SUNY BROOME

8th Annual Robotics Competition

For…

High School and Middle School Teams

April 5th, 2017

Event Rules Booklet

Sponsored by…

Eastern Southern Tier
STEMHUB
Science • Technology • Engineering • Math

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2. Competition Overview

Regional schools have collaborated to create an event to showcase and test their talent with building and designing robots. The competition provides a STEM focused event for local schools. Broome Community College has provided some of the funding for the robotic kits through Project Lead the Way. Some schools also have corporate sponsors that help to buy the robot kits and any other supplies. Each school either has a robotic club or a robotic class of some sort. The types of robots vary among the schools. The intent of the competition is to provide a spotlight for students to showcase their ingenuity and talents in the STEM field. The main focus is on the students.

The competition consists of six main events, the Large and Small Swept Away Challenge, the Autonomous Task Challenge, Autonomous Line-Following Challenge, the Remote Control Forklift Challenge and the Maze Programming Challenge. In each challenge the teams compete for points or best time. The team with the most points or the best time wins. They win bragging rights for the next year along with a trophy or plaque.

A registration Google Form will be sent out about a month before the competition for schools to register teams for events. If for some reason we reach our capacity of people, <u>we may enforce a limit of three teams per event per school.</u> That would mean a school could only bring a max of eighteen teams. If the limit is reached schools will be notified.

2.1. Major Changes for this year
1. Added Small Version of Swept Away for smaller robots.
2. Autonomous Task Platform reset to older version and bottom three blocks of pyramid screwed down.
3. Autonomous Ring is now 3D printed. It is plastic not metal pipe cleaner.
4. Autonomous Line Follow a whole new board.
5. Maze board will be updated for this year.

Events unchanged are the Large Version of Swept Away and the Forklift Challenge.

3. Competition Schedule

Time	Competition Schedule				
8:15 - 9:15	Teams Check in and get their Trial Tickets. Teams Sign Up for Testing Times and Qualifying Times Boards open for testing				
9:30 - 9:45	BCC Opening Welcome (Give Layout of the Schedule)				
Event	Swept Away	Autonomous Task	Line Follow	Forklift	Maze
9:45 - 10:15	**Qualifying Rounds** Large Vex Boards -Teams will compete in 5 minute intervals Small Vex Board -Teams will compete in 5 minute intervals	Trial Tickets are issued this year. Events start at 10:00 AM and run until 11:30 AM Ticket 1 - 10:00 - 10:30 Ticket 2 - 10:30 - 11:00 Ticket 3 - 11:00 - 11:30 **Each team has 3 Trial Tickets.** Teams may use their ticket any time during the corresponding ticket time slot. Best Trial Wins. If a board is empty and the judges allow, teams may practice.			Board Revealed and programming starts at 8:30. **Each team has 3 trials.** Teams can begin their attempts starting at 10:00 and all attempts must be completed by 11:30. As a reference, the first trial runs are from 10:00 until 10:30. Second trial runs from 10:30 until 11:00. Third trial runs from 11:00 until 11:30. The competition ends promptly at 11:30. If the Maze is not being utilized by any team for a trial, it may be used for practice.
10:15 - 10:45	Boards open for testing				
10:45 - 11:30	Larger Vex Board 1 and 2 Grudge Matches Quarter Final Semi Final 3rd Final 1st Final Small Vex Board 1 Grudge Matches Quarter Final Semi Final 3rd Final 1st Final				
11:30 - 11:45	Clean up / Judges Tally Points and Winners				
11:45 - 12:15	Lunch at 11:45 / Teams Eat				
12:15 - 12:45	BCC Presents Awards and Closing Message				

4. Large Swept Away Challenge Overview

The Large Swept Away Challenge takes place on an 8ft x 8ft plywood platform see Figure 1 – Large Swept Away Challenge Platform. This event is intended mainly for VEX robots. If the robot is a plastic robot, it is strongly suggested you enter your robot in the Small Swept Away Challenge. This event is modeled after the VEX Swept Away Challenge. Here is a link to a more complete set of rules and figures for the Swept Away Challenge. The event will use the same board as well as follow the main rules. The board is setup to run two robots at once. This is a knock out type challenge. All registered teams go through a qualifying round.   This qualifying number then will be used to set up the challenge brackets for the knockout round. More than one bracket can be set up. The robots in each bracket have similar qualifying numbers, which keeps the playing field level. Once the brackets are set up, then the knockout round can begin. The robots are timed again in the knockout round having a little longer time of 2 minutes and 30 seconds.

