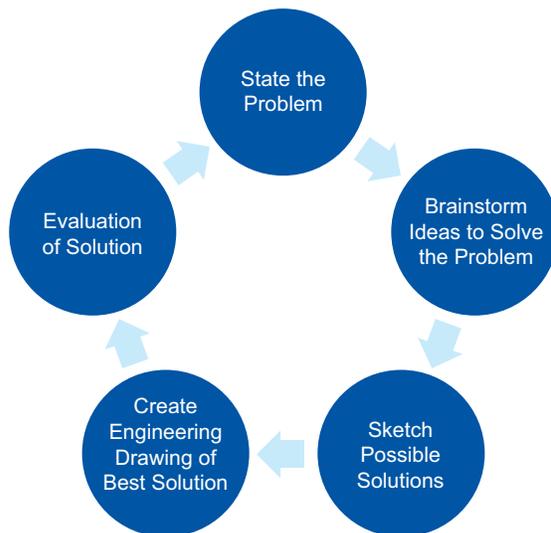


Figure 1. Technical design process loop.



REGULATIONS

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

EVALUATION

The evaluation will assess each element of the notebook and the overall technical design process.

STEM INTEGRATION

This event has the connections to the STEM areas noted below. Please refer to the STEM INTEGRATION of this guide.

Science, Technology, Engineering, Mathematics

LEADERSHIP SKILLS

Leadership skills promoted in this event:

- Communication: Students communicate their solution to the engineering design problem. Use leadership lessons: *Chefs in the Kitchen* and *Mirror Mirror*
- Critical Thinking: Students use critical thinking skills to interpret each element of the design brief and incorporate those elements into a variety of possible solutions ultimately selecting the best solution. Use leadership lessons: *Rebus Puzzles* and *Thinking Like Tarzan*
- Organization: Students organize their notebooks in a logical sequence that corresponds with the technical design process they use in solving their engineering design problem. Use leadership lessons: *Organizing the Stress Away* and *Story Creation*

Additional leadership skills promoted in this event:

- Creative thinking
- Problem solving

TSA AND CAREERS

This competition has connections to one or more of the career areas featured in the TSA AND CAREERS section of this guide. Use The 16 Career Clusters chart and the TSA Competitions and Career Clusters grid as resources for information about careers.

CAREERS RELATED TO THIS EVENT

Designer
Engineer
Quality assurance engineer
Engineering manager
Creative consultant

TECHNICAL DESIGN

EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

- A. Event coordinator
- B. Event evaluators, two (2) or more

MATERIALS

- A. Coordinator's notebook, containing:
 - 1. Event guidelines, one (1) copy each for the coordinator and evaluators
 - 2. Official evaluation rubrics, one (1) for each entry
 - 3. List of entries with finalist report
 - 4. List of evaluators
 - 5. Marking pens for evaluators
 - 6. Results envelope
- B. One (1) copy of the technical design challenge problem in a design brief format for each entry

RESPONSIBILITIES

- A. Upon arrival at the conference, report to the CRC room and check the contents of the coordinator's notebook. Review the event guidelines and check to see that enough evaluators have been scheduled.
- B. Inspect the area or room in which the event is being held for appropriate setup, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.
- C. Meet with all participants at the time and location scheduled in the conference program. Distribute a copy of the technical design challenge problem to each participant. Ensure that all participants understand the event requirements, as well as the time and place to submit their entry.
- D. One (1) hour before the event is scheduled to begin, meet with your evaluators to review the procedures and regulations of the event. If questions arise that cannot be answered, speak to the event manager before the event begins.
- E. Begin entry check in at the time and place noted in the earlier meeting for participants. Check in all entries.



- F. Evaluators independently review each entry.
- G. For participants who violate the rules, the decision either to 1) deduct twenty percent (20%) of the total possible points or 2) disqualify the entry must be discussed and verified with the evaluators, event coordinator, and CRC manager, who all must initial either of these actions on the rating form.
- H. Evaluators tally and submit each rating form to the event coordinator. Secure the initials of each evaluator on the event summary sheet after all evaluators have reviewed it. Through a discussion process, evaluators break any ties that effect the top three (3) placements.
- I. Submit the finalist report, including a ranking of the top ten (10) finalists, and all related forms in the results envelope to the CRC room.
- J. If necessary, manage security and the removal of materials from the event area.

DESIGN BRIEF SAMPLE

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

Design a lighting fixture that can clamp onto a standard 101-key computer keyboard. The primary purpose of this fixture is to illuminate the keyboard in low-light conditions. The fixture should be either a LED or fluorescent lamp and should be powered using the accompanying computer's USB port or through standard 110v A/C. For the design, take into consideration the pros and cons of the fixture's clamping mechanism, the type of illumination, and the power requirements.



Participant/Team ID# _____

TECHNICAL DESIGN			
2012 & 2013 OFFICIAL RATING FORM			MIDDLE SCHOOL
Solution (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 far 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.)			
Contents of notebook Cover page Title page Table of contents Specific sections noted as criteria below (X1)	Type of notebook is incorrect, and/or some pages are not included and/or are formatted incorrectly.	All notebook elements are included, organized, and formatted correctly, with no, or few, typographical errors.	Outstanding organization skills are evident in the preparation of the notebook; there are no typographical errors.
Statement of problem (X1)	Problem statement is vague, with no, or few, criteria/constraints included in the description; statement is difficult to read, and there are many grammar errors.	Problem statement, criteria, and constraints are all included and clearly identified; the description is written with no, or few, errors.	Problem statement is extremely well written and further investigates the included criteria/constraints.
Brainstorming technique (X1)	There is no real 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 technique (which incorporates each element of the design brief) is evident.
Sketch 1 (X1)	Sketch is sloppy and ill-constructed, and/or it appears to be included as an afterthought to the design; there is no design pro/con list.	Sketch is 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.
Sketch 2 (X1)	Sketch is sloppy and ill-constructed, and/or it appears to be included as an afterthought to the design; there is no design pro/con list.	Sketch is well drawn and includes pro/con list. Evidence of final design is illustrated in the sketch.	Sketch is of exceptional quality and includes a creative pro/con list. Clear transformation from sketch to final design is evident.
Sketch 3 (X1)	Sketch is sloppy and ill-constructed, and/or it appears to be included as an afterthought to the design; there is no design pro/con list.	Sketch is well drawn and includes pro/con list. Evidence of final design is illustrated in the sketch.	Sketch is of exceptional quality and includes a creative pro/con list. Clear transformation from sketch to 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 all 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 utilized in the design.
Evaluation of design (X2)	Evaluation is sloppily written; it is simply a regurgitation of the design brief elements, with little or no examination of the finished design.	Evaluation satisfactorily answers the question "Does my 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.
			SUBTOTAL (100 points)

Record scores in the column spaces below.



TECHNICAL DESIGN (continued)

Rules violations (a deduction of 20% of the total possible points) 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: _____

Light blue rectangular box for recording deductions.

(To arrive at TOTAL score, add any subtotals and subtract rules violation points, as necessary. Check your math twice!) **TOTAL (100 points)**

Light blue rectangular box for recording the total score.

Comments:

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

Evaluator

Printed name: _____

Signature: _____