



SYSTEM CONTROL TECHNOLOGY

OVERVIEW

Participants use a team approach to develop a computer-controlled model solution to a given problem, typically one based on 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 judges to operate the device.

ELIGIBILITY

One (1) team of three (3) individuals per state may participate, one (1) entry per team.

TIME LIMITS

The preliminary round consists of three (3) phases:

1. one (1) hour for set up (team captain)
2. fifteen (15) minutes for analysis (team)
3. two and a half (2 ½) hours for problem solution (team)

LEAP

A team LEAP Response is required for this event and must be submitted at event check-in (see LEAP Program).

ATTIRE

TSA competition attire is required.

PROCEDURE

Preliminary Round

1. A team orientation meeting will take place at the beginning of the event. Each team selects a team captain prior to the orientation meeting.
2. Teams submit a LEAP Response at event check-in.
3. The captain checks in for the team during the set-up time meeting by submitting his/her student identification number and the team's identification number for the written and model portions of the event.
4. The problem and the Inventor's Log are presented to teams at the beginning of the fifteen (15)-minute problem analysis session prior to model-building.
5. Teams must complete their description or interpretation of the problem during this time.
6. Each team is given a maximum of two and one-half (2½) hours to:
 - a. Construct a model that simulates realistic industrial processes
 - b. Program the model
 - c. Test the solution
 - d. Describe the program and mechanical features of the model-solution
 - e. Complete directions for judges to use to activate the model



7. When finished, teams save their programs and leave them on-screen in operable form with the ability to be reset.
 - a. Before leaving the event room, teams demonstrate the operation of the model with judges present.
 - b. Judges may ask questions during the demonstration.
 - c. After judges have observed the operation of a team's model, the team leaves the room.
 - d. 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.
 - e. Evaluation of the solutions takes place without the teams present.
8. Team members report to the event area at the time and place stated by the event coordinator to pick up their equipment.
9. A list of twelve (12) semifinalists (in random order) will be posted.

Semifinal Round

1. The LEAP Response will be judged for semifinalist teams.
2. Ten (10) finalists will be announced during the conference awards ceremony.

REGULATIONS

Preliminary Round

- A. Each team provides pencils and scrap paper along with its own materials kit, software, and laptop computer.
- B. No reference materials or building cards are allowed.
- C. Each team's materials kit must be appropriate to build a system that can identify, secure, and move objects and that has light and/or sound outputs.
- D. A problem will be developed by the coordinator based upon the assumption that every materials kit will contain at least:
 1. Two (2) optical sensors
 2. Two (2) touch sensors
 3. Two (2) motors
 4. Two (2) audio and two (2) 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)
- E. Participants provide their own hardware and software systems. All equipment must be labeled with the team's identification number, advisor name, and advisor contact information.
- F. 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 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 the industry.
 4. Conservation of materials - the model reflects the best use of materials to solve the problem, without being overbuilt.
- G. Programs must be written completely on site.
- H. Use or modification of any programs written prior to the competition result in disqualification.



- I. An *example* of a problem for this event is provided below to help students understand and interpret a typical issue common to business and industry that might be used at a national TSA conference.

Johnson Recycling Center needs an automatic system for separating its two primary types of recycling material products. If type A material is detected in the product, the system should move the product to the right side of a sorting line. If type B material is detected on the assembly line, the product should be delivered to the left side. Whenever a product is delivered, a light or buzzer should activate for 10 seconds to alert workers that a product is available on one or the other of the sorting lines. The system should then reset to separate and deliver a new product.

Design a prototype that can automatically deliver at least four products without any user intervention, then reset.

Semifinal Round

- J. The LEAP Response:

1. Teams document the leadership skills the team has developed and demonstrated while working on this event, and on a non-competitive event leadership experience.
2. Find the specific LEAP Response regulations in the LEAP Program section of this guide, and on the [TSA website](#).

EVALUATION

Teams are evaluated on

1. Written work
2. Model function
3. Programming structure and efficiency
4. The content and quality of the LEAP Response (semifinalists only)

Refer to the official rating form for more information.

