Problem Solving Challenge 2019

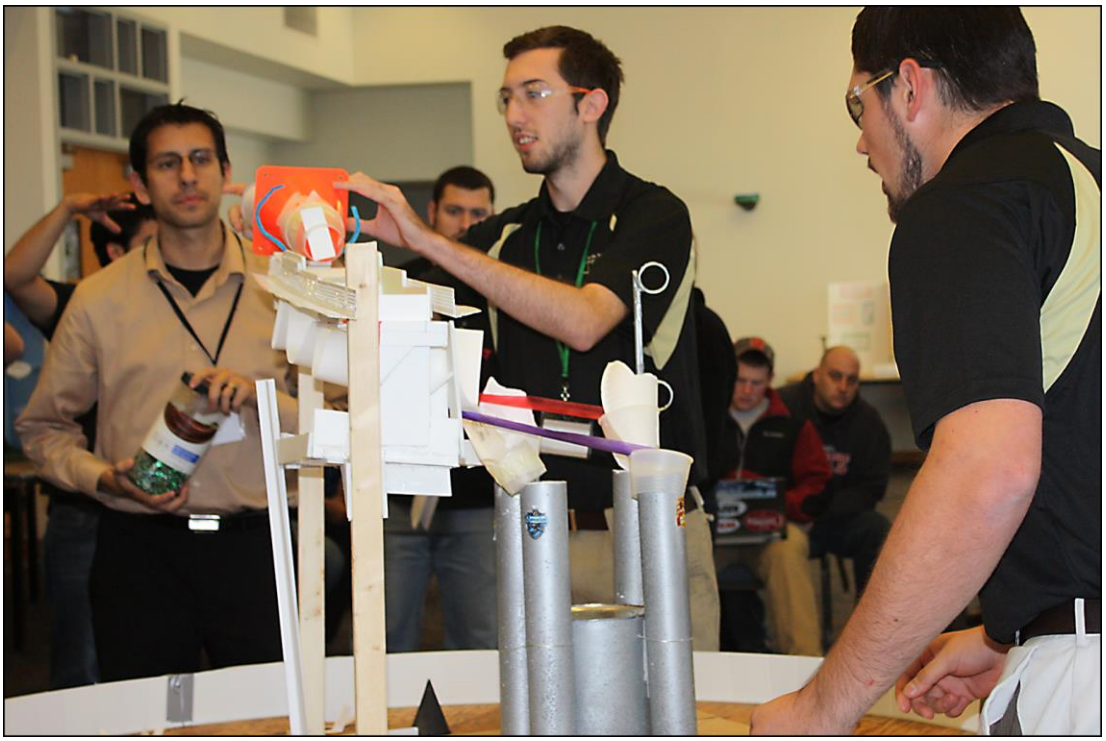
Table of Contents

Challenge

The problem solving competition is designed for teams of college students from TEECA affiliated chapters. The competing teams will receive contest details and additional materials necessary to develop a solution to a specific problem. Each team is responsible for bringing along the tools and materials noted below.

Team

Team members MUST be members of an affiliated TEECA college or university. Teams may have a max of six members. The team may not be composed of over 40% graduate students. One team member should be designated as the PROJECT MANAGER.



Standards and Benchmarks

- Standards for Technological Literacy
  - Standard 8: Students will develop an understand the attributes of design.
  - Standard 9: Students will develop an understanding of engineering design.
  - Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.
  - Standard 11: Students will develop abilities to apply the design process
- Next Generation Science Standards
  - Scientific and Engineering Practices
    Practice 2: Developing and Using Models
    Practice 8: Obtaining, Evaluating, and Communicating Information
- Common Core State Standards - Mathematics
  - High School Geometry - Modeling with Geometry (G-MG)
    Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

Procedures and Timeline

You will be given approximately 1 hour from the time that you receive your packet to conclude the problem solving activity.

Rules and Constraints

1. Students may use any tools or develop jigs using any materials, but the final model must utilize only the paper, tape, and foam board base provided by the project coordinator. Using additional materials in the model will result in disqualification.
2. Construction quality must be durable enough for repeated testing and attractive enough to present to contest judges.

Equipment and Materials

The following items must be brought to the competition by each team:

Safety Glasses / Goggles for each participant

White glue

Xacto / hobby knife and a cutting mat

Masking tape (.75 or 1" wide)

Portable drill and index Clear cellophane tape or packing tape

Extension Cord and outlet strip

Cyanoacrylate adhesive (CA) fast setting glue

Hot or cool melt glue gun

Hacksaw

Abrasives (sandpaper & steel wool)

Needle nose pliers

Flexible drinking straws

Rulers and/or tape measure

Cyanoacrylate adhesive (CA), fast setting glue

Coping saw

Solder Pencils / colored pencils

Wire Utility knife

Pair of scissors

Triangles (30° / 60° & 45°)

Calculator (on phone is fine)

Stapler

Soldering iron & stand

Circle template Wire strippers

Evaluation and Judging

Students will be judged on two separate criteria of documentation and performance. The documentation must be organized as a portfolio to be turned into the judges. Although the design process is not linear, the portfolio must be organized with the following sections in the order of: 1. Problem identification 2. Constraint and criteria 3. Research 4. Brainstorming 5. Exploring possibilities 6. Selecting an approach 7. Modeling 8. Evaluation and 9. Communicating final results. It is recommended that teams either leave space in various sections that they may add additional information later, or organize with a method that allows the addition of pages like a three ring binder. Further clarification of these sections is provided below, along with the evaluation rubric. The performance section will be evaluated on-site. Teams will be given three attempts to successfully demonstrate their solutions.

Following the demonstrations, portfolios, models and prototypes will be left with the judges for evaluating the documentation and solutions.

Required Documentation

1. **Problem identification:** Students must identify the problem (or creating an opportunity) they are trying to solve.
2. **Identifying design constraints and criteria:** Students must identify all of the design constraints and criteria in developing their design.
3. **Researching relevant data:** Students will list the research they conducted into developing their design and the role the research played in creating design solutions.
4. **Brainstorming and ideation:** Students will be responsible for documenting the concepts the team develops as potential solutions to the problem. Students must sketch and/or describe ideas, including describing how it works, and evaluate each concept in meeting the design criteria.
5. **Explore possibilities:** Students must sketch and/or describe ideas, including describing how it works, and evaluate each concept in meeting the design criteria
6. **Selecting an approach:** Students must provide a detailed sketch or drawing of the technological device that was identified during the brainstorming session as the "best solution" to the problem. Additionally, students must describe the criteria the device must meet as listed in the "problem" statement
7. **Building and testing the model:** Students must construct a model capable of withstanding repeated testing during presenting to the park officials who are judging the design.
8. **Evaluating the design:** Students will test their developed solution using the appropriate technique. Additionally, students will summarize the results of the test and the modifications made to refine the solution (if applicable).
9. **Communicating the final solution:** Students must provide a sketch or a drawing of the final solution. Additionally, students must justify how the final solution meets the design criteria and why the proposed ride is the best solution for the theme park.

Learning and Resources

- Engineering Design Process Example

References

International Technology and Engineering Educators Association (2007). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author. Retrieved October 6, 2013, from http://www.iteea.org/TAA/Publications/TAA_Publications.html