2025 ASEE MODEL DESIGN COMPETITION
Sponsored by the Two Year College Division of ASEE

Date: October 8, 2024 (revision G9)

Dear Colleague,

On behalf of the American Society for Engineering Education (ASEE) - Two Year College Division (TYCD), we invite you to encourage the submission of student design projects for the 27th Annual ASEE Two-College Division MODEL DESIGN COMPETITION. This event will be held in conjunction with the 2025 ASEE Annual Convention, Montreal, Quebec, Canada, June of 2025. This competition is open to 1st and 2nd year engineering and technology students at two-year and four-year colleges and universities.

As this year's competition will be held in Canada which is known for its committed fans, each student team will design and build an autonomous robot that will perform a sort of hockey skirmish by making goals with pucks laid around the track. The robot must adhere to the rules of the model design competition (attached).
An Exhibition session is included as part of the competition.

The main reason for this competition is for students to gain a better understanding of the design process from start to finish. Designing and building something from an idea is probably why they chose engineering in the first place. Use this design competition as a platform to reinforce their ideas and have some *engineering fun!*
We hope to see you and your students' entries in Montreal.

Please find enclosed the guidelines and registration forms for this event. The interest and registration forms are on the back of this letter.

Sincerely,

Kenny Grimes
Phone: 757-822-7278
Email: kgrimes@tcc.edu

Clint Kohl
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Geoff Berl
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Email: gberl001@monroecc.edu

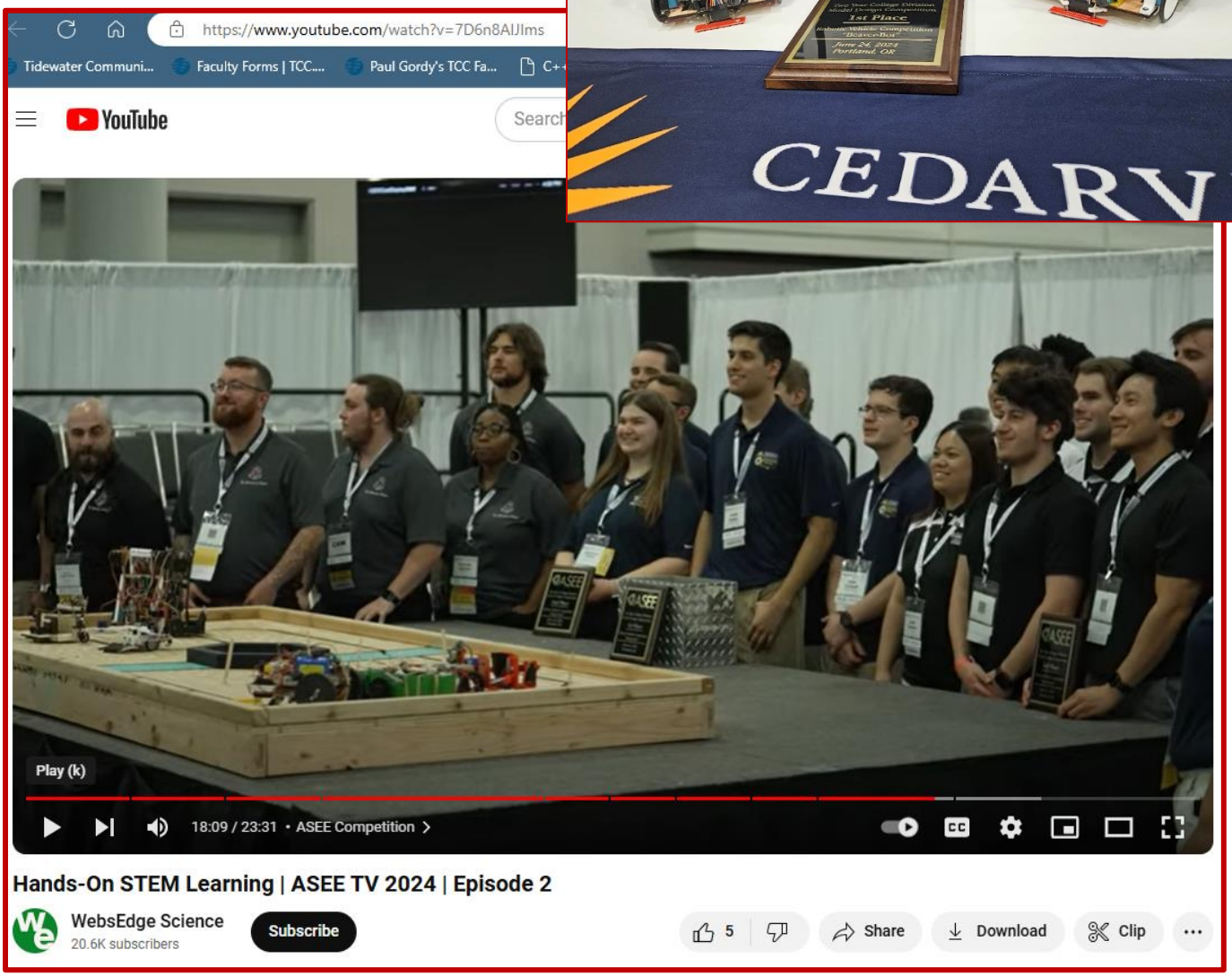
Previous Results from the

26th Annual ASEE Model Design Competition

June 24, 2024 - Portland, OR

The recent Beaver Bot competition in Portland required teams to design and build an autonomous robot to find and harvest (popsicle stick) trees and then deliver them to either a pond or river area of the playfield.
7 teams competed and the results were as follows:

