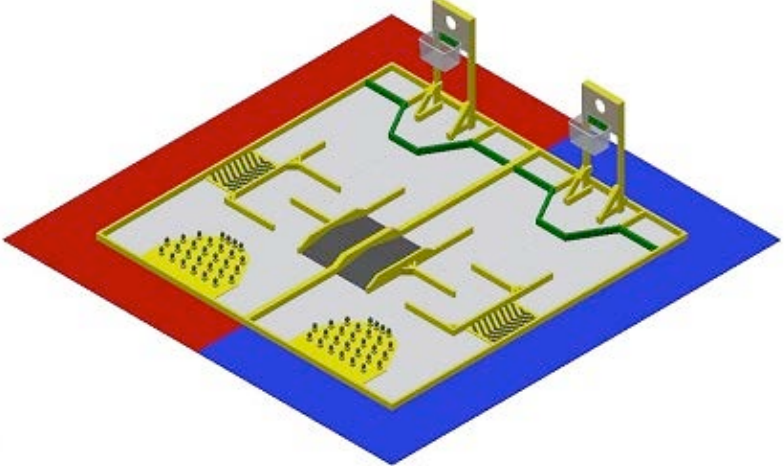





CONTEST DESCRIPTION / DESCRIPTION DE CONCOURS

ROBOTICS ROBOTIQUE

SECONDARY /
NIVEAU SECONDAIRE

Day One: June 1 st , 2017	Day Two: June 2 nd , 2017
	
<p>Competitor entries involve <u>Built At Home</u> and brought to the competition site robot equipment</p>	<p>Competitor entries involve <u>Built In the Competition Site</u> robot equipment</p>

NATIONAL TECHNICAL COMMITTEE MEMBERS

Member Organisation	Name	Email address
Alberta	Sheldon Marquis	
Manitoba	Rory Winters	
Nova Scotia	Piotr Kawalec	
British Columbia	Bryan China	
Ontario - Chair	Bob Tone	bobtone@rogers.com
Saskatchewan	Kevin Chiasson	
Newfoundland and Labrador	Dave Keefe	

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Duration: 16 Hours

Purpose of the Challenge:

To create engineering projects to encourage individuals with different skill sets to form co-operative teams to design, fabricate and operate a robot or multiple robots.

Mission Statement:

The intent of the challenge is to have teams of students independently designing / fabricating / operating robots capable of completing the competition tasks in competition with other student-fabricated robots. Teams are not allowed to develop or implement strategies based on interfering with their opponent's ability to complete the competition task set.

Essential Skills applied:

- Working with Others
- Document Use
- Thinking: Problem Solving, Decision Making
- Numeracy

Knowledge applied:

- | | |
|---|--|
| <ul style="list-style-type: none"> • Drafting • Mechanics • Electronics • Computer Programing | <ul style="list-style-type: none"> • Metalwork • Woodworking • Communications |
|---|--|

Responsibility of competitors:

- | | |
|---|--|
| <ul style="list-style-type: none"> • Robots - Robot accessories (including batteries, battery charger, spare parts) • Various tools required to modify and repair robots onsite • Safety equipment including mandatory eye protection • Extension cord and power cord • Wiring diagram | <ul style="list-style-type: none"> • Easily accessible fuses (Day 1) • Easily accessible kill switch/s (Day 1) • Robot stand (Day 1) • Teams will provide their own microcontroller/s for Day 2 task • Laptop/s |
|---|--|

*** Teams deciding not to use the provided microprocessor / software will have the option to provide their own microcontroller and software for Day 2 Competition (Lego Brick, Vex, Raspberry Pi, etc).

Equipment and material provided by Skills/ Compétences Canada:

- Day 1: An exclusive use playing field for each team's game experiences
- One worktable with access to a 120 V power outlet (minimum 100W) per team
- Day 2: A components collection providing ALL mechanical / electrical / control hardware required for Day 2 participation

Judging Criteria: On the court performance of the robot in the set tasks.

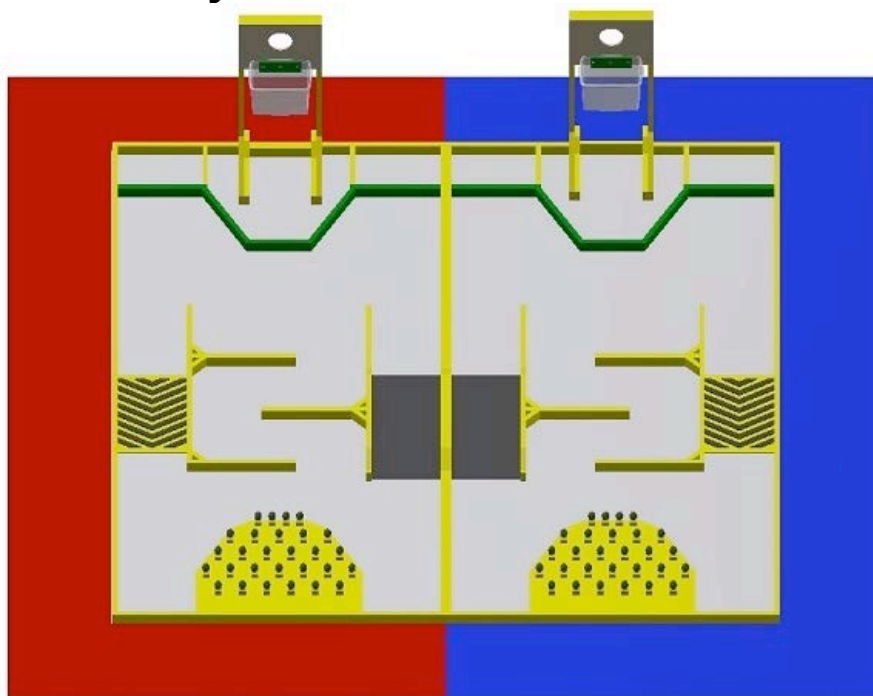
Team Size: **Two** Students maximum

Number of Teams: **One** team per province or territory

Definition of terms referenced in this document:

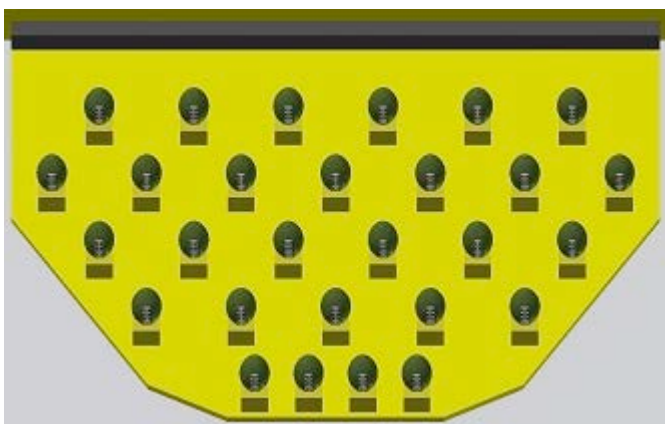
- a) Tele-operated Robot Elements are elements under the direct / active control of competitors during game play through the use of one or two radios / game controllers held by the courtside competitors.
- b) Mobile Independent Autonomous Mobile Robot Elements are elements that at the start of a game have a competitor pressing their start button or enter on a computer keyboard as the only competitor to Independent Autonomous Mobile Robot Element communication during the entire game.
- c) Stationary Independent Autonomous Elements are elements that have their power on at the start of games but have no direct contact with a competitor during game play. These units may interact with the team's tele-operated mobile robot with the actions of the tele-operated mobile robot triggering an active response by the Independent Autonomous Element which may be managed either by a mechanical based system (eg. A series of limit switches / no programmed elements) or a pre-programmed system (eg. Managed by an Arduino or other microprocessor) internal to the Independent Autonomous Element.
- d) Two Independent Elements are considered to be ONE when an element has taken possession of / is asserting control over the second element (eg. A Tele-operated Mobile Element is moving / pushing / pulling a Stationary Element into position). While this control over the second element is active the combined group of elements can be in possession of a Maximum of ONE Football.

Day One: The Football Game



Day One: Game Overview

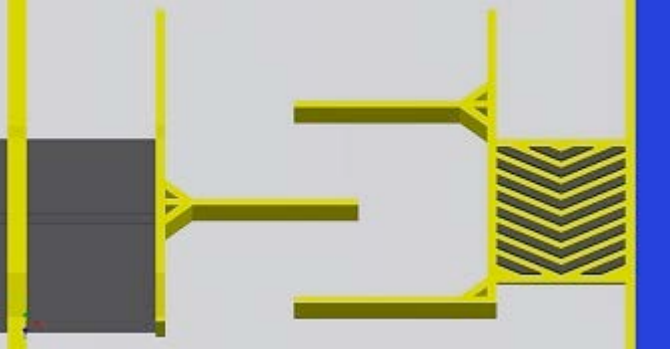
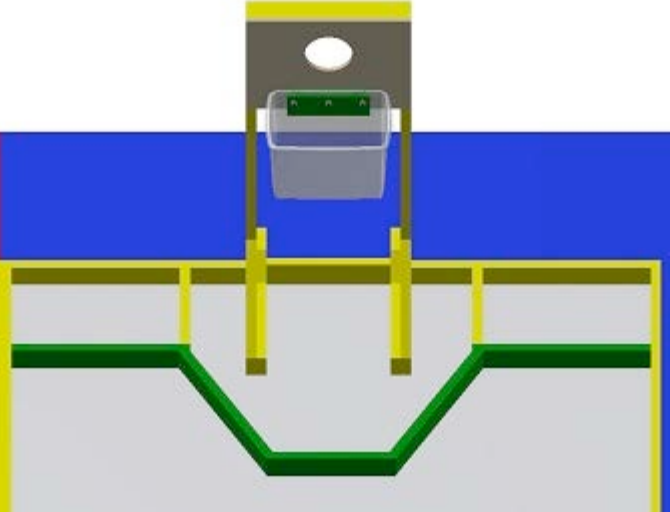
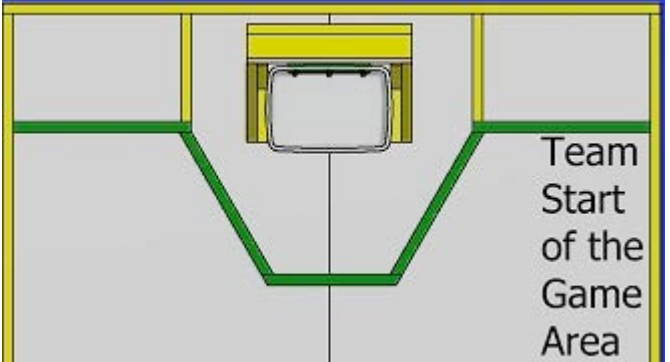
The core game situation is Football with the focus on can a Higher Reward / More Technically Difficult Passing Game beat a Lower Reward / Less Technically Difficult Running Game.