Figure 1 – Large Swept Away Challenge Platform

4.1. Large Swept Away Challenge Rules

4.1.1. Size and Weight Restrictions

There is one size restriction. Robots must start under 12 inches high. The robot may unfold or have an arm that can go higher, but at the start it must be under 12 inches tall. This event is intended mainly for VEX robots. If the robot is a plastic robot, it is strongly suggested you enter your robot in the Small Swept Away Challenge

4.1.2. Official Rules

Here is a link to a more complete set of rules and figures for the Swept Away Challenge.

NOTE: Judges will only wait 30 seconds for teams to arrive. If you are late, you may be disqualified for your bracket. Make sure you are on time.

If the robot needs to be reset for any reason, then only the judge can reset the robot. The robot will be placed back at the start position. **Any balls being carried at the time are removed from the field of play at no penalty. They cannot be used for future points.**

4. Small Swept Away Challenge Overview

The Small Swept Away Challenge takes place on an 4ft x 8ft plywood platform see Figure 2 – Small Swept Away Challenge Platform. This event is intended mainly for Lego Mindstorm and VEX IQ robots. Anyone may enter, but the robot must be under 16 x 16 x 12 inches in size. If the robot is a metal robot, it is strongly suggested you enter your robot in the Large Swept Away Challenge. This event is a scaled down version of the VEX Swept Away Challenge. Here is a link to a more complete set of rules and figures for the Swept Away Challenge. The event will use a scaled down version of the VEX board as well as follow the same main rules. Instead of green foam balls there will be small golf ball sized wiffle balls. Instead of the large form footballs, the larger ball will be a large softball wiffle ball. The board is setup to run two robots at once. This is a knock out type challenge. All registered teams go through a qualifying round. This qualifying number then will be used to set up the challenge brackets for the knockout round. More than one bracket can be set up. The robots in each bracket have similar qualifying numbers, which keeps the playing field level. Once the brackets are set up, then the knockout round can begin. The robots are timed again in the knockout round having a little longer time of 2 minutes and 30 seconds.
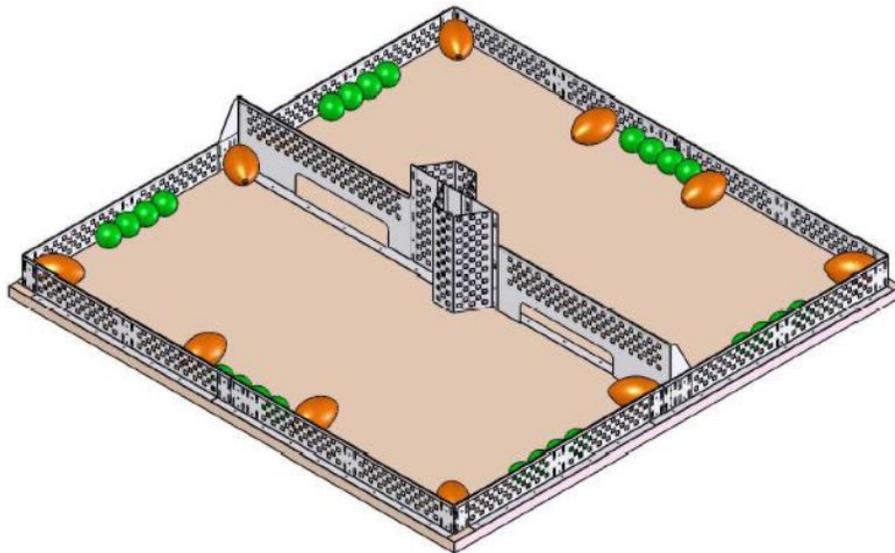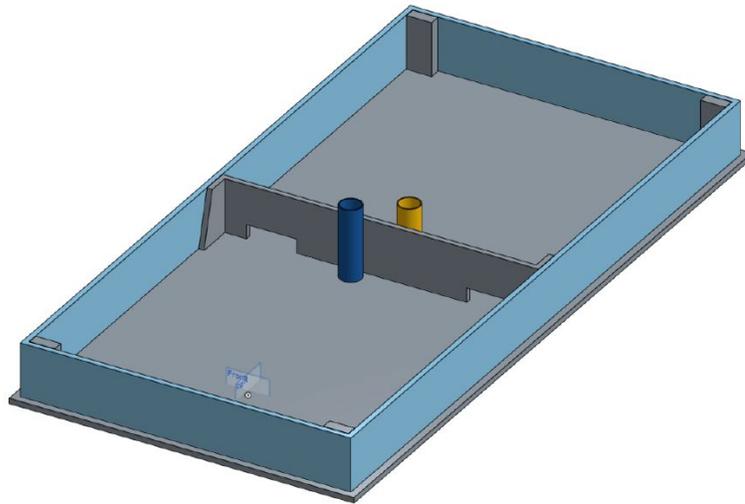