- 1st Place: <***Mr. and Mrs. Beaver***> – <***Cedarville University***>
- 2nd Place: <***Mega Ohm***> – <***Tidewater Community College***>
- 3rd Place: <***The Lumberjack***> – <***Monroe Community College***>



For complete results, including scores, pictures, videos, and more, visit the competition websites at
[ASEE Model Design Competition | Robot Research Lab](https://robotresearchlab.com/asee-model-design-competition/)
https://robotresearchlab.com/asee-model-design-competition/

2025 ASEE TYCD MODEL DESIGN COMPETITION RULES

Montreal, Quebec, Canada

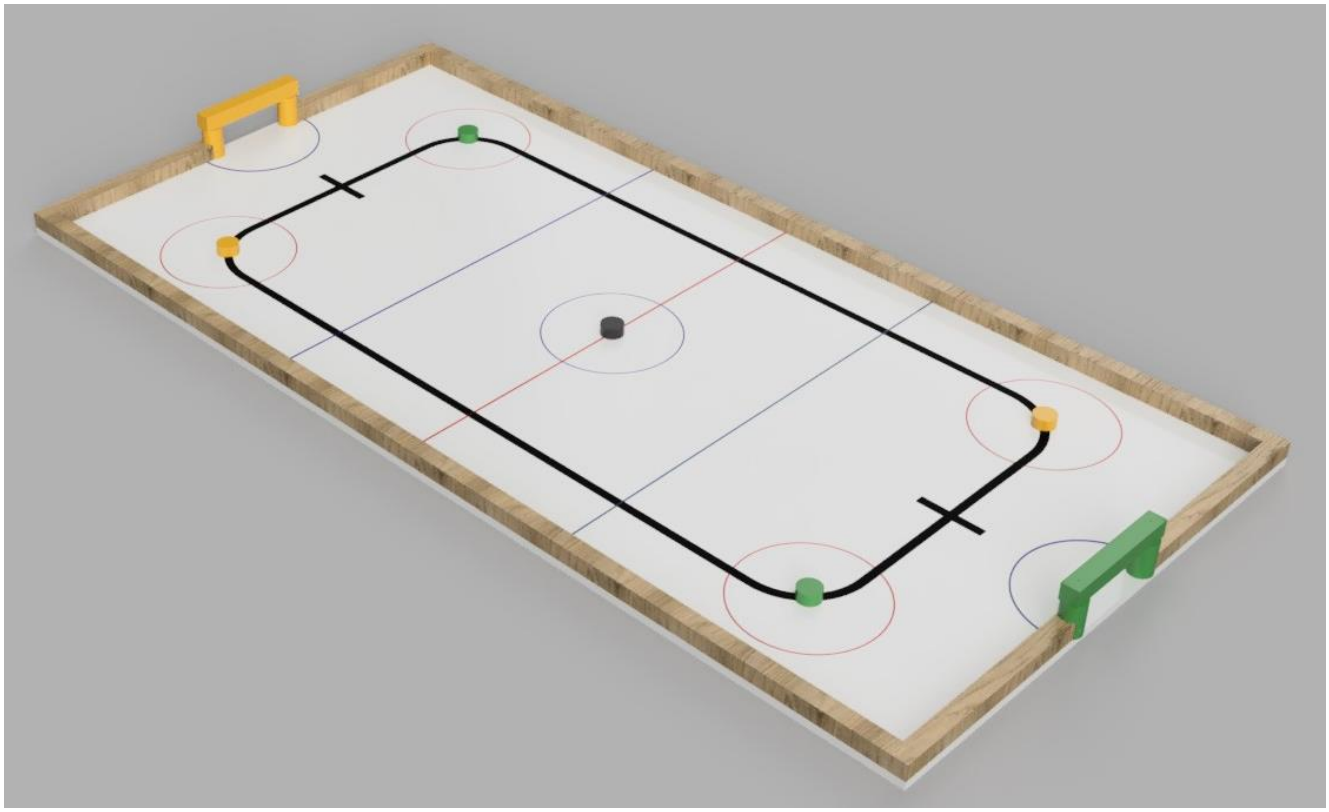
The 27th Annual American Society for Engineering Education (ASEE) Two-Year College Division (TYCD), Model Design Competition will be held in conjunction with the ASEE Annual Convention on June 22 – 25, 2025 in Montreal, Quebec, Canada.