STEM INTEGRATION

This event has connections to the STEM areas of Science, Technology, Engineering, and Mathematics.

CAREERS RELATED TO THIS EVENT

This competition has connections to one or more of the careers below:

- CNC programmer
- Computer programmer
- Robotics engineer



SYSTEM CONTROL TECHNOLOGY INVENTOR'S LOG

Team captain's and team's ID#s

Use only the space provided.

This section must be completed DURING the process of problem analysis.

1. Description or interpretation of the given problem:

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

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

3. Directions to evaluators to start the system:



SYSTEM CONTROL TECHNOLOGY EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

- A. Event coordinator
- B. Judges:
 - 1. Preliminary round, two (2) or more
 - 2. Semifinal round, two (2) or more
- C. Assistants, two (2)

MATERIALS

- A. Coordinator's packet, containing:
 - 1. Event guidelines, one (1) copy for the coordinator and each judge
 - 2. TSA Event Coordinator Report
 - 3. List of judges/assistants
 - 4. Stopwatches
 - 5. Copies of the written problem
 - 6. Copies of the Inventor's Log
 - 7. Results envelope with coordinator forms
- B. Large room with sufficient electrical outlets to accommodate a first place team from every state and affiliated country
- C. Power strips with surge protectors and extension cords
- D. One (1) table and three (3) chairs per team

RESPONSIBILITIES

- A. At the conference:
 - 1. Attend the mandatory coordinator's meeting at the designated time and location.
 - 2. Report to the CRC room and obtain the coordinator's packet; check contents.
 - 3. Review the event guidelines and check to see that enough evaluators/assistants have been scheduled.
 - 4. Inspect the area or room in which the event is to be held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.
 - 5. At least one (1) hour before the event is scheduled to begin, meet with judges/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
- B. Preliminary Round
 - 1. Begin the event at the scheduled time by closing the doors and checking the entry list.
 - 2. All participants and judges should be in the room at this time.
 - 3. Participants not present may be disqualified.
 - 4. In order to compete, participants must be on the entry list or must have approval of the CRC.



5. Secure teams' equipment in the area designated.
 6. At the orientation meeting, obtain identification numbers for each team captain and the captain's respective team.
 - a. Judges must be present at the orientation meeting.
 - b. Review the time limits, procedure, and regulations with team captains.
 7. Distribute the problem and Inventor's Log to teams at the beginning of the event.
 8. Teams have fifteen (15) minutes to complete their interpretation of the problem, using the Inventor's Log.
 9. Each team is given two and one-half (2 ½) hours to complete the remaining portion of the event.
 10. Prior to leaving the event room, teams must demonstrate that their device/model is operable and has the ability to reset.
 - a. Judges must observe this demonstration and may ask a few questions.
 - b. Judges also may take notes, but evaluation of a team's work occurs only after the team has left the event room.
 11. Judges independently evaluate the entries.
 12. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either
 - to deduct twenty percent (20%) of the total possible points in this round or
 - to disqualify the entry
 - The event coordinator, judges and CRC manager must all initial either of these actions on the rating form.
 13. Judges determine the twelve (12) semifinalists and discuss and break any ties.
 14. Submit the semifinalist results and all related forms in the results envelope to the CRC room.
 15. If necessary, manage security and the removal of materials from the event area.
- C. Semifinal Round
1. Judges independently evaluate the entries.
 2. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either
 - to deduct twenty percent (20%) of the total possible points in this round or
 - to disqualify the entry
 - The event coordinator, judges and CRC manager must all initial either of these actions on the rating form.
 3. Judges determine the ten (10) finalists.
 4. Submit the finalist results and all related forms in the results envelope to the CRC room.
 5. If necessary, manage security and the removal of materials from the event area.



Participant/Team ID# _____

SYSTEM CONTROL TECHNOLOGY

2018 & 2019 OFFICIAL RATING FORM

MIDDLE SCHOOL

Go/No Go Specifications

Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box. If an item is missing, leave the box blank and place a check mark in the box labeled ENTRY NOT EVALUATED. This will disqualify the entry and it will not be judged.