Figure 2 – Small Swept Away Challenge Platform

4.1. Small Swept Away Challenge Rules

4.1.1. Size and Weight Restrictions

The robot should be plastic, and not metal. The robot may unfold or have an arm that can go higher, but at the start it must be under 12 inches tall. This event is intended mainly for Lego Mindstorm and VEX IQ robots. Anyone may enter, but the robot should be 16" wide x 16" long x 12" high inches in size. If the robot is a metal robot, it is strongly suggested you enter your robot in the Large Swept Away Challenge. This event is a scaled down version of the VEX Swept Away Challenge.

4.1.2. Official Rules

Here is a link to a more complete set of rules and figures for the Swept Away Challenge.

The event will use a scaled down version of the VEX board as well as follow the same main rules. Instead of green foam balls there will be small golf ball sized wiffle balls. Instead of the large form footballs, the larger ball will be a large softball wiffle ball.

NOTE: Judges will only wait 30 seconds for teams to arrive. If you are late, you may be disqualified for your bracket. Make sure you are on time.

The wiffle balls that will be used are white golf ball sized wiffle balls used in place of the green soccer ball. In place of the larger football the small vex board will use yellow softball sized wiffle balls.

24 Polyurethane White Plastic Golf Balls by Crown Sporting Goods	12 Athletic Specialties Perforated Softballs Yellow
Sold at Amazon https://www.amazon.com/Polyurethane-Plastic-Crown-Sporting-Goods/dp/B009LNRHO4/ref=sr_1_sc_1?ie=UTF8&qid=1487335884&sr=8-1-spell&keywords=ployurathane+lastic+crown	Sold At Amazon https://www.amazon.com/Athletic-Specialties-Perforated-Softballs-Yellow/dp/B01D2AMTMQ/ref=sr_1_sc_1?ie=UTF8&qid=1487336147&sr=8-1-spell&keywords=athletic+specities+sfotballs+yellow

4.1.3. Resetting Robot

If the robot needs to be reset for any reason, then only the judge can reset the robot. The robot will be placed back at the start position. **Any balls being carried at the time are removed from the field of play at no penalty. They cannot be used for future points.**

4.1.4. Complete Diagram of Board

Scale is in inches. Circle Tube Towers will be 3 inch PVC tubes. They will have a stop in the center, it will only hold so many of the small golf ball size wiffle balls. The yellow sized wiffle balls will not fit in the circle towers.