Event Name: Hockey Hat-trick

Objective:

To design and build an autonomous robot that can successfully score hockey goals with 5 pucks initially placed in specific locations on the play field. The robots have a maximum time of 120 seconds in each of their four allotted trials to deliver up to 5 different colored pucks to yellow and green goals, according to the point system described in the 'Robot Time Trial Scoring' section of the rules. The robot must begin within an 8" X 12" X 10" high size limit but may expand to any size during a trial.
An Exhibit Session will precede the robot trials.

Figure 1: Isometric View of the Play field



Track Specifications:

1. Each goal is identified by a green or yellow side posts and cross bar that straddles over top of the goal.
2. There is no goalie to defend the open goal.
3. Four pucks will be laid out as shown on the rounded corners of the (line following) black line. One yellow and one green puck will be on each end of the ice. One puck will be close to its matching color goal, and the other puck will be on the far end of its matching color goal. A robot traveling along the black line would encounter pucks of alternating color.
4. The fifth puck is black and is placed directly on the center of the ice and center of the mid red line.

5. The goal crease (**Figure 2**) is a 6" radius semi-circle in the center of each goal opening.
6. All tape and line dimensions shown in Figure 2 are to the outer edge of each line.
7. The oval robot 'line following path' is ¾" wide black line. All other (blue and red) lines are 1/8" wide.
8. The goal posts are cylinders to be 3D printed according to the dimensions in Figure 3a. (STL available)
9. Although effort will be made to build the tracks according to specifications, participants should allow for some minor variations in dimensions due to practical construction limitations.

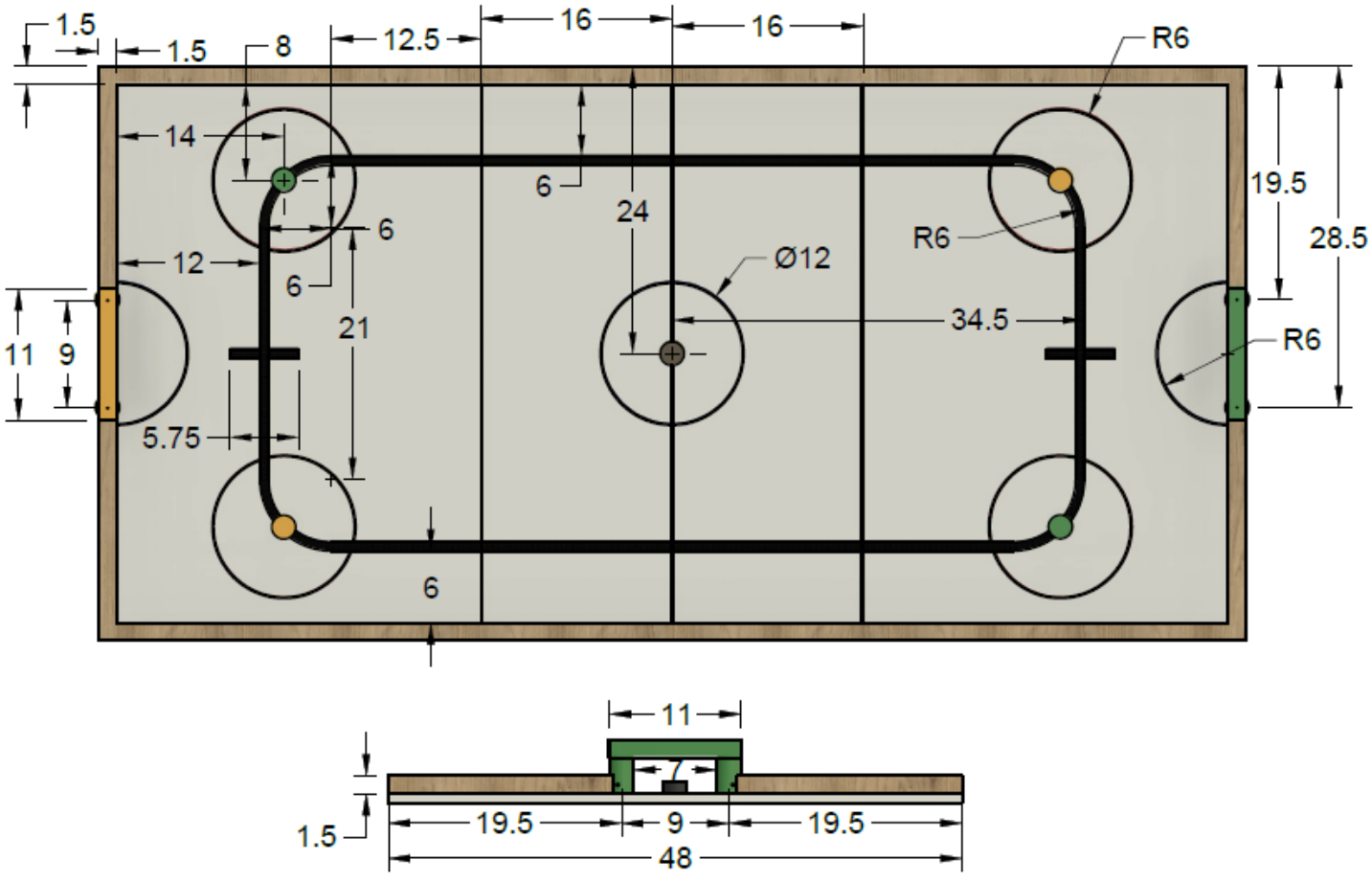


Figure 2: Track dimensions

Required Materials:

The play field (hockey rink)

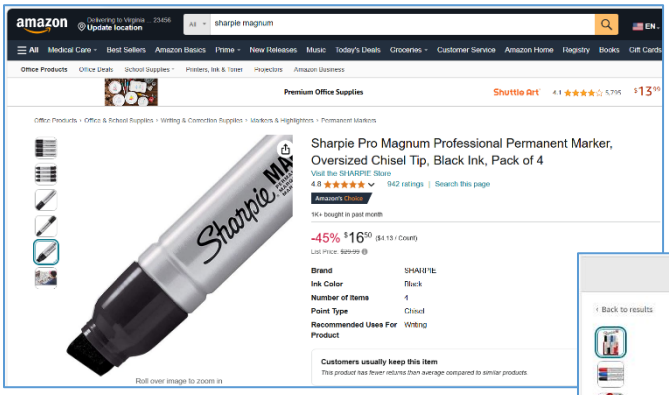
1. **One** 3/4” thick 4’ X 8’ X sheet of Melamine white board
2. **Three** 2” x 2” x 96” boards (actual size 1.5” x 1.5” x 96”) to be cut into the following lengths:

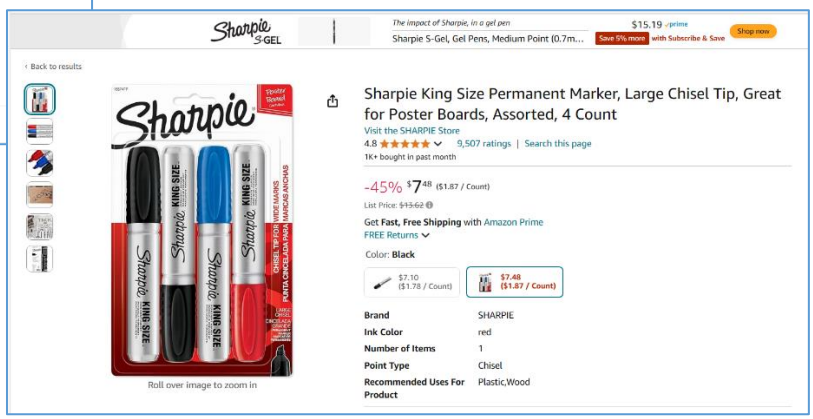
- 96” (2 boards for 8’ sides)
- 19.5” (4 boards, 2 each on either side of the goals on the shorter sides of the ice rink)

3. **One** (or more) Black Sharpie Pro Magnum Professional Permanent Marker
4. **One** RED chisel point Sharpie King Size Permanent Marker (for face-off circles & mid-rink RED line)
5. **One** BLUE chisel point Sharpie King Size Permanent Marker (for goal crease zones & BLUE lines)
6. **Five** 2” Franklin Mini NHL Foam pucks. (1 black, 2 green, 2 yellow)
7. **One** Box of 2” Wood Screws (or deck screws) play field borders.

Goals

1. **Two** 3D printed goal posts. (see attached *.stl file provided by the game committee)
2. M3 screws (M3x8 or assorted).





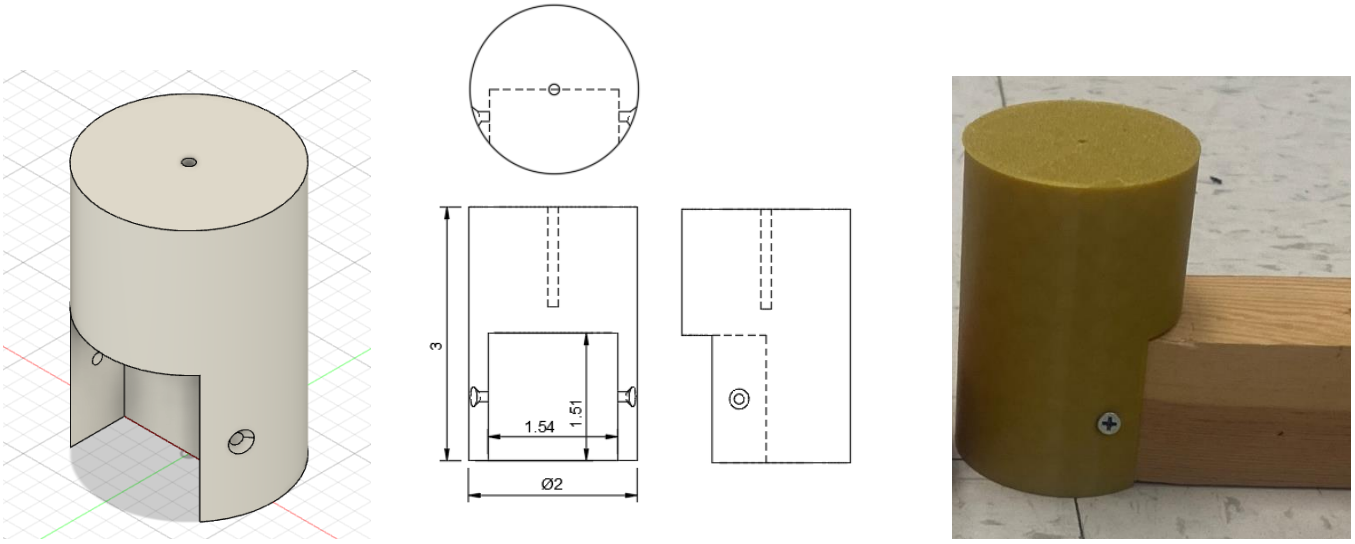
3. 

