COMPUTER-AIDED DESIGN (CAD) 3D, ENGINEERING

OVERVIEW

Participants create a 3D computer model(s) of an engineering or machine object, such as a machine part, tool, device, or manufactured product.

PURPOSE

Participants have the opportunity to use complex computer graphic skills, tools, and processes to develop three (3)-dimensional representations of engineering subjects.

ELIGIBILITY

Participants may compete in CAD 2D, Architecture or CAD 3D, Engineering, but not both. Participants are limited to two (2) individuals per state.

TIME LIMITS

A. Thirty (30) minutes set up time
B. Four (4) hours to develop the drawing(s)
C. One (1) hour for final evaluation

ATTIRE

Competition attire, as described in National TSA Dress Code (www.tsaweb.org/Dress-Code), is required for this event.

PROCEDURE

A. Participants bring their own computer systems (see regulations below) to the event area at the time and place stated in the conference program.

B. Each participant, with one (1) assistant (an instructor, fellow student, or adult chaperone), is allowed thirty (30) minutes to set-up and test equipment. At the end of the thirty (30)-minute set-up period, assistants are required to leave the area.
C. Participants are given a design problem to solve during a four (4)-hour work session.

D. Participants work independently, without assistance from evaluators, teachers, fellow participants, other students or observers.

E. Participants are advised to save their work onto their hard drives every fifteen (15) minutes.

F. At the end of the session, participants save their work on their hard drives and on a CD or DVD.

G. One (1) additional hour is spent interviewing the participants and evaluating the entries from each participant’s computer monitor.

H. Participants break down and remove their equipment.

It is essential that students and advisors routinely check the TSA website (www.tsaweb.org) for updated information about TSA general rules and competitive events. This information is found on the website under Competitions/Updates and Clarification. When students participate in any TSA competitive event, they are responsible for knowing of updates, changes, or clarification related to that event.

REGULATIONS

A. Participants provide their own systems, including hardware (only one [1] CPU and one [1] monitor are allowed per student), software, two blank CDs or DVDs, power strip/surge protector, and reference materials. It is not necessary to bring a printer for this event. Laptop computers are recommended; computers must be equipped with a CD or DVD drive.

B. Event coordinators supply a table, chair, sketching paper, and electricity for each participant. Students are required to provide their own pencils.

C. Participants are not permitted to leave the event room without permission from the event coordinator. If a participant must use the rest room, s/he is accompanied by an escort.

D. Participants are not permitted to share solutions to problems, reference materials, hardware, or software.

E. Participants identify their work using only their conference identification number.

F. All CDs/DVDs and the work they contain become the property of TSA, Inc., and will not be returned.
G. Breakdown of equipment is permitted only after the work of all participants has been evaluated.

**EVALUATION**

Entries are evaluated on screen according to the criteria on the official rating form.
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 this guide for more information.

PRIMARY LEADERSHIP SKILLS

Leadership skills promoted in this event:

- COMMUNICATION — Students use CAD to communicate a design. Suggested leadership lessons: Promote It and Put It Together
- CREATIVE THINKING — Students create representations of ideas. Suggested leadership lessons: Color Hunt and Creative Techniques
- EVALUATION — Students evaluate a design according to requirements. Suggested leadership lessons: Evaluation Methods and Seven Components of Effective Evaluation

Additional leadership skills promoted in this event: organization, problem solving, teamwork

TSA AND CAREERS

This competition connects 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 The 16 Career Clusters grid as resources for information about careers.

CAREERS RELATED TO THIS EVENT

- Engineer
- Automobile designer
- CAD professional
- Machine designer
COMPUTER-AIDED DESIGN  
(CAD) 3D, ENGINEERING  
EVENT COORDINATOR INSTRUCTIONS

PERSONNEL
A. Event coordinator
B. Evaluators, two (2) or more
C. Assistants, one (1)

MATERIALS
A. Coordinator’s notebook, containing:
   1. Event guidelines, one (1) copy for the coordinator and for each evaluator
   2. Official rating forms
   3. List of entries with finalist report
   4. List of evaluators/assistants
   5. Four (4) pens and three (3) calculators
   6. Results envelope
B. Tables and chairs for competitors and evaluators
C. One (1) ream of 8½" x 11" white copier paper
D. Statement of problem as a hard-copy sketch, fifty (50) copies.

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/assistants have been scheduled.
B. 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.
C. At least one (1) hour before the event is to begin, meet with your evaluators 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.
D. As participants arrive, check the entry list and assign them to work stations.
E. Begin the event at the scheduled time. All participants and evaluators should be in the room at this time. Participants not present may be disqualified. In order to compete, participants must be on the entry list or must have approval of the CRC chairperson.

F. Allow thirty (30) minutes for participants and their assistants (no more than one [1] per participant) to set up equipment. At the end of the thirty (30)-minute set-up time, non-participants are required to leave the event area. Review with the participants the time limits, procedures, regulations, and protocol of the event.

G. Remind participants to save their work at regular time intervals.

H. Distribute copies of the CAD problem. Answer any appropriate questions concerning the problem. Begin the event and announce the ending time.

I. During the event, the evaluators and assistants monitor and evaluate participant progress and work.

J. Announce time remaining to work at one (1) hour, thirty (30) minutes, fifteen (15) minutes, and five (5) minutes before time is called.

K. When time is called, participants stop and save their work on their hard drives and on their CDs or DVDs.

L. Collect the entries, checking to be sure each one is labeled with the student’s conference identification number.

M. Participants remain at their computers for up to one (1) hour as evaluation of the entries is completed.

N. The evaluators review the entries independently and submit their signed official rating forms to the event coordinator.