Link to actual DWG file: Swept Away Drawing 1
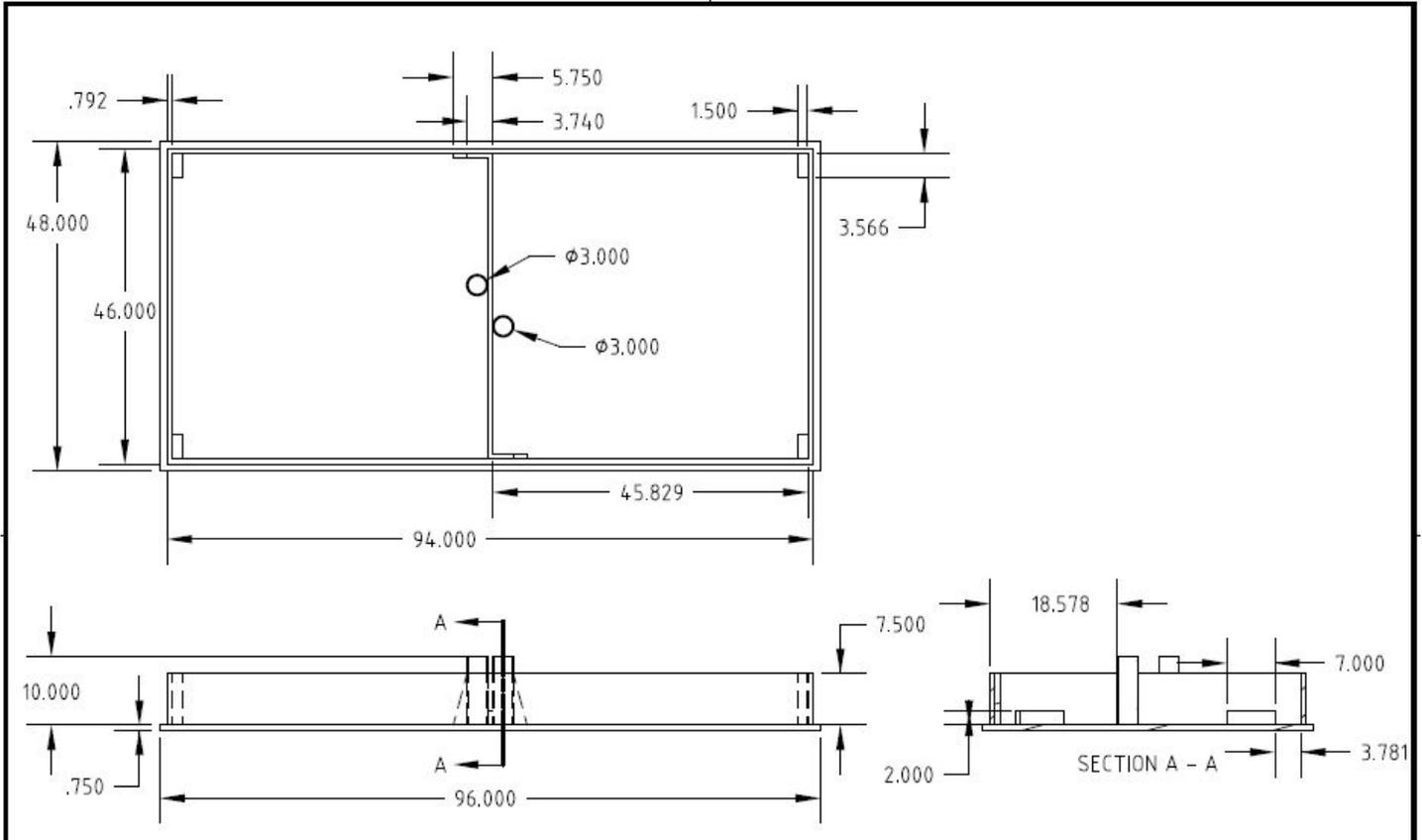
Figure 3 – Small Swept Away Challenge Detailed Drawing

5. Autonomous Task Challenge Overview

The Autonomous Task Challenge takes place on a 4ft x 4ft plywood platform see Figure 4 Autonomous Task Point Challenge Platform.   Only one robot can compete at a time on the platform. This is a task based challenge. The robot must complete tasks in order to earn points in the least amount of time. The robots must perform these actions on their own programming; no outside remote control allowed. The Home Zone on the board is where the robot starts from and this is a safe zone. Team members are allowed to change anything on the robot or even change to a new robot in the Home Zone. Once the robot leaves the Home Zone any contact to the robot will result in a point or time penalty. The robot can complete Tasks 1-4 in any order.   **Main change for this year is the bottom three blocks of the pyramid knock over will be screwed down to the platform. The bottom three will not be allowed to move. Teams knock over the top of the pyramid and must drive around the bottom three to get to the new loop. The new loops will be 3D printed. Check the Loop STL file for dimensions. The electrical tape used to outline home will be ¾" electrical tape.**