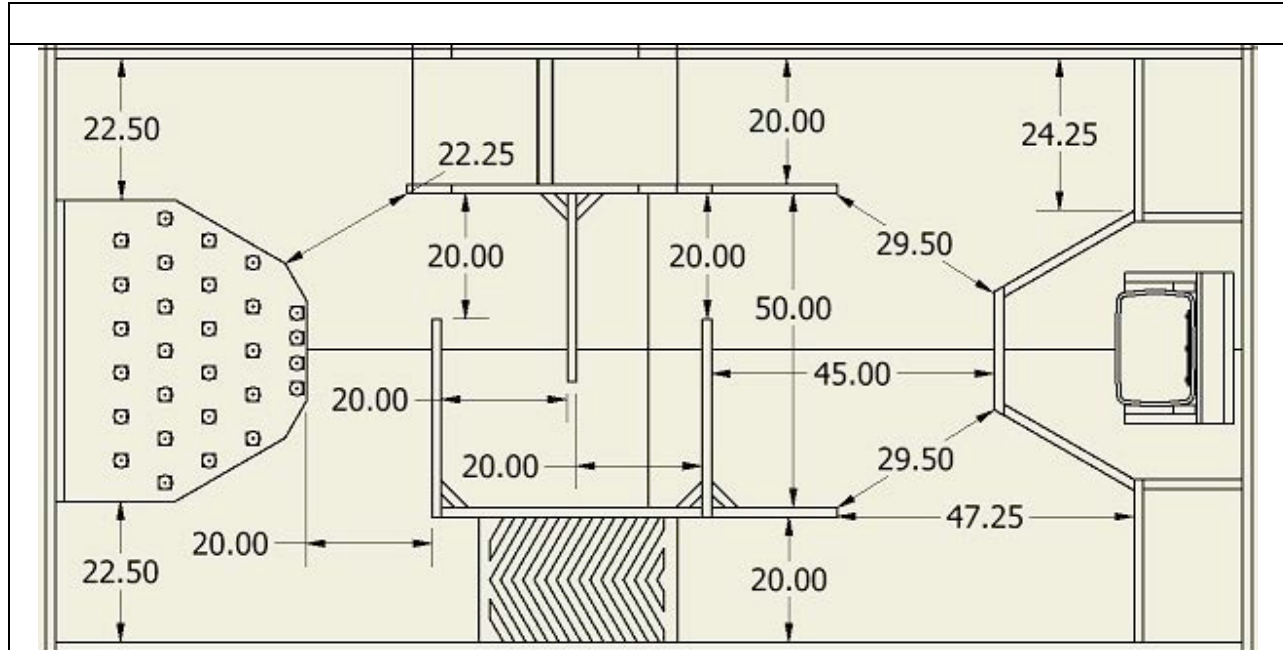


Each team's exclusive use space has a football source platform where 28 sponge footballs approximately 3.25 in. long with a major dia. of 2.25 in. are located.

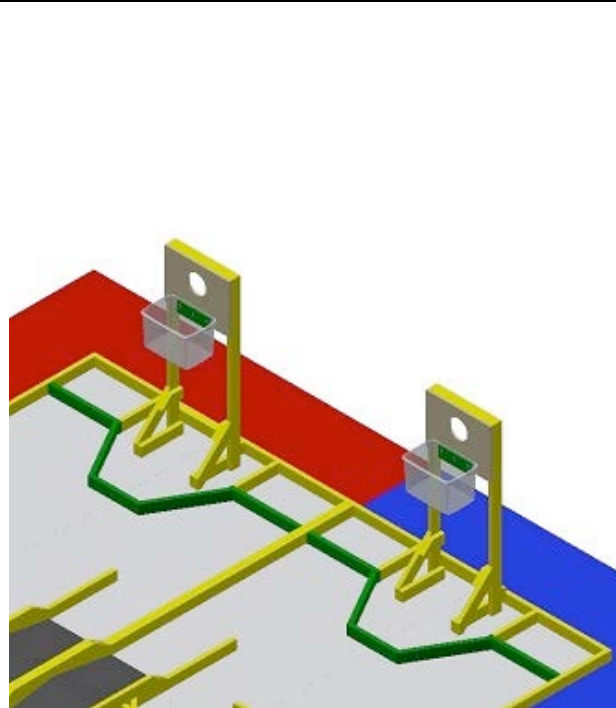
These footballs are positioned in a grid pattern on fixed in place stands that are 2 by 2 by 1.5 in.

The tee blocks form a passive defensive team with 5.0 in. spaces between the rows of tee blocks with the exception of the front row where the tee blocks are 2.0 in apart.

	<p>The transition zone separating the ball source area from the scoring area provides THREE travel options:</p> <ol style="list-style-type: none"> 1) A straight line path that includes travel over a two-sided ramp 2) A straight line path that includes travel over a bumpy road section 3) A winding path that provides a flat, smooth surface at ALL times
	<p>Teams can score:</p> <ol style="list-style-type: none"> a) Rushing touchdowns (deliver a football to the floor area beyond the green end zone line / barrier), Value: 1 Point b) Passing touchdowns (deliver a football into the elevated receiver's bin), Value: 2 Points, or c) 'Hail Mary touchdowns' by shooting the football into the 7" Dia. hole in the backboard. Value: 3 Points <p>Football MUST be completely free of contact with the robot when the end of the game buzzer sounds for points to be awarded.</p>
 <p>Team Start of the Game Area</p>	<p>Each team's complete entry start of the game position is in the outside corner of their scoring area.</p> <p>Each team's <u>entire</u> entry must be IN the starting position and in compliance with the overall maximum 4 cubic feet size restriction.</p>



Each team's exclusive use area is approximately 8 ft. by 16 ft. and provides a minimum passageway opening of 20 inches at all times.



- Games will involve two teams at a time.
- Both competitors are allowed unrestricted movement around the perimeter of their team's assigned court area.
- Teams can utilize a maximum of 2 tele-operated robots.
- Teams will NOT be in possession of a football at the start of a game.
- Each team's robot CANNOT be in possession of more than one football at any time.
- Robots in double tele-operated robot entries may possess one football each
- Teams may also have independent autonomous elements as part of their entry. These elements may possess **ONLY ONE** football at a time each and these football(s) do NOT count against their team's maximum two footballs at a time limitation.



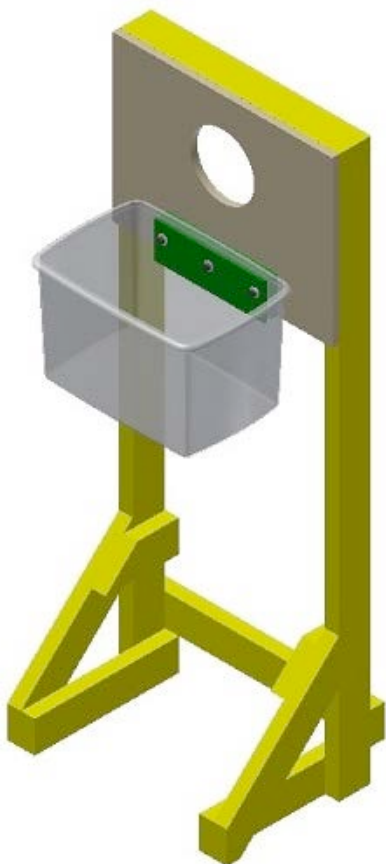
- The game footballs are mini foam footballs
- All schools preparing a 2017 Skills/Compétences Canada robotics teams in any province or territory will be provided with 36 mini-footballs at NO COST to the school by Studica.
- Schools requesting a competition set of mini-footballs MUST NOT contact Studica directly to request their footballs.
- Schools requesting a competition set of mini-footballs MUST DO the following:
- Send an email to Bob Tone, 2017 Skills/Compétences Canada Robotics Technical Chair, email address bobtone@rogers.com providing the following information:
- The name of your school and school board
- The name and email address of the teacher advisor supporting your Team
- The full school mailing address, the school phone number and fax number



- All Footballs will be standing on 2.0 x 2.0 x 1.5 in tees (blocks) that have a 1 in diameter 0.75 in. Deep hole at the center point of the block's top surface.



