OVERVIEW

Participants work as part of a team on site to develop a computer-controlled model-solution to a problem, typically one from an industrial setting. Teams analyze the problem, build a computer-controlled mechanical model, program the model, explain the program and mechanical features of the model-solution, and leave instructions for evaluators to operate the device.

PURPOSE

Participants are provided with the opportunity to work as a team to develop a systematic solution to a problem and to build a computer-controlled model to represent and illustrate their solution.

ELIGIBILITY

Participants are limited to one (1) team of three (3) members per state, one (1) entry per team. Team members must be from the same chapter.

TIME LIMITS

A. The competition consists of three phases: Phase 1) one (1)-hour setup; Phase 2) fifteen (15)-minute analysis; and Phase 3) two and one half (2½) hours for problem solution.

B. The team’s captain will be given one (1) hour to set up the team’s equipment and reference materials.

C. Following the set up time, teams will be given fifteen (15) minutes for problem analysis.

D. Following the problem analysis time, teams are provided two and one-half (2½) hours for model development and programming. Programs must be written completely on site. Use or modification of any programs written prior to the competition will result in disqualification.
ATTIRE

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

PROCEDURE

A. Each team selects a “team captain” prior to the orientation meeting.

B. The captain checks in for the team during the set-up phase by submitting his/her ID # for identification of the written and model portions of the event.

C. The problem and the inventor’s log are presented to the teams at the beginning of the fifteen (15)-minute problem analysis phase prior to model building. Teams must complete their description or interpretation of the problem during this time.

D. Each team is given a maximum of two and one-half (2½) hours to construct a model simulating realistic industrial processes, to program the model, to test the solution, to describe the program and mechanical features of the model-solution, and to complete directions for evaluators to actuate the model.

E. When finished, teams save their programs and leave them on-screen in operable form, with the ability to be reset.
   1. Before leaving the event room, teams demonstrate the operation of the model with evaluators present. Evaluators may ask questions during the demonstration.
   2. After all the evaluators have observed the operation of a team’s model, the team leaves the room. The coordinator determines the amount of time permitted for the team’s demonstration based on the number of teams and the complexity of the problem.
   3. Evaluation of the solutions takes place without the teams present.

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. Each team provides pencils and scrap paper along with its own materials kit, software, and laptop computer. No reference materials or building cards are allowed. Each team’s material kit must be appropriate to build a system that can identify, secure, and move objects and has light and/or sound outputs. A problem will be developed based upon the assumption that every material kit will contain at least:

1. Two (2) optical sensors
2. Two (2) touch sensors
3. Two (2) motors
4. Two audio AND two light outputs
5. Gears, wheels, and axles appropriate to build a motorized vehicle and/or conveyor belt
6. Balls, blocks, and pegs that can be used as objects to be moved and manipulated
7. Velcro, tape, clamps and other materials to secure or move the above objects (balls, blocks, and pegs)

B. Participants provide their own hardware and software systems.

C. The following definitions are an integral part of the event regulations:

1. Repeatability—the device is programmed to reset automatically.
2. Functional control—the device/model must accomplish the task in an efficient manner and be user friendly.
3. Model-solution—the physical device must simulate the realistic processes used in industry.
4. Conservation of materials—the model reflects the best use of materials to solve the problem, without being overbuilt.

D. The following example of a problem for this event is provided to help students understand and interpret a typical issue common to industry that might be used at a national conference.

A manufacturing company has asked your engineering firm to design an important component in its manufacturing process. The company specializes in the production of cylindrical items. Its manufacturing line is getting “jammed” because multiple cylindrical items are making their way to stations that can handle only one item at a time. Your design must include a “hopper” that will store items as they wait to make their way to a station. When a station is empty, a light should turn on; this will indicate to an operator to press a button that will send one cylinder into the station. After ten (10) seconds, the item will need to be moved to the next hopper, leaving the station empty and signaling the operator to send in another cylinder.
Requirements

- A minimum of three (3) cylindrical items of consistent size and shape must be included.
- A hopper must store these items until a button is pushed.
- Only one item can advance when the button is pushed.
- Ten (10) seconds must pass with the item at a station before it is moved to the next hopper.
- A light must signal the operator when the station is empty.
- No additional cylinder can be sent to a station when a cylinder already is in place.

EVALUATION

Teams are evaluated on their written work, model function, and programming structure and efficiency.
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:

- CREATIVE THINKING — Students will emphasize original ideas in order to create a competitive edge. Suggested leadership lessons: Creative Techniques and HAT To Be Creative
- PROBLEM SOLVING — Students will analyze each step in the design process. Suggested leadership lessons: Lend A Hand and Problem Solving Steps
- TEAMWORK — Students will assign tasks based on specific individual skills. Suggested leadership lessons: Effective Meetings and The Gift

Additional leadership skills promoted in this event: communication, critical thinking, ethics, evaluation

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

- CNC programmer
- Computer programmer
- Robotics engineer
SYSTEM CONTROL TECHNOLOGY
INVENTOR’S LOG

Team Captain ID #

Use only the space provided. The description/interpretation of the problem must be completed DURING the problem analysis session.

Description or interpretation of the given problem:

The two parts below are to be completed AFTER the problem analysis session.