Figure 4 – Autonomous Task Platform

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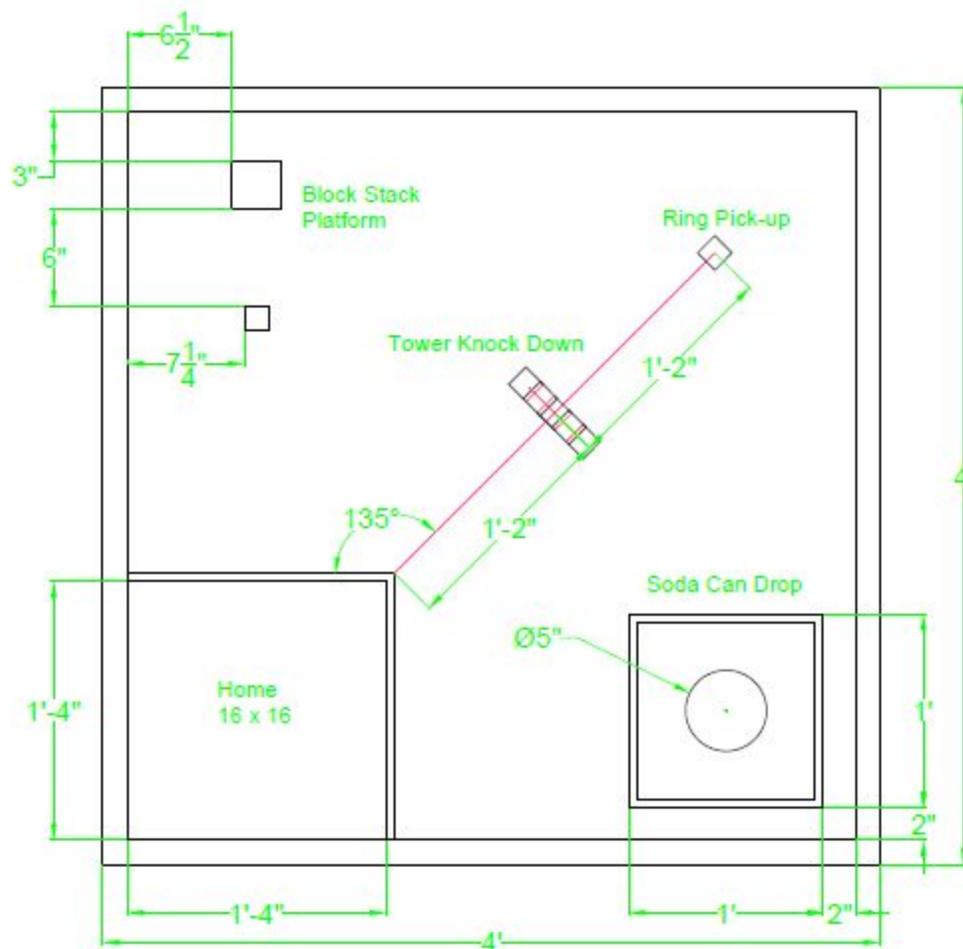
5.1. Autonomous Task Challenge Rules

5.1.1. Size and Weight Restrictions

The robot must fit within the Home Zone which is 16in x 16in. The robot cannot be over 30 lbs.

5.1.2. Autonomous Task Platform Setup

The competition will be run on a 4 ft x 4 ft piece of plywood that has been painted white. Light pencil black lines will delineate the placement of the four activities' materials. All robots will start in the 16 inch square Home Zone which will be placed on the long edge, with half of the Box in each 4 ft sq part of the competition board. The soda can circle platform is ¾ inch above the surface. This circle is screwed to the table and can not move. The 3 x 3 inch block where the 1.5 inch cube is to be placed upon is also screwed to the table and can not move. The other blocks for the pyramid and the circle hoop are not attached and are moveable.
** TEAMS ARE REQUIRED TO SETUP THE BOARD TO THEIR SATISFACTION. **
** PLACEMENT OF BLOCKS MUST BE ON LINES, YET TEAMS ARE TO PLACE BLOCKS. **

Task 1 – Soda Can: The soda can is a 12 oz. empty aluminum soda can. The tab will remain in place. The soda can starts in the Home Zone and may start placed on the robot.

Task 2 – Block Lift – consist of 1 1.5 inch wooden cube cut from 2in x 4in lumber. The robot lift and carry the block to the top of the 3 x 3 inch 1.5 inch tall platform.