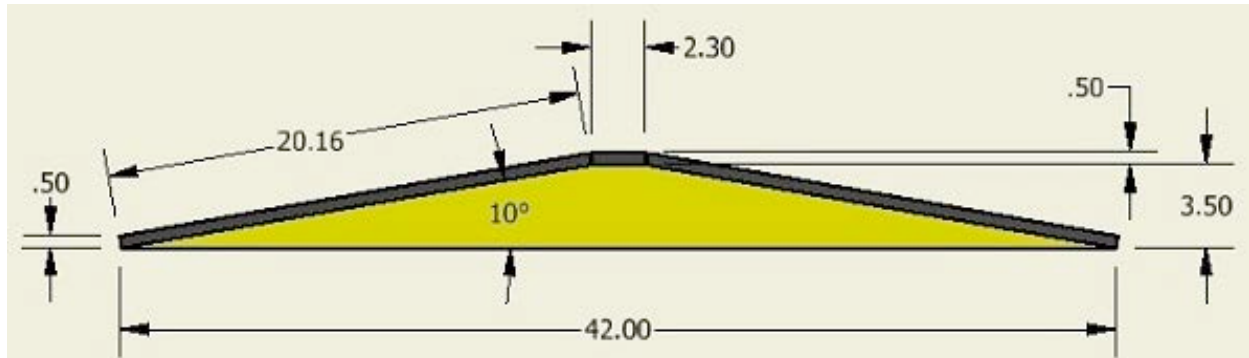
- The receiver's hands are a Canadian Tire 28 L ultra latch bin, Product ID: 142-0954-2 cost \$13.99 (CAN)
- NOTE: The bin comes with a lid that **WILL NOT** be used during game play



The receiver's hands (the elevated bins) provide:

- An approximately 16 by 12 In. Top opening positioned 48 Inches above the court floor
- Has its' forward edge 22 in. back from the end zone line / barrier
- Has a 7 In. Dia. hole positioned in the center of the backboard above the elevated bin.

The receiver's hands details are provided in the appendix section of this document.



- The ramp runs side to side in one passageway and the two sided ramp's details are provided in the appendix section of this document.



- The ramp slope and top caps ALL have straight edge cuts. This results in a small opening where the slope and top caps meet.



- These straight edge cuts result in a 0.5 in. Tall sloped edge where the ramp cap meets the court floor.

In Summary Teams will have exclusive use of a court area with:

- An open smooth surface, 2 sided ramp, bumpy road and winding passageway
 - Robot starting positions in the outside corner of the scoring area
 - The running scoring end zone is an irregular shaped 7 ft. 9.75 in. wide area defined by a 3.5 in. tall end zone line / barrier.
 - Running touchdowns are scored by delivering the football onto the floor of the end zone area.
 - Robots are not allowed to climb onto the end zone line / barrier or to grasp hold of the end zone line / barrier
 - Robots are allowed to contact / touch the front of the end zone line / barrier or to reach over it.
 - Passing touchdowns are scored by delivering a football into the receiver's hands (the elevated bins).
 - No part of a robot may make direct contact with the receiver's hands (bin) or the structure supporting it (touch or lean on these items for support).
 - Balls cannot be retrieved from the end zone and put into play a second time.
- Robots must stop all operation when the end of the game buzzer sounds.

Pit Area and Court Area

Robots must be designed and built by students to the criteria outlined in this document.

A pit area is provided so that students may make repairs and improvements to their robots between games. (Note: Teachers are not permitted in the pit area once the competition has started).

Teams must bring their robots into the competition area when the orientation meeting is held. Teams are not allowed to remove their robot from the competition area during the over-night periods between Orientation Day, Competition Day 1, and Competition Day 2 of the competition.

The pit area and competition court may be available to teams to work or practice during lunch breaks.

Medals will be awarded based on:

- Robot on the court performance in Day 1 Games, identified through the results of Day 1 Tournament Play will be combined with the results of Competition Day 2 Robot Performance to determine the awarding of medals.

Scoring

Teams will be awarded Game Points on the following basis:

1. **One Point** will be awarded for each football delivered into the end zone.
2. **Two Points** will be awarded for each football delivered into the receiver's hands.
3. **Three Points** will be awarded for each football delivered through the backboard hole.
4. **Tournament Standing** will be determined based on the total points scored in all tournament games played by each team.
5. All teams will play an equal number of tournament games.

Score Sheet				
Game # Court A Team Name	Total Number of Running Touchdowns Value: One Point Each	Total Number of Passing Touchdowns Value: One Point Each	Total Number of 'Hail Mary' Touchdowns Value: One Point Each	Total game Score
Team Signature:				
Game # Court B Team Name	Total Number of Running Touchdowns Value: One Point Each	Total Number of Passing Touchdowns Value: One Point Each	Total Number of 'Hail Mary' Touchdowns Value: One Point Each	Total game Score

Rules and Regulations

1. Each Team will be assigned exclusive use of a court space.
2. Each team will be assigned a team court side area.
3. Both competitors are allowed to move freely throughout their team's assigned courtside perimeter.
4. Robots may reach over the end zone line / barrier but robots may NOT touch any element of the court within the end zone.
5. Teams may NOT install a camera or other image generating device on their robot for the purpose of sending a signal / image to an outside the court surface lap top or other type of signal receiver visible to either the spotter or driver.
6. An autonomous robot by competition definition is a device that is turned on at the start of the game and operates without input from the user during. This robot may perform based on feedback from on board sensors or may be pre-programmed to perform or repeat a routine task

Tournament Play

1. Tournament standing will be based on the total number of points scored in all games played by each team.
2. There will be no playoff game following the tournament. Team's score for the day will be determined by summing all the scores in each tournament game.
3. Teams will play in an equal number of tournament games.
4. If time permits, teams will participate in an equal number of games against each opponent team.
5. Tournament games will last 4 minutes.
6. The amount of time between games will be determined by the number of participants. This information will be provided to teams at the start of the tournament.
7. Between tournament games, battery changes and repairs to robots may be completed at the team's assigned worktable.
8. During the competition, protective safety glasses and appropriate Personal Protective Equipment is expected to be worn while performing material removal tasks (cutting, drilling, etc.).
9. During game play, the National Technical Committee (referees) will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.
10. Damaging the court area will not be tolerated. If a robot's design causes damage to the footballs, or court elements, then it will not be allowed to compete until it can operate without causing damage. Games missed due to this situation will be forfeited.

