 This challenging event attracts a special kind of student — a team player who is creative and who can perform under pressure.

## 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.

## 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 (2.5) 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 (2.5) hours for model development and programming.
- E. Semifinalists will participate in a LEAP interview that will last a maximum of five (5) minutes.

## LEAP LEADERSHIP RESUME/INTERVIEW

A Team LEAP Leadership Resume is required for this event and must be submitted at event check-in. Semifinalists will respond to interview questions related to their submitted LEAP Resume for a maximum of five (5) minutes.


## ATTIRE

Competition attire, as described in the [National TSA Dress Code](#) section of this guide, is required for this event.

## PROCEDURE

- A. An orientation meeting for teams will take place at the beginning of the set-up time. Each team selects a team captain prior to the orientation meeting.
- B. The captain checks in and submits a LEAP Leadership Resume for the team during the set-up time meeting by submitting his/her ID# and the team's ID# for the identification of the written and model portions of the event.
- C. 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. 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 that simulates 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 use to activate 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 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.
- F. Team members report to the event area at the time and place stated in the conference program to pick up their equipment.
- G. Semifinalists will be determined and posted by the CRC.
- H. Semifinalist teams will report at the time and place stated in the conference program to sign up for a semifinalist LEAP interview.
- I. The LEAP interview will last a maximum of five (5) minutes.



 Read the General Rules and Regulations section in the front of this guide for information that applies to all of TSA's competitive events.

It is essential that students and advisors routinely check the TSA website ([www.tsaweb.org](http://www.tsaweb.org)) for updated information about TSA general rules and competitive events. This information is found on the website under [Competitions/Updates](#). 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 on the assumption that every material kit will contain at least:
  - 1. Optical sensors, two (2)
  - 2. Touch sensors, two (2)
  - 3. Motors, two (2)
  - 4. Audio AND light outputs, two (2) each
  - 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. Programs must be written completely on-site. Use or modification of any programs written prior to the competition will result in disqualification.
- E. An example of a problem for this event is provided below 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 if a cylinder already is in place.
- F. LEAP Leadership Resume (see Forms Appendix or TSA website)/Interview — Teams document, in the LEAP leadership resume (see resume template), the leadership skills that the team has developed and demonstrated while working on this event. Semifinalists will respond to questions about the content of their resume as part of their presentation and/or interview. The LEAP Leadership Resume/Interview guidelines and other resources can be found on the [TSA website](#).

### **EVALUATION**

Teams are evaluated on their written work, model function, programming structure and efficiency, and the LEAP requirements. Please refer to 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

### **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 Career Clusters* chart and the *TSA Competitions and The Career Clusters* grid as resources for information about careers.

### **CAREERS RELATED TO THIS EVENT**

CNC programmer  
Computer programmer  
Robotics engineer



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## 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. Evaluators for semifinalist interviews, two (2) or more

### MATERIALS

- A. Coordinator's packet, containing:
  - 1. Event guidelines, one (1) copy for the coordinator and for each evaluator
  - 2. TSA Event Coordinator Report
  - 3. List of evaluators/assistants
  - 4. Pre-populated flash drives for evaluators
  - 5. Stopwatch, one (1)
  - 6. Written problem, one (1) copy per team and evaluator
  - 7. Inventor's log, one (1) copy per team
  - 8. Power strips with surge protectors, and extension cords, as needed
  - 9. Results envelope
  - 10. Envelope for LEAP Leadership Resumes
  - 11. LEAP Interview Judging Protocol
- 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 packet. 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 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, checking the entry list, and collecting LEAP Leadership Resumes from each team. Teams must submit a resume in order to compete. 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.
- E. Secure participants' equipment in the area designated.
- F. At the orientation meeting obtain the team/chapter identification numbers from each team captain.
  - 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 may take notes, but evaluation occurs only after all teams have left the event room.
- J. 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.
- K. Semifinalists will be determined and posted by the CRC.
- L. Semifinalist teams will report at the time and place stated in the conference program to sign up for a semifinalist LEAP interview.
- M. The LEAP interview will last a maximum of five (5) minutes.
- N. Review and submit the finalist results and all items/forms in the results envelope to the CRC room.
- O. If necessary, manage security and the removal of materials from the area.





Participant/Team ID# \_\_\_\_\_

# SYSTEM CONTROL TECHNOLOGY

**2017 & 2018 OFFICIAL RATING FORM**

**HIGH 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. If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

- Completed LEAP Leadership Resume is present.
- ENTRY NOT EVALUATED

## Inventor's Log (20 points)

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.			
<b>Description of problem</b> (X1)	The description is incomplete, and/or it is illogical and unorganized; the description is simply a restatement of the problem's guidelines.	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.	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.
<b>Description of solution and activation instructions</b> (X1)	The team's solution has little correlation with the final system creation; the solution is illogical in terms of the problem's guidelines; the directions to activate the solution are included, but they are incomplete.	The team's 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 description of the solution is written clearly and concisely; instructions for the solution are included and written concisely.
<b>SUBTOTAL (20 points)</b>			

Record scores in the column spaces below.

## Solution to Problem (60 points)

CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>Realistic simulation</b> (X1)	The simulation is not realistic; it has an abstract design that would be largely ineffective in its intended environment.	The simulation is somewhat realistic and logically designed; it may be adequately effective in its intended environment.	The simulation is realistic and is similar to a system that would be effective in its intended environment.
<b>Dependability of solution</b> (X1)	The solution is not constructed with dependability in mind; when the system is operated, construction pieces fall off, etc.	Most of the parts of the solution are well constructed and dependable.	Every component of the solution is well constructed and dependable; practical construction techniques have been used.
<b>Conservation of materials</b> (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.



Solution to Problem (continued) (60 points)			
<b>Solution to problem</b> (X2)	The solution is missing three or more attributes/criteria, and several do not function as intended.	The solution includes most attributes/criteria, and they function adequately.	The solution includes all attributes/criteria listed in the design details, and all attributes function appropriately and correctly.
<b>Ingenuity and creativity</b> (X1)	The solution and design are unauthentic, complex, and/or 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.
			<b>SUBTOTAL (60 points)</b>

Programming Structure (20 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>Programming efficiency</b> (X1)	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.	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.
<b>Program structure</b> (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.
			<b>SUBTOTAL (20 points)</b>

Rules violations (a deduction of 20% of the total possible points in the sections above) 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: \_\_\_\_\_

Semifinalist LEAP Interview (20 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>LEAP Leadership Resume/Interview</b> See Regulation F and instructions on TSA website (X2)	The team's efforts are not clearly communicated, lack detail, and/or are unconvincing; few, if any, attempts are made to identify and/or incorporate the LEAP Be. Know. Do. criteria.	The team's efforts are adequately communicated, include some detail, are clear, and/or are generally convincing; identification and/or incorporation of the LEAP Be. Know. Do. criteria is adequate.	The team's efforts are clearly communicated, fully-detailed, and convincing; identification and/or incorporation of the LEAP Be. Know. Do. criteria is excellent.
			<b>SUBTOTAL (20 points)</b>

Rules violations (a deduction of 20% of the total possible points in the semifinalist section) 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: \_\_\_\_\_



(To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary.)

**TOTAL (120 points)**

Comments:

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

Evaluator

Printed name: \_\_\_\_\_

Signature: \_\_\_\_\_