Task 3 – Block Knock Over – consist of 6 1.5 inch wooden cubes cut from 2in x 4in lumber stacked in a pyramid with 3 on bottom, then 2 then 1 on top. **The three on the bottom will be screwed to the table.**

Task 4 – Ring Pick Up –   The base is a 1" cube with a 2" diameter ring on top of it. The height from the bottom of the base of the cube to the center of the hoop is 3".   See Figure 5 below.

Figure 5 – Autonomous Task 3D Printed Ring

** IT IS EACH TEAM'S RESPONSIBILITY TO MAKE SURE THE BOARD IS SETUP CORRECTLY. **

5.1.3. Autonomous Task Timing

Time will start as soon as the robot leaves the Home Zone. Maximum time allowed to complete all 4 tasks in 5 minutes. A team may call time at any point if the robot malfunctions or cannot complete a task. Time will only stop

when a team calls for a Stop Time. Otherwise time will continue until all tasks are completed, or until the limit of 5 minutes has been reached.

** TIME WILL ONLY STOP WHEN A TEAM CALLS TIME. **

** TIME WILL RUN UNTIL 5 MINUTES, UNLESS TEAM CALLS TIME. **

** ROBOT MUST RETURN TO HOME ZONE AFTER COMPLETION OF ALL TASKS. **

5.1.4. Autonomous Tasks

Task 1 – Place Soda Can on designated circle pedestal.

Task 2 – Block Lift – lift and move block to top of a platform.

Task 3 – Block Knock Over – a pyramid of blocks must all be knocked off the bottom three and make one layer.

Task 4 –Ring Pick Up – Pick up ring and return to Home Zone.

Tasks 1-4 can be completed in any order. Time will end when a robot is back in Home Zone and the team calls time.

5.1.5. Scoring

Each team is allowed three trials. Best trial wins. Best trial is most points with the least amount of time. A total of 100 points can be earned in this event.
1) Task 1 – Soda Can (25 pts)
    a. 25 pts for placement on top center pedestal. The can must be upright and does not have to be centered.
    b. 18 pts for placement on top pedestal and the can is not upright.
    c. 11 pts for placement of can off the pedestal and can remains upright in outer box.
    d. 5 pts for placement of can off pedestal and can is not upright but any portion still remains in outer box.
    e. 2 pts for placement of can anywhere on or off pedestal but can falls over and rolls out of designated area.
2) Task 2 - Block Lift (25pts)
    a. 25 points for lifting block to top of a pedestal.
    b. 15 points successful lift but block falls off robot, or block falls off of pedestal.
3) Task 3 - Block Knock Over (25 pts)
    a. 9 points for all blocks knocked down to the bottom level from on top of the pyramid.
    b. 8 points for each if only 1 or 2 blocks knocked down.
4) Task 4 - Ring Pick Up (25 pts)
    a. 25 points for the ring being carried or dragged to the Home Zone. The ring does not have to be in Home Zone, but any portion of the robot has to be in the Home Zone and it still can be moving when the team removes the ring from the robot. This is all or nothing.

When the Robot is in the Home Zone, either of the two team members may touch the robot to reposition, remove or attach parts of the robot, or take off the Ring or add on the Soda Can. As long as just part of the robot 'breaks the plane' of the Home Zone, it may be touched. BUT time shall still run.

The team may have their robot come back to the Home Zone after each activity or not, time will continue to run.

Highest points accumulated will win. If there is a tie in points, then shortest time will break the tie.
If the robot gets stuck, one of the two team members may pick up the robot and move it to the Home Zone with a 10 Point penalty.

Time will start once the robot leaves the Home Zone for the first Task, and ends after the robot reaches the Home Zone after completing all Tasks and the team calls End Time. The team with the most task points in the least amount of time wins.