NOTE: Damage is considered to be breaking court components. Robots bumping into court components and causing them to shift position without breaking any court element will not be considered to be damaging the court. It is expected that all court components will be fixed firmly in place so that the court is a neutral factor in the competition.

11. Games will start on time. Teams are responsible to know when their games are scheduled. Teams arriving late will be allowed to use the remainder of the time in the game. Competitors cannot enter onto the court surface or make adjustments to their robot during a game.
12. If a robot is mal-functioning and represents a hazard to participants, other robots or itself in the opinion of the National Technical Committee (NTC), then, the NTC may stop the clock, and may authorize the shutting off of the robot during a game. Disabled robots or parts of robots not generating any safety concerns will be left on the court until the game time expires.
13. It is a team decision what roles team members will fill. Drivers are the competitors holding the robot controller and asserting direct control over a tele-operated robot.

14. The spotter would be the competitor providing navigational guidance to the driver.
15. Competitors may change roles while a game is in progress.
16. Competitors (driver/s and/or spotters) can move freely in their assigned courtside team area throughout the game.
17. Competitors may **not** enter an opponent team's assigned courtside team area at any time during game play.
18. At the start of a game, robots are expected to be in their team selected starting positions.
19. Robots arriving after a game has started will be allowed to enter the game and use the time remaining in the 4 min. game.
20. Robots must not leave the competition court at any time during a game.
21. It will be the NTC ruling that decides if an end of the game 'football delivery' took place before or after the game-ending buzzer sounded.
22. Scoring will take place after the end of the game buzzer
23. Footballs miss shot by teams that land in an opponent's end zone or receiver's bin will remain where they landed and will score points for the opponent team at the end of the game.
24. Footballs landing outside the court boundaries, as a result of robot behavior, will **not** be returned to the competition court.
25. No aerial (flying) robots are allowed.

Court Layout

Note: Although great pains will be made to keep the court in compliance with the drawings, some inaccuracies in construction may occur. Please make your robot designs allowing for a possible ½ inch tolerance.

The primary court items that have a direct bearing on robot design are:

- 1) The open court surface will consist of the good side of 'White Melamine Sheets' **OR** the facility floor **OR** the smooth side of Masonite Sheeting.
- 2) The perimeter court wall, passageway sides and the end zone line / barrier are made from 2 by 4 inch planks laying on their narrow side.
- 3) The football tees / blocking blocks are 2.0 by 2.0 by 1.5 in.
- 4) The football source platform is a 0.75 in. thick plywood sheet

Detailed court information has been included in the appendix section of this Contest Description.

The Robot(s)

Restrictions

All Day 1 robots must pass a pre-competition inspection for compliance with the safety and design rules before they will be allowed to participate in tournament games.

Note: Robots must remain in compliance with these rules throughout the competition. If teams fall out of compliance with these rules then they will not be permitted to compete and will forfeit all of their scheduled games until they have corrected the problem.

Start of the Game Robots Status

When a robot's main power is turned on prior to the start of a game the robot must be in an overall 'Idle State' and the following conditions must exist:

1. Robots must be stationary
2. Robots must be in their team selected starting location.
3. If team entries involve multiple robots / mechanisms then all of them must be placed in the team selected starting location and must be positioned to not exceed the allowed total 4 cu ft. volume per team.
4. All systems may be ON.
5. Air system circuits may be fully charged to 100 PSI and their compressors can be ON.

Overall Team Robot Entry Size

Complete team entries must not exceed an overall size of **4 cubic feet** (6,912 cubic inches) at the start of each game.

Team entries may expand to a larger size once a game has started.

Overall team entry size will be calculated by using the maximum single dimension in each category (Length / Width / Height) of the complete team entry not average dimensions.

This overall size maximum will allow team entries to be any variation / combination of elements that does not exceed **6,912** cubic inches, using the following formula:

$$\text{Volume} = \text{Length} \times \text{Width} \times \text{Height}$$

Power Sources/ Management

1. The total voltage in any individual circuit cannot exceed **24 Volts**.
2. The maximum continuous power rating allowed in any circuit is **240 W**, which will be limited by voltage and fuse selection. To calculate power in any given circuit, use the following formula:
$$\text{Power (Watts)} = \text{Voltage (Volts)} \times \text{Current (Amps)}$$
3. Teams are reminded that it is the purpose of a fuse to protect the students themselves and the equipment in their circuits. Teams must develop circuit diagrams, and calculate the appropriate values for all circuits on their robot. Teams must submit a wiring diagram of their robot's circuits.
4. Each current branch path from the battery must include either an **in-line fuse, resettable fuse, circuit breaker**, or be connected to a dedicated fuse in a rack.
5. Batteries must be complete sealed commercial battery packs.
6. ALL Robots must be able to be turned off with a single motion.
7. Robot controller receivers may be in an independent circuit.
8. No explosive materials of any kind may be used (ether, gunpowder, acetylene etc.).

Non-Electrical (Battery) Energy Sources

Pressure based energy sources (air or other) may be pre-charged to a maximum of 100-PSI pressure in their reservoirs (cylinders) at the start of each game.

1. Air pressure systems using competitor-made or modified air pressure hardware are **NOT** permitted.
2. All pressurized tanks on robots must have a pressure gauge to indicate the stored pressure and a form of automatic overpressure safety relief system.
3. The pressure tanks and related gauges / controls must be shielded from damage due to collisions or flying target objects.
4. The stored pressure in the tank must not exceed a maximum of 100 PSI at any time.
5. Tension-based energy sources (elastics, springs or other) may be in either a relaxed at rest state or in a tense / compressed state at the start of each game.
6. Laser devices are prohibited.