O. For participants who violate the rules, the decision either to deduct 20% of the total possible points or to disqualify the entry must be discussed and verified with the evaluators, event coordinator, and a CRC manager; all must initial either of these actions on the rating form.

P. Breakdown of equipment is permitted only after the work of ALL participants has been evaluated.

Q. Complete and submit the finalist report, which includes a ranking of the ten (10) finalists, and all related forms in the results envelope to the CRC room.

R. If necessary, manage security and the removal of materials from the event area.
# CAD 3D, ENGINEERING

**2015 & 2016 OFFICIAL RATING FORM**

**HIGH SCHOOL**

## Solution to problem (40 points)

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Minimal performance 1-4 points</th>
<th>Adequate performance 5-8 points</th>
<th>Exemplary performance 9-10 points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design</strong> (X1)</td>
<td>The drawing as presented does not create an effective model for the problem assigned.</td>
<td>The layout and design of the drawing as presented are somewhat effective in modeling the problem assigned.</td>
<td>The layout and design of the drawing completely and effectively model the problem assigned.</td>
</tr>
<tr>
<td><strong>Functionality</strong> (X1)</td>
<td>The design as drawn lacks order of direction and is impractical.</td>
<td>The design is somewhat practical in directional flow and overall organization.</td>
<td>The design is completely effective, practical, and functional.</td>
</tr>
<tr>
<td><strong>Originality</strong> (X1)</td>
<td>The design drawing provides no quality of newness or deviation from tradition.</td>
<td>The design drawing shows some attempt to be creative and less non-traditional.</td>
<td>The design drawing provides a unique and creative quality of newness that departs from tradition.</td>
</tr>
<tr>
<td><strong>Aesthetics</strong> (X1)</td>
<td>The design is unappealing and fails to “capture the eye” of the observer.</td>
<td>The design is somewhat pleasing and appealing and attempts to capture the observer’s attention.</td>
<td>The design as drawn is pleasing and appealing and effectively draws attention to its appearance/beauty.</td>
</tr>
</tbody>
</table>

**SUBTOTAL (40 points)**

## Layout (60 points)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Correct geometry</strong> (X2)</td>
<td>The correct views and orientation have not been selected or used throughout the drawing process and final layout.</td>
<td>Most of the views and orientation selected and used are correct and in the proper layout format.</td>
<td>All of the views and orientation that have been selected and used are correct and in the proper layout.</td>
</tr>
<tr>
<td><strong>Detailing</strong> (X1)</td>
<td>Many of the details are missing or placed incorrectly.</td>
<td>Most of the details are included and are correctly placed.</td>
<td>All necessary details are included and are placed correctly.</td>
</tr>
<tr>
<td><strong>Lettering</strong> (X1)</td>
<td>The choice of font style, size, color and application is inappropriate for the drawing assignment.</td>
<td>The choice of font style, size, color, and application is appropriate, with few inconsistencies/variations.</td>
<td>The choice of appropriate font style, size, color and application is clearly evident and applied consistently.</td>
</tr>
<tr>
<td><strong>Dimensioning</strong> (X1)</td>
<td>Many of the necessary dimensions are missing and/or placed incorrectly.</td>
<td>Most of the required dimensions are included and placed correctly.</td>
<td>All of the necessary dimensions are included and correctly placed.</td>
</tr>
<tr>
<td><strong>Scale</strong> (X1)</td>
<td>The scale selected for the drawings is incorrect and not properly noted.</td>
<td>The scale for some or most aspects of the drawings is correct and properly noted.</td>
<td>The scale selected for all aspects of the drawings is correct and properly noted.</td>
</tr>
</tbody>
</table>

**SUBTOTAL (60 points)**
### Computer-Aided Design (CAD) 3D, Engineering

#### Engineering Application (20 points)

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<tr>
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<tr>
<td>Application of practices (X1)</td>
<td>Many, if not most, of the engineering practices selected and used are incorrectly applied.</td>
<td>Most of the engineering practices selected and used are correctly applied.</td>
<td>All of the engineering practices selected and used are correctly and appropriately applied.</td>
</tr>
<tr>
<td>Appropriate use of conventions (X1)</td>
<td>There is little or no evidence of appropriate application of engineering conventions in the completed design and drawings.</td>
<td>There is some evidence of effective application of engineering conventions in the completed design and drawings.</td>
<td>There is clear evidence of an effective and knowledgeable application of engineering conventions in the completed design and drawings.</td>
</tr>
</tbody>
</table>

#### Software Utilization (20 points)

<table>
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<th>Exemplary performance 9-10 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD functions (X1)</td>
<td>There is little evidence of an understanding and application of CAD functions.</td>
<td>There is evidence of a general understanding and effective application of CAD functions.</td>
<td>A complete and effective understanding and application of CAD functions is evident.</td>
</tr>
<tr>
<td>CAD features (X1)</td>
<td>There is little evidence of understanding and application of CAD special features.</td>
<td>There appears to be a general understanding and application of CAD special features.</td>
<td>There is complete understanding and application of the various special features of CAD.</td>
</tr>
</tbody>
</table>

**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 far right.**

**Indicate the rule violated:**

(To arrive at TOTAL score, add any subtotals and subtract rules violation points, as necessary. Check your math twice!) **TOTAL (140 points)**

**Comments:**

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

**Evaluator**

Printed name: ____________________  Signature: ____________________