6. Autonomous Line-Following Challenge Overview

The Autonomous Line-Following Challenge takes place on a 4 ft. x 8 ft. plywood platform (see Figure 6 – Line Follow Platform).   Only one robot can compete at a time on the platform. This is a timed challenge. The robot must follow the line and attempt to place one wooden 1.5 inch cube block in each designated drop zone. The robots must perform these actions on their own programming; no outside remote control allowed. The Home Zone on the board is where the robot starts from, and ends, and is the only place where the robot may be touched. **The robot must start entirely within the Home Zone, including the sensor.** Time will start once any part of the robot breaks the plane of the Home Zone. Once the robot leaves the Home Zone any contact to the robot will result in a failed run. The robot starts with the wooden blocks. The robot must follow the line, keeping the line between its outside edge of wheels. The robot must drop the wooden blocks in the drop zones and then continue to follow the line. Once any part of the robot breaks the plane of the Home Zone, time will stop. If the blocks are placed correctly, time will be deducted as reward.   Least amount of time wins.

Figure 6 – Line Follow Platform

6.1. Autonomous Line-Following Challenge Rules

6.1.1. Size and Weight Restrictions

The robot must fit within the Home Zone which is 16in x 16in. The robot cannot be over 30 lbs.

6.1.2. Platform Setup

The competition will be run on a 4 ft x 8 ft piece of plywood that has been painted white. Black paint will delineate the line to be followed and red and green paint will outline the drop zones. Only three sides of the drop zones will be red or green, the side that is the line will remain black. All curves have a 5 inch radius.

6.1.3. Line Follow

Robot starts completely inside the Home Zone, including any sensor. Robot starts with two 1.5 inch cube wooden blocks in its jaws or holders. The line can be followed in either a clockwise or counter-clockwise direction. The robot must follow the line completely autonomously with no outside remote control help. The line must remain between the outside edges of the drive wheels. During the drop, the robot may leave the line. After the drop the robot must return to the line where it left the line. Time will stop once the robot breaks the plane of the Home Zone after following the line and making the drops.

6.1.4. Scoring with Time

Each team is allowed 3 attempts at the line follow, with their best time being recorded. The teams may take time between runs to re-program or otherwise adjust their robot. Time will start once the robot breaks the plane of the Home Zone, and ends after the robot again breaks the plane of the Home Zone after completing a circuit. Maximum time allowed to complete a circuit of the line and make the drops is 5 minutes.
   ** ROBOT MUST RETURN TO HOME ZONE AFTER COMPLETION TO STOP TIME. **

If a wooden cube is placed entirely within its correct drop zone (i.e. the block is completely inside the zone without touching the boundary lines) 15 seconds will be removed from the team's overall time. If only part of a cube is touching the inside of the designated drop zone, then 10 seconds of time will be removed from the team's overall time. There is a maximum of a 30 second deduction for placement of blocks in drop zones. It may be possible for negative times. The team with the least amount of time or the most negative time wins.

The robot must drop both of the blocks. If a block is still held by the robot at the end of its run, 5 seconds will be **added** to the team's time for that run for each block that was not dropped.

   If the robot is touched, malfunctions, or drives off the line, or if 5 minutes has expired, it fails that run.

Best time wins!

7. Forklift Challenge Overview

   The Forlift Remote Control Timed Challenge takes place on a 4ft x 4ft plywood platform (see Fig 7- Remote Control Forklift Challenge Platform). This is a timed challenge. The robot will start in the central home position, facing the loading docks. On start, robot will drive to pick up a pallet, lift to carry and place in its proper color coded loading dock. The robot will continue until all 9 pallets are placed and stacked in their respected loading dock. **The robot**

must have forks as the main lifting mechanism. The robot can be of any design, but must have forks that can slide under the 3D printed pallets.

All robot actions will be controlled via remote. Once the robot leaves the central home position, any contact to the robot will result in a time penalty. When placing a pallet, if said pallet falls off or cannot be placed properly on the current positioned pallet through use of remote control, operator can call 'REMOVE PALLET' and pallet will be removed from board. Robot may continue on with challenge or operator may call time and points will be calculated based on scoring breakdown.

Figure 7 – Remote Control Forklift Challenge Platform

7.1. Forklift Challenge Rules

7.1.1. Pallet Design, Size and Weight Restrictions

Pallets will be printed on a 3D printer and made of PLA or ABS plastic.

Pallet DWG File with Dimensions

STL 3D Print File

Please contact Robert Lofthouse at (lofthouserw@sunybroome.edu) if you need a set of pallets printed and sent to you.