- Laptop computer is present
- Materials kit is present
- Completed LEAP Response is present
- ENTRY NOT EVALUATED

Criterion Performance Levels

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 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.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

Inventor's Log (20 points)

Description of problem (X1)	The written description is incomplete, and/or it is illogical and unorganized; the description is simply a restatement of the problem's guidelines.	The written description includes a logical and general understanding of the problem's guidelines.	An organized, logical, and concisely written description of the problem is provided; it includes all major aspects of the problem's guidelines, as well as original thoughts.
Description of solution and activation instructions (X1)	The team's written solution does not correlate with the final system creation; the solution is illogical related to the problem's guidelines, and/or directions to activate the solution are included but incomplete.	The team's written solution correlates generally with the final system creation; adequate directions to activate the solution are included.	A strong correlation between the team's written solution and final system creation is provided; the solution is written clearly and concisely; activation instructions are included and written concisely.

INVENTOR'S LOG SUBTOTAL (20 points)

Solution to Problem (60 points)

CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
Realistic simulation (X1)	The simulation is not realistic; it has an abstract design that would not work effectively in its intended environment.	The simulation is somewhat realistic and logically designed, and it may work effectively in its intended environment.	The simulation is realistic and similar to a system that would be effective in its intended environment.
Dependability of solution (X1)	The solution is not constructed with dependability in mind; when the system is operated, construction pieces fall off, etc.	Most of the solution is well constructed and dependable, with only a few components that are questionable.	Every component of the solution is well constructed and dependable; practical construction techniques have been used.
Conservation of materials (X1)	An inefficient use of construction materials is obvious; too many unnecessary materials are incorporated into the design.	Most of the components of the solution are designed with conservation in mind; the construction is generally adequate.	All components of the solution are designed and assembled with conservation of materials in mind; the construction is elegant and not overbuilt.

Record scores in the column spaces below.



Solution to Problem continued (60 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
Solution to problem (X2)	The solution is missing three or more required attributes/criteria and several do not function as intended.	The solution includes most of the required attributes/criteria, and they function adequately.	The solution includes all required attributes/criteria listed in the design details, and all attributes function appropriately and correctly.
Ingenuity and creativity (X1)	The solution and design are unauthentic, complex, and do not function as a system.	The solution has some original ideas in its design, and its construction is adequate.	The solution is truly unique and authentic; its construction is concise and designed with simplicity.
SOLUTION TO PROBLEM SUBTOTAL (60 points)			
Programming Structure (20 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
Programming efficiency (X1)	The software used to program the system is overly complex and inefficient; advanced programming techniques, which would have simplified the programming of specific tasks, are not included.	The programming software is efficient, with some advanced features that simplify the solution's criteria and/or attributes.	A concise and logical programming application is used that incorporates advanced features to simplify the solution's criteria and/or attributes.
Program order (X1)	The programming structure is illogical, unorganized, or overly complicated and/or complex; the program does not reset.	There is evidence of an organized programming structure and adequate use of sub-routines; the program resets.	The programming structure is concise and predictable; there is appropriate use of sub-routines where needed; the program resets.
PROGRAMMING STRUCTURE 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 right.			
Indicate the rule violated: _____			
PRELIMINARY SUBTOTAL (100 points)			
Semifinal LEAP Response (10 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
LEAP (10% of the total event points)	The team's efforts are not clearly communicated, lack detail, and are unconvincing; few, if any, attempts are made to identify and incorporate the SLC Practices.	The team's efforts are adequately communicated, include some detail, are clear, and are generally convincing; identification and incorporation of the SLC Practices are satisfactory.	The team's efforts are clearly communicated, fully-detailed, and convincing; identification and incorporation of the SLC Practices are excellent.
SEMIFINAL LEAP RESPONSE SUBTOTAL (10 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 right.			
Indicate the rule violated: _____			
SEMIFINAL SUBTOTAL (10 points)			



(To arrive at the TOTAL score, add the PRELIMINARY SUBTOTAL and the SEMIFINAL SUBTOTAL.)	TOTAL (110 points)
Comments:	
I certify these results to be true and accurate to the best of my knowledge.	
<u>Evaluator</u> Printed name: _____ Signature: _____	