Description of the team solution (explain the unique features of the program and model):

Directions to evaluators to start the system:
SYSTEM CONTROL TECHNOLOGY
EVENT COORDINATOR INSTRUCTIONS

PERSONNEL
A. Event coordinator
B. Evaluators, two (2) or more
C. Assistants, two (2)
D. Event sponsors, two (2) to write the problem and direct evaluators

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. Stopwatches
   6. Calculator
   7. Copies of the problem written collaboratively by sponsors
   8. Copies of the inventor’s log
   9. Results envelope
   10. Power strips with surge protectors, and extension cords
B. Large room to accommodate a first place team from every state and affiliated country
C. One (1) table and three (3) chairs per team

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. One (1) hour before the event is scheduled to begin, meet with your evaluators/assistants to distribute materials and to review time limits, procedures, and regulations. If questions arise that
cannot be answered, speak to the event manager before the event begins.

D. Begin the event at the scheduled time by closing the doors and checking the entry list. 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.

E. Secure participants’ equipment in the area designated.

F. At the orientation meeting obtain the team/chapter identification numbers from team captains.
   1. Evaluators must be present at the orientation meeting.
   2. Review the time limits, procedure, and regulations with team captains.

G. Distribute the problem and Inventor’s Log to teams at the beginning of the event. Teams have fifteen (15) minutes to complete their interpretation of the problem in the Inventor’s Log.

H. Each team is given two and one-half (2½) hours to complete the remaining portions of the event.

I. Teams must demonstrate that their device/model is operable and has the ability to reset prior to leaving. Evaluators must observe this portion and may ask a few questions. Evaluators also may take notes, but evaluation occurs only after all teams have left the event room.

J. The evaluators judge the entries without consulting one another.

K. 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.

L. Ensure that all rating forms have been completed, tallied, and averaged before evaluators are dismissed.

M. Complete and submit the finalist report and all related forms in the results envelope to the CRC room.

N. If necessary, manage security and the removal of materials from the area.
### SYSTEM CONTROL TECHNOLOGY

**2015 & 2016 OFFICIAL RATING FORM**

#### Invener’s Log (20 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>Description of problem (X1)</td>
<td>The description is incomplete, and/or it is illogical and unorganized; the description is simply a restatement of the problem’s guidelines.</td>
<td>The description includes a logical, but only general, understanding of the problem’s guidelines; it restates the guidelines with an overall understanding of the problem.</td>
<td>An organized, logical, and concise description of the problem is provided; it includes all major aspects of the problem’s guidelines, as well as original thoughts.</td>
</tr>
<tr>
<td>Description of solution and activation instructions (X1)</td>
<td>The team’s solution does not correlate with the final system creation; the solution is illogical, related to the problem’s guidelines; the directions to activate the solution are included but incomplete.</td>
<td>The team’s solution correlates generally with the final system creation; adequate directions to activate the solution are included.</td>
<td>A strong correlation between the team’s written solution and final system creation is provided; it is written clearly and concisely; instructions for the solution are included and written concisely.</td>
</tr>
</tbody>
</table>

#### Solution to Problem (60 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>Realistic simulation (X1)</td>
<td>The solution is not realistic; it has an abstract design that would not work effectively in its intended environment.</td>
<td>The simulation is somewhat realistic and logically designed, but it may not work effectively in its intended environment.</td>
<td>The simulation is realistic and similar to a system that would be effective in its intended environment.</td>
</tr>
<tr>
<td>Dependability of solution (X1)</td>
<td>The solution is not constructed with dependability in mind; when the system is operated, construction pieces fall off, etc.</td>
<td>Most of the parts of the solution are well constructed and dependable, with only a few that are questionable.</td>
<td>Every component of the solution is well constructed and dependable; practical construction techniques have been used.</td>
</tr>
<tr>
<td>Conservation of materials (X1)</td>
<td>An inefficient use of construction materials is obvious; too many unnecessary materials are incorporated into the design.</td>
<td>Most of the components of the solution are designed with conservation in mind; the construction is generally adequate.</td>
<td>All components of the solution are designed and assembled with conservation of materials in mind; the construction is elegant and not overbuilt.</td>
</tr>
<tr>
<td>Solution to problem (X2)</td>
<td>The solution is missing three or more attributes/criteria and several do not function as intended.</td>
<td>The solution includes most attributes/criteria, and they function adequately.</td>
<td>The solution includes all attributes/criteria listed in the design details, and all attributes function appropriately and correctly.</td>
</tr>
<tr>
<td>Ingenuity and creativity (X1)</td>
<td>The solution and design are unauthentic, complex, and do not function as a system.</td>
<td>The solution has some original ideas in its design, and its construction is adequate.</td>
<td>The solution is truly unique and authentic; its construction is concise and designed with simplicity.</td>
</tr>
</tbody>
</table>

**SUBTOTAL (20 points)**

**SUBTOTAL (60 points)**
### System Control Technology (continued)

#### Programming Structure (20 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>Programming efficiency</strong> (X1)</td>
<td>The software used to program the system is overly complex and inefficient; advanced programming techniques, which would have simplified programming specific tasks, are not included.</td>
<td>The programming software is efficient, with some advanced features that simplify the solution's criteria and/or attributes.</td>
<td>A concise and logical programming application was used that incorporates advanced features to simplify the solution's criteria and/or attributes.</td>
</tr>
<tr>
<td><strong>Program structure</strong> (X1)</td>
<td>The programming structure is illogical, unorganized, or overly complicated and/or complex; the program does not reset.</td>
<td>There is evidence of an organized programming structure and adequate use of sub-routines; the program resets.</td>
<td>The programming structure is concise and predictable; there is appropriate use of sub-routines where needed; the program resets.</td>
</tr>
</tbody>
</table>

**SUBTOTAL (20 points)**

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 (100 points)**

Comments:

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

Evaluator

Printed name: ___________________________ Signature: ___________________________