The robot must fit within the central home zone which is 16in x 16in. The robot cannot be over 30lbs. The robot must have a fork as the lifting mechanism.

7.1.2. Platform Setup

The competition will be run on a 4ft x 4ft piece of plywood that has been painted white. The robot picks up pallets locked in the loading zones. The robot must deliver the pallet to the properly color coded unloading zone. After dropping the first pallet, the robot must continue retrieving pallets from the loading zones and place in their proper unloading color zone. Once the last pallet is stacked, time will end. If a pallet was dropped or unable to be properly stacked or corrected, time will end when last available pallet is placed or operator calls 'TIME.' If operator calls time, points will be awarded based on properly stacked pallets.

7.1.3. Scoring

Each team is allowed three trials. Best trial wins. Best trials is most points with the least amount of time.

Level 1, Base Row Pallet……………. 1 point

Level 2, Second Row Pallet……….… 2 points

Level 3, Top Row Pallet……………… 5 points

Maximum Point Value: 24 points

In the event that there are multiple robots with a maximum score, quickest time will be the tie breaker. No points will be awarded for pallets that are not stacked in their color coded unloading zones.

8. Maze Programming Challenge

You will need to build a robot that can be programmed to travel autonomously through a maze. You will need to build a robot who can make turns and traverse the coarse. The Maze will not be revealed until the day of the challenge. Teams will be allotted a certain amount of time to initially program their robots for the Maze. After each trial run Teams will get more time to make programming tweaks.

8.1. Maze Challenge Rules
- Each team will be given a "Layout Map" and a roll of painter's tape.
- Each team will be given 3 attempts on the track
  - Each will be timed (max time allowed is 5 minutes.)
    - The clock starts when you pass the green tape
    - The clock stops when you pass the red tape
    - There will be intermediate black lines to indicate progress through the maze in case 5 teams do not complete the entire maze.

■ A team may call time and the progress through the maze will be recorded for that run along with the time. For instance, if a robot has made it to the third intermediate line but is not making progress towards the next line, the team calls time.

8.1.1. Maze Challenge Specifications of Platform

● Maze will always be 16 inches wide
● Turns can be of any angle (1 degree to 180 degrees)
● Maze walls will be built out of foam board 6 inches high
● The floor will be pegboard
● The entire track will be 8' by 8'

8.1.2. Maze Challenge Specifications of Robot

● Must move autonomously

8.1.3. Maze Challenge Scoring:

● Every robot will be scored on distance and then time.
● Fastest single run that completes the entire maze will win. Followed by all of the robots that completed the maze, based on time. These are followed in order by the robots that made it to the last intermediate line, etc.

9. Awards

1st Place and 2nd Place trophies for each event will be awarded to individual teams. A school that has entered more than one team in an event could possibly win 1st and 2nd place for that event.

Points for Grand Champion will be awarded by school. So if a school takes 1st and 2nd place, they will only be awarded 10 points for winning 1st. The school that won 3rd place in the event will earn 8 points since they are the second school to place in the event.

Each event will awards points to the school as follows:
　　　　1st Place - 10 points
　　　　2nd Place - 8 points
　　　　3rd Place - 6 points
　　　　4th Place - 4 points
　　　　5th Place - 2 points

One event will be scored on the odd scale as follows:
　　　　1st Place - 11 points
　　　　2nd Place - 9 points
　　　　3rd Place - 7 points
　　　　4th Place - 5 points
　　　　5th Place - 3 points

On the day of the competition an event will be drawn from a hat at random. This event will be the one scored on the odd scale. The odd scale is to try and prevent a tie between schools for the overall Grand Champion School.

If there is a tie between schools for the Grand Champion then the tie will be broken following these steps:
1. Highest Single Point Total in Large Swept Away Challenge
    a. If still a tie between schools then add step 2
2. Fastest Line Follow Time
    a. If still a tie between schools then add step 3
3. Fastest Maze Time
    a. If still a tie between schools then add step 4
4. Fastest Forklift Time
    a. If still a tie between schools then add step 5
5. Most Points awarded in Autonomous
    a. If for some unlikely reason there is still a tie between schools at this point, then NO grand champion will be awarded.

If you have any questions or comments please contact Robert Lofthouse:

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10. Robotic Competition Committee Members

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