Figure 3: 3D printed Goal Posts (on which the crossbar rests) with play field border 2" x 2" board in place.

Construction Procedures:

Track

1. Purchase the (nominally) 4'x 8' Melamine 3/8" thick board.
2. Cut TWO 11" goal top bars from 2" x 2" lumber. Paint one yellow, and the other green.
3. 3D-print two yellow and two green goal side posts from the *.stl file (provided separately).
4. Cut FOUR 19.5" 2" x 2" boards for the end borders of the play field.
5. Assemble TWO 19.5" end boards to TWO goal posts and ONE goal top bar to form the play field ends. Attach the 2" x 2" boards used to form the tops of the goals using **2"** screws.
6. Attach TWO 8-foot long 2" x 2" boards used for the side borders of the rink using **2"** screws. NOTE: If the actual dimensions of item #1 Melamine board is oversized at 49" x 97", leave an approximately ½" excess surface on the outside of the rink wall (or play field border).
7. Draw light construction lines on the tile board to mark the centerline of the black line-following line, face-off circles, blue goal creases, blue and red lines of the 'neutral zone', as shown in Figure 2.
8. Apply the ¾" wide (nominal, 5/8" actual) BLACK Sharpie Magnum oval line to the Melamine Board.
9. Apply the ¼" wide (nominal, 3/16" actual) RED Sharpie King marker lines for the face off circles and mid-rink line to the Melamine Board.
10. Apply the ¼" wide (nominal, 3/16" actual) BLUE Sharpie King marker lines for the goal crease zones and blue 'offsides' lines to the Melamine Board.
11. Place the pucks in the locations indicated in Figure 1a and Figure 2.

Goal Opening (x2)

1. Two vertical side goal posts (3D printed) and a horizontal top cross board will define each of the goal openings (yellow and green) in the play field wall.
2. Each goal post will have a hole in the 3D printing for a M3x8 machine screw to fasten horizontally into the play field border wall.
3. The yellow and green painted goal cross bars will rest on the 3D-printed goal side posts, and fasten into the top of each goal side posts with a M3x8 machine screw.

Robot Specifications:

1. Autonomy:
The robot is autonomous. It must perform its tasks without the aid of a human operator.

2. **Allowable Energy Sources:**
Any energy source is allowed as long as it is completely contained within the robot. Energy sources must not present any safety hazards to participants or spectators.

3. **Prohibition Against Flying Robots:**
Since the competition is held in a crowded Exhibition Hall with hundreds of spectators, flying robots (such as quad copters) are prohibited.

4. **Maximum Robot Size:**
·The robot must have an original configuration that fits inside the official sizing box. The sizing box's interior dimensions are vertical sides of 8.0" X 12.0" and an interior height of 10.0" maximum.
·The robot may expand to any size after the start of a trial, even to the extent that it is no longer confined to initial volume constraints. The robot is not required to resume its initial configuration at the end of the trial.
·All members of a multiple robot squad must fit simultaneously in this sizing box in the configuration with which these multiple robots actually begin each trial run.
·A 20-point penalty will be applied to each trial run of a robot whose initial configuration does not meet the dimensions constraints, if violated by 1/4" or less. A 'slightly' oversized will be permitted to compete, but with a penalty. Any robot's initial configuration exceeding dimensional constraints beyond 1/4" will be permitted to perform, but receive a zero (0) score for each of the four trials that it arrives at the playfield in an oversized configuration.

5. **Components, Fabrication, and Cost:**
Team members using materials which are commonly available to the general public must perform all fabrication. Use of commercially available vehicles, robots, or entire kits such as RC cars, VEX, K-nex, Fischer-Technics, Parallax or Erector sets may not be used. The use of self-programming type microcontrollers like **Lego Mindstorm bricks are prohibited.** Individual components from these cars, robots, or kits (except the Mindstorm Brick) may be integrated into a team's robot as long as the majority of the robot's components are not from the same car, robot, or kit source. The cost of purchasing all components contained on the final robot design must not exceed **$600.** There is no limit to development costs incurred by a team or a school.