Recommended Controllers

1. It is recommended (not required) that all teams use 2.4 GHz “non-crystal” control systems on tele-operated robots.
2. Teams are allowed the use of an unlimited amount of channels, but only two separate tele-operated robots. Teams assume full responsibility if any interference is to occur with their respective communication systems that could render the robot(s) useless.
3. Tele-operated robots may not transmit audio/visual information to off the robot devices. (Ex: Having a camera transmit images real time to a computer near the driver, etc.)

Pit Area

1. Competitors must wear safety glasses when doing fabrication work involving material removal processes (grinding / cutting).
2. Only registered robot competitors are permitted in the pit area.
3. Designated teacher/industry team advisors are permitted in the pit area **only** to inspect the worktable setup of their team prior to the start of the tournament.
4. Designated teacher/industry team advisors are **not** allowed in the pit area during tournament play.
5. Teachers and industry advisors are not permitted to handle tools or robot parts. Students must affect all repairs and modifications on their robot.
6. Teams will be provided with a pit area workspace on a standard project table. Depending on the number of teams and availability of space, teams may have to share a 60 by 30 inch table.
7. Each pit area table will have access to one electrical outlet. Teams are requested to bring a 25-foot multi-outlet extension cord / power bar as part of their equipment.
8. It is required that teams fabricate a **tabletop stand** for holding their robot(s) in the pit area. This stand or these stands should hold the robot(s) securely and be capable of preventing the robot(s) from driving on or off the table in the case of either deliberate motor testing during repairs or due to random, unexpected motor activity.

Overall Court Description

- The court-playing surface will be a 16' by 16' square.
- Individual exclusive use team spaces are 8' by 16' rectangles.
- The perimeter court walls will be made using 2 by 4 inch planks.
- This wall will as a result be approximately 3.5 inches tall.
- The court surface may vary between melamine, concrete, hardboard, or plywood.

Day 1 Pre-Inspection for Compliance with Safety and Design Rules

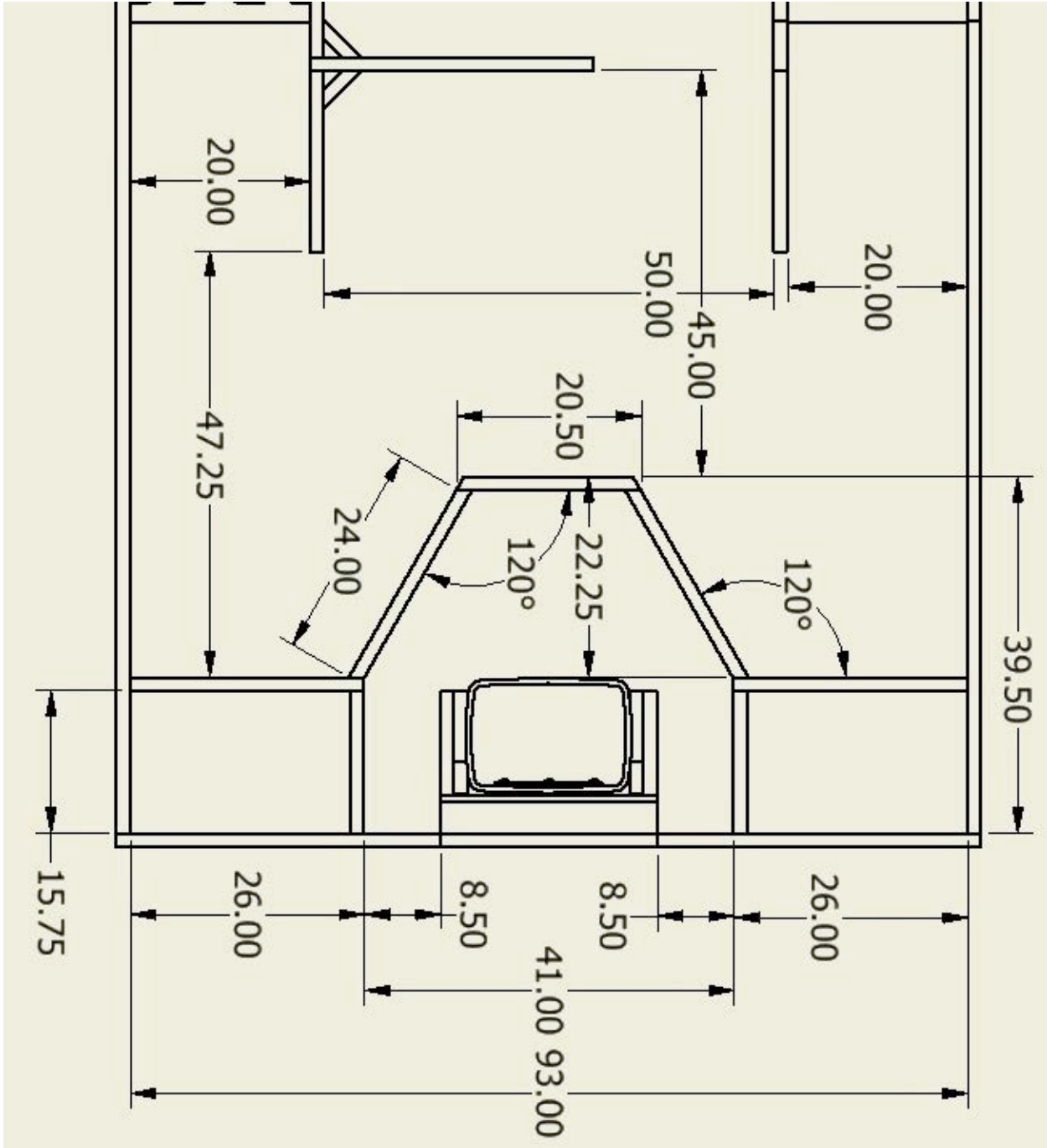
- Mandatory wiring diagram provided.
- Table top robot stand
- Overall volume $\leq 4 \text{ ft}^3$ or $6,912 \text{ in}^3$
- No explosives/combustibles
- No lasers
- All batteries are sealed commercial batteries in good physical condition
- Batteries wired in series should be the same amp hour rating (ex. both 1500 mAh) and batteries in parallel are of same voltage (ex. both 12 volts).
- Batteries securely mounted
- Total voltage in any individual circuit does not exceed 24V
- No circuit exceeds 240W (Voltage x Fuse Current Rating, easily accessible)
- All circuits have a fuse or breaker (breakers must have **DC rating**) and all fuses / breakers must be readily accessible.
- Mandatory Pressure System Circuit Diagram provided.
- No competitor-made or modified air pressure hardware being used.
- Only commercially manufactured pressure tanks (cylinders) can be used.
- Pressure indicator
- Pressure in tanks does not exceed 100 psi
- Over-pressure safety valve
- Pressure tanks and related gauges and controls are shielded from damage due to collisions
- Robot is able to be turned off with a single motion. Radio receivers / logic circuits may be independent of the kill switch.
- Control unit to support operator to robot communication are being used.
- Demonstration of robot functionality

