

OPTICAL ENGINEERING

Note: *this is a NJ TSA winter design challenge. This competition is NOT being offered as part of the spring State Conference. Participating teams present their solution at TCNJ on February 27, 2016.*

OVERVIEW

Participants work as part of a team to design and fabricate an optical device that will meet the specific needs of an animal shelter. The focus will be on the design process; participants should incorporate innovation into their entry/solution. Through use of a model/prototype, display, and portfolio, participants document and justify their approach and reasoning in identifying a problem and their solution's direct impact on animal shelters in their community. Participants justify and demonstrate their solution in a timed presentation.

☑ The ultimate goal for this event is the creation of an optical device to meet the needs of an animal shelter. Read the regulations carefully, identify a problem, conduct research, and choose a new or improved design for your team.

PURPOSE

Participants apply the principles and practices of engineering and universal design to develop an effective and practical solution to a specific design problem that they have identified. The solution incorporates the application of optical and mathematical principles and concepts; demonstrates the application of technology; and assesses the impact of the solution on an animal shelter.

☑ **Think outside the box.** Each design team should utilize this concept when selecting its animal shelter design problem. Many examples of optical devices already exist that may serve as the basis for designing and creating newer and more effective products and solutions. Integration of electronics and robotics into design solutions is encouraged.

ELIGIBILITY

Participants are limited to one (1) team of three to five (3-5) students per chapter; one (1) entry per team.

TIME LIMITS

- A. Entries must be started and completed between January 4, 2016 and February 27, 2016.
- B. Teams are allowed up to eight (8) minutes to present their entry.

ATTIRE

Business Casual dress (as described on the NJ TSA website) is the minimum requirement.

PROCEDURE

- A. Participants check in their entries at The College of New Jersey (room location TBA) on Saturday, February 27, 2016. No more than two (2) team members set up the display. Teams sign up for presentation times.
- B. Entries are reviewed by a panel of Edmund Optics Engineers. Neither students nor advisors are present at this time.
- C. Teams report to the event area at the assigned presentation time.
- D. Teams explain their solution. Evaluators are free to ask questions of each team of presenters.
- E. No more than two (2) team members pick up their entry from the display area at the time specified by the event coordinator.

REGULATIONS

- A. The model prototype must not exceed 2' deep x 3' wide x 4' high.
- B. Students may use any combination of Edmund Optics' line of Anchor Optics found at <http://www.edmundoptics.com/anchor-optics/> Each team can receive up to \$50 of Anchor Optics products donated from Edmund Optics.
- C. Teams can order their Anchor Optics by going to www.edmundscientific.com and clicking on "Request a Donation," where they will be asked to complete an order form. **THE TEAM'S ADVISOR SHOULD COMPLETE AND SUBMIT THE ORDER FORM. The team's order will also act as their registration for the challenge.** Note—teams may only choose optics from Edmund's line of Anchor Optics: <http://www.edmundoptics.com/anchor-optics/>
- D. Documentation materials, comprising a portfolio, are required and should be secured in a clear front report cover. The portfolio must include the following single-sided, 8 1/2" x 11" pages, in this order:
 - I. Title page with the event title, the conference city and state, and the year
 - II. Table of contents
 - III. A design brief (format that follows) that describes the design and its constraints.
 - i. **Context:** States the nature of the engineering design
 - ii. **Task:** Clearly states what the team will be involved in
 - iii. **Restrictions:** Identifies any restrictions
 - iv. **Investigations:** Identifies the research involved
 - v. **Development:** States essential elements involved in planning
 - vi. **Production:** Identifies the expected result
 - vii. **Evaluation:** Identifies the expected assessment procedure and criteria
 - IV. A description of the problem solving steps
 - V. Plan of Work log that indicates preparation, as noted by date, task, time involved, team member responsible and comments (see Plan of Work log)
 - VI. Evidence of research conducted by the design team
 - VII. Documentation of brainstorming; pages as needed
 - VIII. Descriptions and illustrations of a minimum of three (3) possible solutions with a brief, but concise, evaluation of the merits of each
 - IX. A detailed description of the final solution, including an explanation of the steps of operation

- X. A three (3)-dimensional technical or CAD drawing and/or rendering of the final solution; the maximum sheet size is drawing sheet cut size B—11" x 17"; when this sheet size is used, the sheet must be hole-punched and folded or placed in a sheet protector for insertion in the portfolio
- XI. Math and science concepts and applications involved in the final design solution
- XII. Explanation of the areas of technology that are an integral part of the solution, including as many as apply
 - i. Optics
 - ii. Manufacturing
 - iii. Construction
 - iv. Medical technology
 - v. Transportation
 - vi. Energy and power
 - vii. Information and communication
- XIII. A list of references and resources; MLA style must be used
- XIV. A bill of materials for all materials used for the model prototype and their cost (bonus points will be given for budget efficiency; see official rating form).
*Using pre-manufactured optic devices for the model prototype is prohibited
- XV. An evaluation of how well the final solution addresses the identified problem and an explanation of the impact of the solution on animal shelters
- E. Any special set-up and/or equipment required for the display or presentation is the responsibility of the participants. Battery powered prototypes are acceptable. Dry cell only. Power will not be provided for the presentation.

EVALUATION

Evaluation is based on the documentation, display, prototype and presentation, including the team's knowledge of the concepts related to their solution. See 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

COMMON CORE STATE STANDARDS (CCSS) INTEGRATION

Please refer to the Common Core State Standards (CCSS) Integration section of the National TSA Competitive Events Guide for more information.

PRIMARY LEADERSHIP SKILLS

Leadership skills promoted in this event:

- COMMUNICATION — Students choose an existing design problem and develop and explain their solution. Suggested leadership lessons: *Personality Types* and *Promote It*
- CRITICAL THINKING — Students analyze and evaluate a problem in order to develop an acceptable solution. Suggested leadership lessons: *And The Answer Is* and *Critical Thinking Tips*
- PROBLEM SOLVING — Students devise a plan that will yield an acceptable solution. Suggested leadership lessons: *Debate It* and *Effective Brainstorming*

Additional leadership skills promoted in this event: creative thinking, decision making, ethics, evaluation, organization, teamwork

TSA AND CAREERS

This competition connects to one or more of the career areas featured in the TSA AND CAREERS section of the National TSA Competitive Events Guide. Use *The 16 Career Clusters* chart and the *TSA Competitions and The 16 Career Clusters* grid as resources for information about careers.

CAREERS RELATED TO THIS EVENT

Optical engineer
Mechanical engineer
Manufacturing consultant
Mathematician
CAD Technician