Robot Time Trial Rules:

1) It is the responsibility of the team to inspect the condition of the track before starting their robot to be certain that everything is in order. Once a team presses or pulls the start mechanism, the run counts as an official trial and may not be done over.

2) The order of testing will be determined by random draw. Teams will alternate on the two competition tracks making 2 rounds on each track during the complete 4 rounds of competition. For example: if during round 1 a team competes on track A, then for round 2 that team will compete on track B. Teams will be assigned their track and are not free to choose which track they run on.

3) While the preceding team is on the opposite track for a trial, the on-deck team must have their robot on the other track ready to run immediately after the previous team completes their trial. Each team will have one minute to begin a trial after being called.

4) All teams will be called for a trial in a current round before any teams begin the next round of testing.

5) Robot sizes will be tested with the measuring box prior to each team's first run and in subsequent runs if requested by the competition officials (judges). Team members will be responsible for placing the measuring box over their robots. If a robot fails to meet the size constraints the judges will assess a penalty proportional to the severity of the violation (See Robot Specifications).

6) The pucks will be provided by the competition officials and will be placed on the track positions indicated in Figures 1-2. Each team should inspect the placement of the pucks to be sure that they are satisfied with their position before each trial.

7) The robot must start entirely contained within the vertical plane between the two blue lines that define the neutral zone. The robot may not be contact with the black puck. The black puck shall not be moved from its original location as placed by the competition officials.

8) The robot may extend beyond the perimeter of the track during the trial as long as the robot is fully supported by the Melamine track surface or the perimeter boards. The robot can make contact with the wooden outer walls of the play field and goal, but cannot damage these walls.

9) The time for a trial will begin when the judge gives the team the command to start. Once this start command is given, a team may only activate a single switch or mechanism to start the robot. Once the robot begins to move in any way, team members may not touch the robot or send commands to control it with any remote control device.

10) If a robot fails to move once the judge's start command is given, the team members may work on their robot to get it moving but the trial timer will continue to run from the moment the start command was given. If the robot has not moved within 120 seconds of the start command, a score of zero will be assigned for that trial.

11) A trial will end when any of the following actions occur:
    a. The robot becomes disabled or shows no evidence of being able to continue.
    b. The robot has successfully achieved a total of scoring five goals using the two yellow, two green, and single black puck on the play field.
    c. The team chooses to end their run.
    d. 120 seconds elapses from the start command.

12) Teams may make modifications or repairs to their robot between trials but they must be ready within one minute of being called to the track.

13) Teams may not make practice runs during the Exhibit Session or after the start of the Robot Time Trials.

Robot Time Trial Scoring:

Robots will earn points by successfully achieving goals with the five pucks contained on the track.

A 'goal' is considered successfully achieved when all of the following criteria are met:

- The puck passes within the 7" wide opening
- The puck passes under the goal crossbar.
- The puck has fully left the surface of the ice rink play field.

1. **Points earned for successfully achieving goals with the YELLOW pucks:**
   20 Points will be awarded for each a successful goal of a YELLOW puck in the GREEN goal.
   10 points for scoring a yellow puck in its own yellow goal.
   5 points for delivering a yellow puck to either goal crease area, but not scoring.

2. **Points earned for successfully achieving goals with the GREEN pucks:**
   20 Points will be awarded for each a successful goal of a GREEN puck in the YELLOW goal.
   10 points for scoring a green puck in its own green goal.
   5 points for delivering a green puck to either goal crease area, but not scoring.

3. **Points earned for successfully achieving a goal with the BLACK puck:**
   30 Points will be awarded for a successful goal of a black puck into either goal from a shot that originates from the neutral zone (located between the two blue lines). See Figure 4.
   The position of the robot is not limited to the neutral zone for this black puck shot.

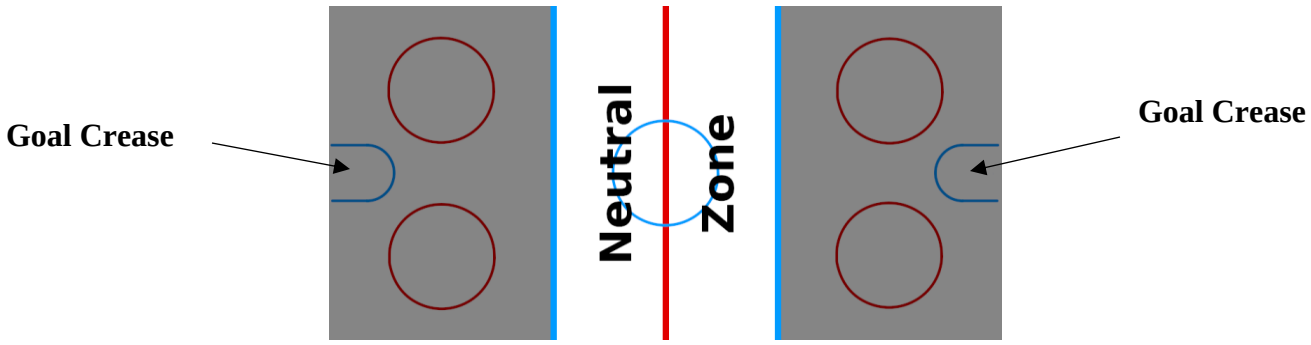


Figure 4: The Neutral Zone

   10 points for scoring the black puck in either goal from outside the Neutral zone (that is, from a closer distance than the blue lines).
   5 points for delivering the black puck to either goal crease area, but not scoring (from any distance).

4. **Points deducted for entering the goal crease:** **5 Points** will be ***deducted from each goal scored*** if any portion of the robot is within the goal crease area while in the process of shooting the puck. No penalty will be deducted for 'in-the-crease' non-goal delivery of a puck to the goal crease. The goal crease is identified by a vertical plane defined by the blue semi-circular border on the ice surface that surrounds each goal. See **Figure 1 and Figure 2**.

5. **Example of a non-perfect trial scenario** impacted by all of the robot scoring rules:
   (all 5 pucks shoved into YELLOW goal by a robot in the goal crease):

2 GREEN pucks in YELLOW goal = (20 - 5 points crease penalty) = 15pts each X 2	= 30 points
2 YELLOW pucks in YELLOW goal = (10 - 5 pt crease penalty) = 5pts each X 2	= 10 points
1 BLACK puck in YELLOW goal = (10 - 5 pt crease penalty)	= 5 points
Total	= 45 points + NO Time Bonus points

6. **Time Bonus points (for perfect trial runs)**:
   a. If all four yellow and green pucks are successfully delivered in the correct opposing color goals, and the black puck is scored from the neutral zone into either goal, and **no goal crease penalties** have occurred **…** a 'perfect run' has happened and will be awarded a bonus of (120 - trial time) which is added for every second of the 120 max allowable time that is not used.

GREEN puck in YELLOW goal 20 points x 2 pucks	=	40 points
YELLOW puck in GREEN goal 20 points x 2 pucks	=	40 points
BLACK puck in either goal from the neutral zone	=	30 points
Total	= **110** points + Time Bonus points	

7. Teams may make changes or repairs to their robots between trials but they must be ready within one minute of being called to the track, or have that trial score be declared zero (0).

Exhibit Session Scoring:

A maximum score of 120 points may be earned in the Exhibit Session. Scoring details are described below.

Overall Scoring:

The overall score for a team will be equal to the sum of the scores for the Exhibition Session and the four Robot Time Trials. A team will be disqualified from the competition if they fail to participate in the entire Exhibition Session.

Overall Score = Sum of the Points from all four Robot Time Trials + Exhibition Session Point Total

Exhibit Session:

Prior to the Robot Time Trials, each team must participate in an exhibit session where they will create a booth to promote their project to judges, other students, and conference attendees. Each team will be supplied with a 6' long table, a board behind the table suitable for mounting poster boards, and electrical power. The entire session is scheduled to last approximately 2 hours during the grand opening of the Exhibition Hall on Monday, June 22nd.

All participants must be present during the entire exhibit session. Teams may use posters, written documents, physical prototypes, multimedia displays, and other visual aids at their booths. In addition, each team's robot must remain on display at their booth for the entire duration of the exhibit session. **Team members may neither work on, nor test their robots during this session.** The number of entries from a given school will be limited by the available space during the exhibit session.

Students from each team are required to visit the exhibits from all other schools. A captain from each school will score each team from other schools on a scale from 0-20 (20 being best) based upon the criteria that the judges will use. Each school will designate a single captain even if that school has multiple teams. The captains' score will be computed by deleting the highest and lowest scores from the captains and then computing the average of the remaining scores.

The judges will visit each booth for approximately 10 minutes depending on the number of teams competing. During this visit, team members will guide the judges through their display for the first five minutes. In the second 5 minute period, the judges will ask the team questions. Each judge will score teams on a scale of 0 to 20 (20 being best) on the first five items below. The score in each category will be computed by deleting the highest and lowest scores from the judges, and then computing the average of the remaining scores.

1. Design Development:
   Guide the judges through the design process that your team followed from the initial ideas to the final solution. Describe your rationale for making design decisions.
2. Robot Operation:
   Discuss how your robot works.
3. Fabrication Methods:
   Explain how you fabricated your robot.
4. Design Analysis:
   Convince the judges that your design is optimal based upon its performance, cost, and environmental impact.
5. Exhibit Quality:
   Your exhibit quality will be judged on the following items: team and exhibit appearance, technical expertise displayed, communication skills, and effectiveness of visual aids.
6. Captain Scoring:
   The score from the captains will be added to the judges' scores from the five categories above.

Schedule of Events on the day of the competition:

The exact schedule may vary as the competition is subject to the scheduling needs of ASEE. A typical schedule might be as follows (but look for emails from the competition organizers for any possible time changes):

7:30 am: Report to the Exhibition Hall

- Set up your team's table. Identify student judge for each team.
- Draw for the order of the presentations and time trials

8:00 – 9:00 am: Exhibit Session

- Judges will visit each table in the order determined by the drawing
- Team captains will visit the table of all other teams
- The track is closed during the Exhibit Session. Teams may not work on robots or test robots at this time.

9:30 am – 11:00 am: Robot Time Trials

- Trial 1: Each team will compete in the order determined by the drawing.
- Trial 2: Each team will compete in the order determined by the drawing.
- Trial 3: Each team will compete in the order determined by the drawing.
- Trial 4: Each team will compete in the order determined by the drawing.

1:00 pm (or when the time trials end): Awards and Team Photos

Rule Interpretation Questions:

Prior to the date of the competition direct your inquiries to either of the following:

Kenny Grimes	Geoff Berl	Clint Kohl
Tidewater Community College	Monroe Community College	Cedarville University
1700 College Crescent	1000 E. Henrietta Road	251 N. Main St.
Virginia Beach, VA 23453	Rochester, NY 14623	Cedarville, OH 45314
Email: kgrimes@tcc.edu	Email: gberl001@monroecc.edu	Email: KOHLC@cedarville.edu

On the date of the competition:

The judges will interpret the intent of the rules and make all decisions. If the judges determine that a team is in violation of the intent of any rule or specification, they will deduct points in proportion to the severity of the violation. All decisions by the judges are final and may not be appealed. Teams have shown respect for the judges, participants, and spectators in the past, and this positive attitude is expected from each participant this year.

Competition Registration Questions:

Questions related to registering for the competition should be directed to:

Bill Simmons
Tidewater Community College
1700 College Crescent
Virginia Beach, VA 23453
Phone: 757-822-5269
Email: wsimmons@tcc.edu

Please find the entry forms on the following pages. The Interest Form should be received no later than April 1, 2025. A Registration Form for each model design team must be received no later than June 1, 2025.

PROJECT TEAM / ENTRY LIMITATIONS:

Each team must have at least one faculty advisor and at least 2 student members but no more than 10 student members. Each team member must primarily be enrolled in freshman or sophomore level classes. The number of entries from each school will be limited by the space available in the Exhibit Session. If a school has more than one entry then each team must represent a unique solution to the design problem. Multiple copies of the same solution are prohibited.

ASEE ANNUAL CONVENTION PASSES:

It is not required that student team members or faculty advisors be registered for the ASEE Annual Convention. Passes will be provided for all team members and advisors so that they can enter the conference area and exhibition area on the day of the competition. Details for obtaining passes will be made available a couple of weeks prior to the competition.

PRACTICE SESSION:

It is expected that two tracks will be ready for teams to practice on by Sunday morning, June 23rd. Teams should be considerate and only use the tracks for brief periods if other teams are waiting to use the tracks.

On the day of the competition the tracks will be available in the Exhibition Hall for teams to practice on prior to and following the Exhibit Session. No practice runs may be made during the Exhibit Session or after the Robot Time Trials have begun.

AWARDS:

First, second, and third-place teams will receive plaques.

Revision History:

5-31-24: revK1 - First draft of rules, for 2025 competition.
6-20-24: revK6 – This is first version distributed to select reviewers of the ASEE community.
10-8-24: revG9 – Replaced taped lines with marker lines.
Replaced Euka Lite Tile with Melamine board.
Replace wood dowel with Franklin Sports NHL mini foam pucks.

2025 ASEE Model Design Competition Registration Form

Name of college/university: _____

Team Name: _____

Name of faculty advisor(s): _____

Mailing Address: _____

Phone: _____

Email (print clearly): _____

Student team captain: _____

Other student team members:

1. _____ 2. _____ 3. _____

4. _____ 5. _____ 6. _____

7. _____ 8. _____ 9. _____

Which students/advisors need badges for the convention center? (Badges are needed if you are not registered for the convention).
Circle one: **All need badges** **None need badges** **Only those listed below need badges**

Will your team require electrical power at your Exhibition Table? Circle one: **YES** **NO**

Please submit this form to:

Bill Simmons
Tidewater Community College
1700 College Crescent
Virginia Beach, VA 23453
Phone: 757-822-5269
Email: wsimmons@tcc.edu

Return one copy of this form for each team entered by June 1, 2025 (by US mail or email)

2025 ASEE Model Design Competition Interest Form

Name of college/university: _____

Name of faculty advisor(s): _____

Mailing Address: _____

Phone: _____

Email (print clearly): _____

Number of model entries desired : _____

Please submit this form to:

Bill Simmons
Tidewater Community College
1700 College Crescent
Virginia Beach, VA 23453
Phone: 757-822-5269
Email: wsimmons@tcc.edu

Return this form by April 1, 2025 (by US mail or email)