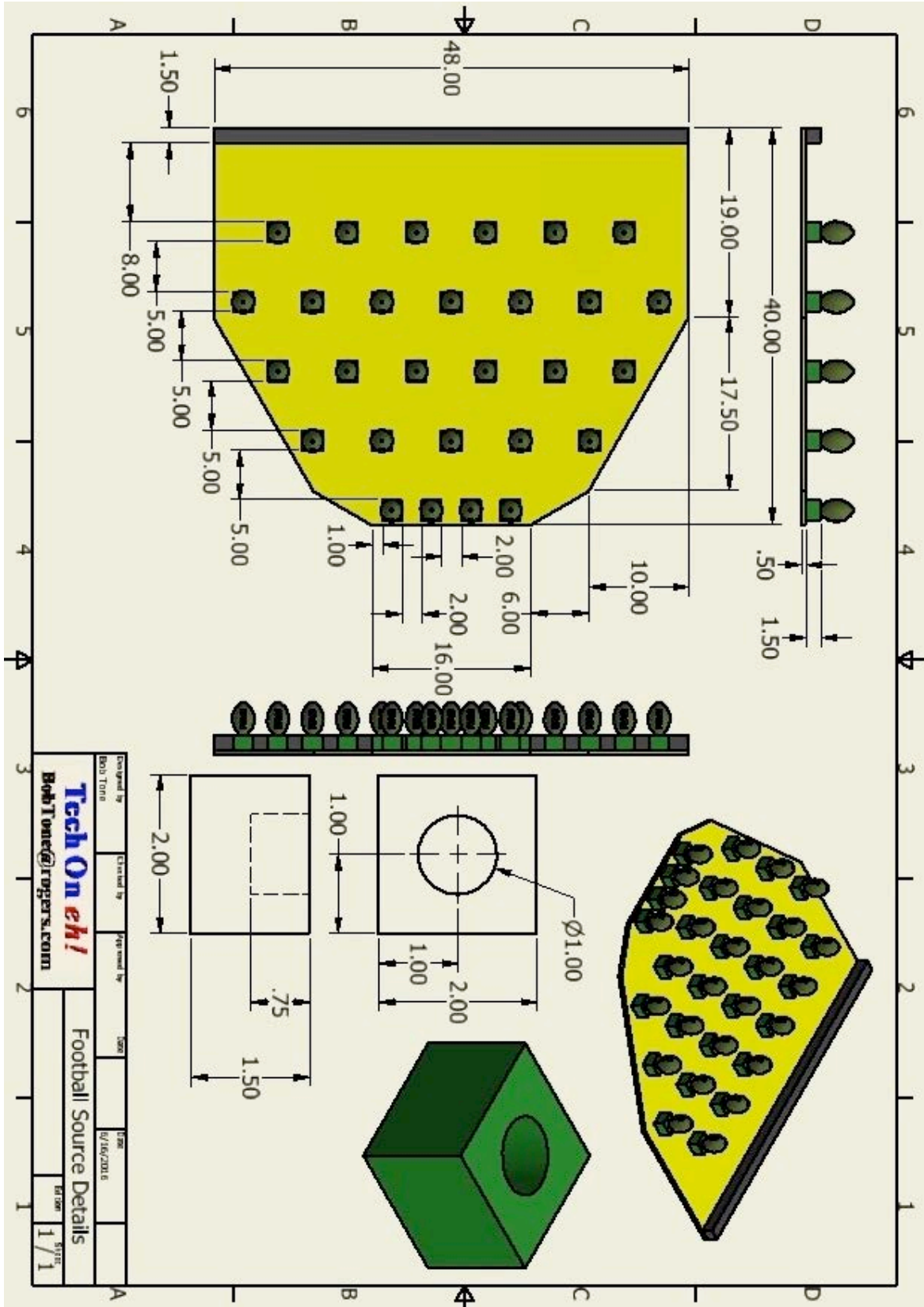
Additional concerns:

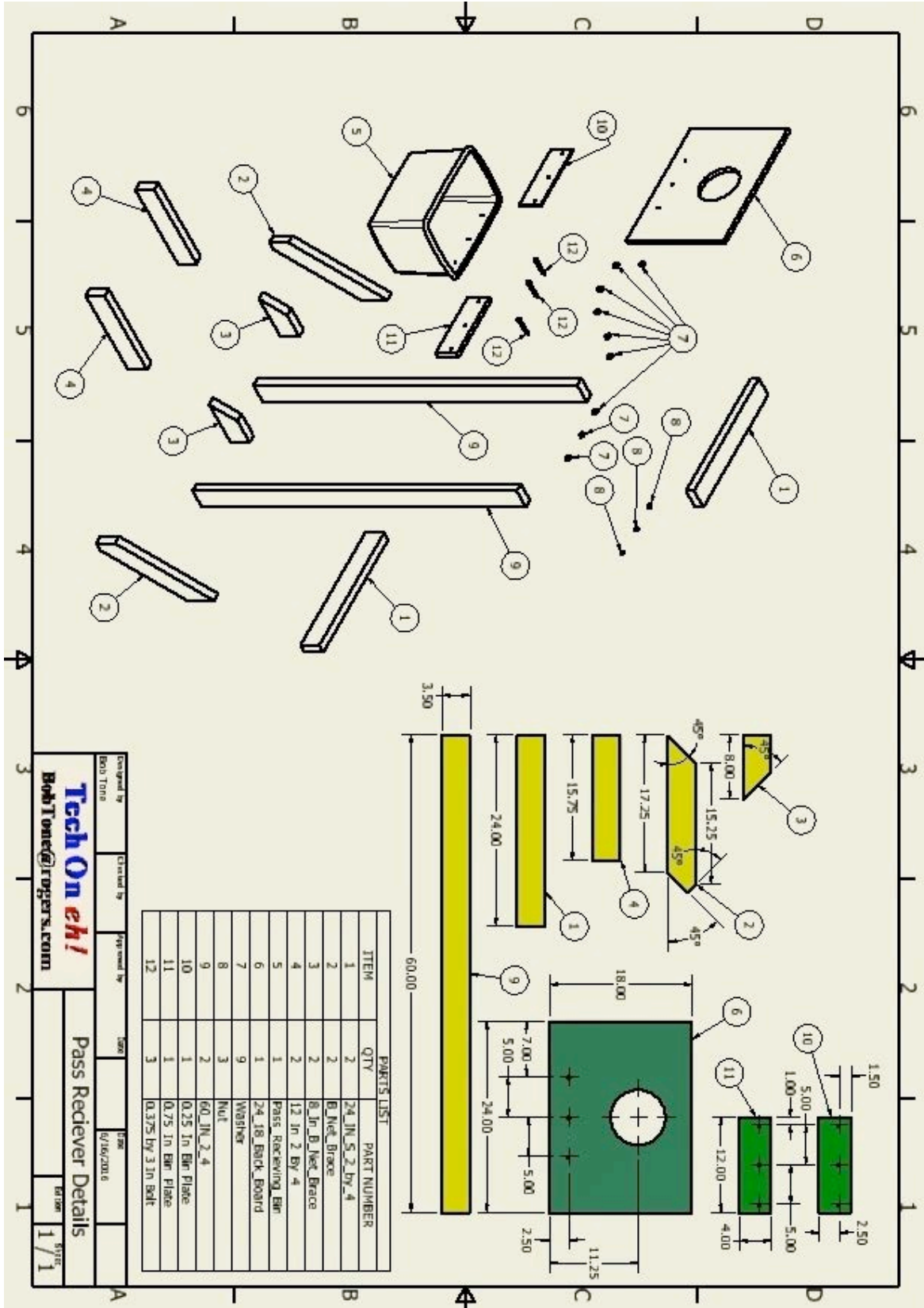
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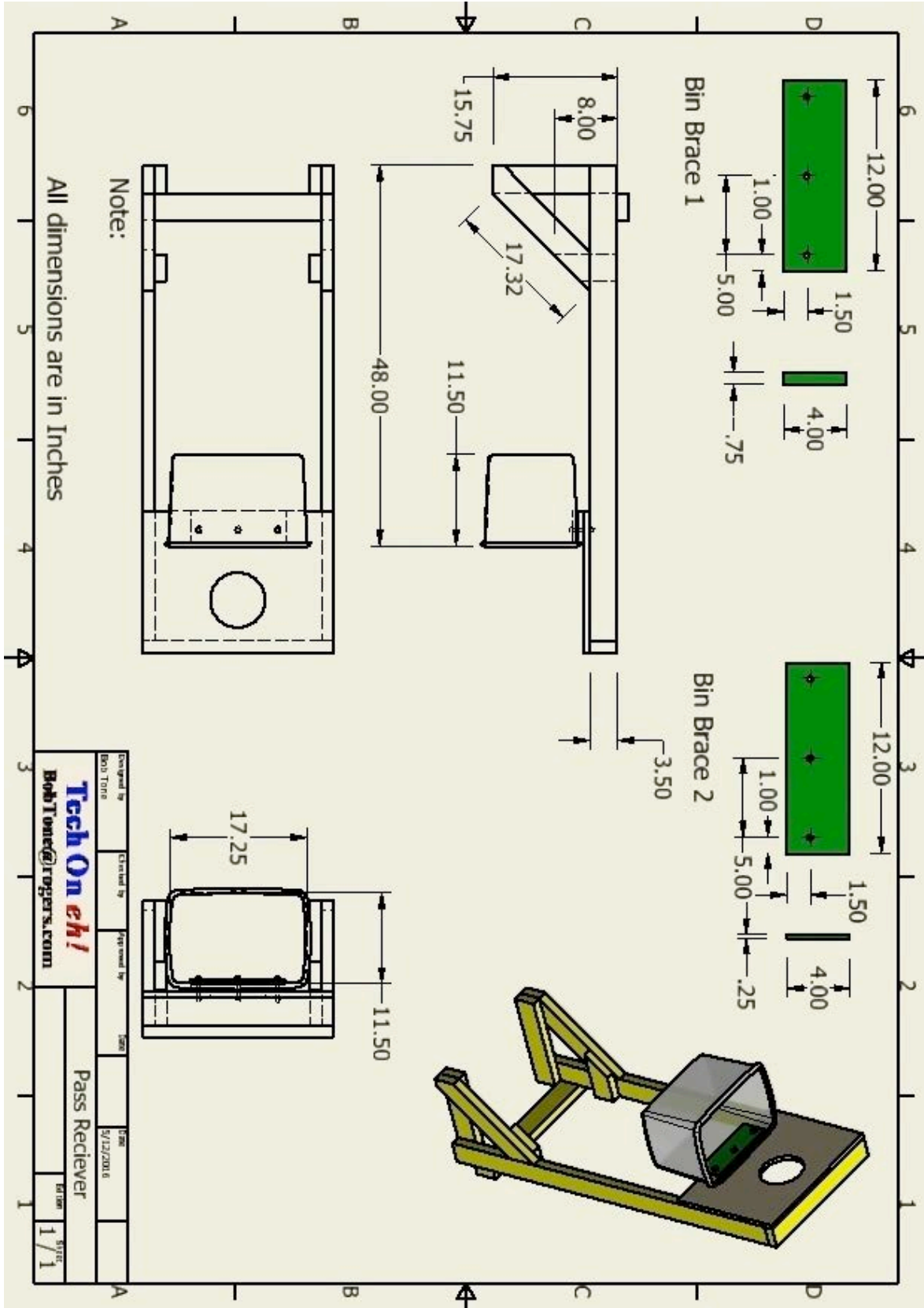
Robot Evaluator Signature

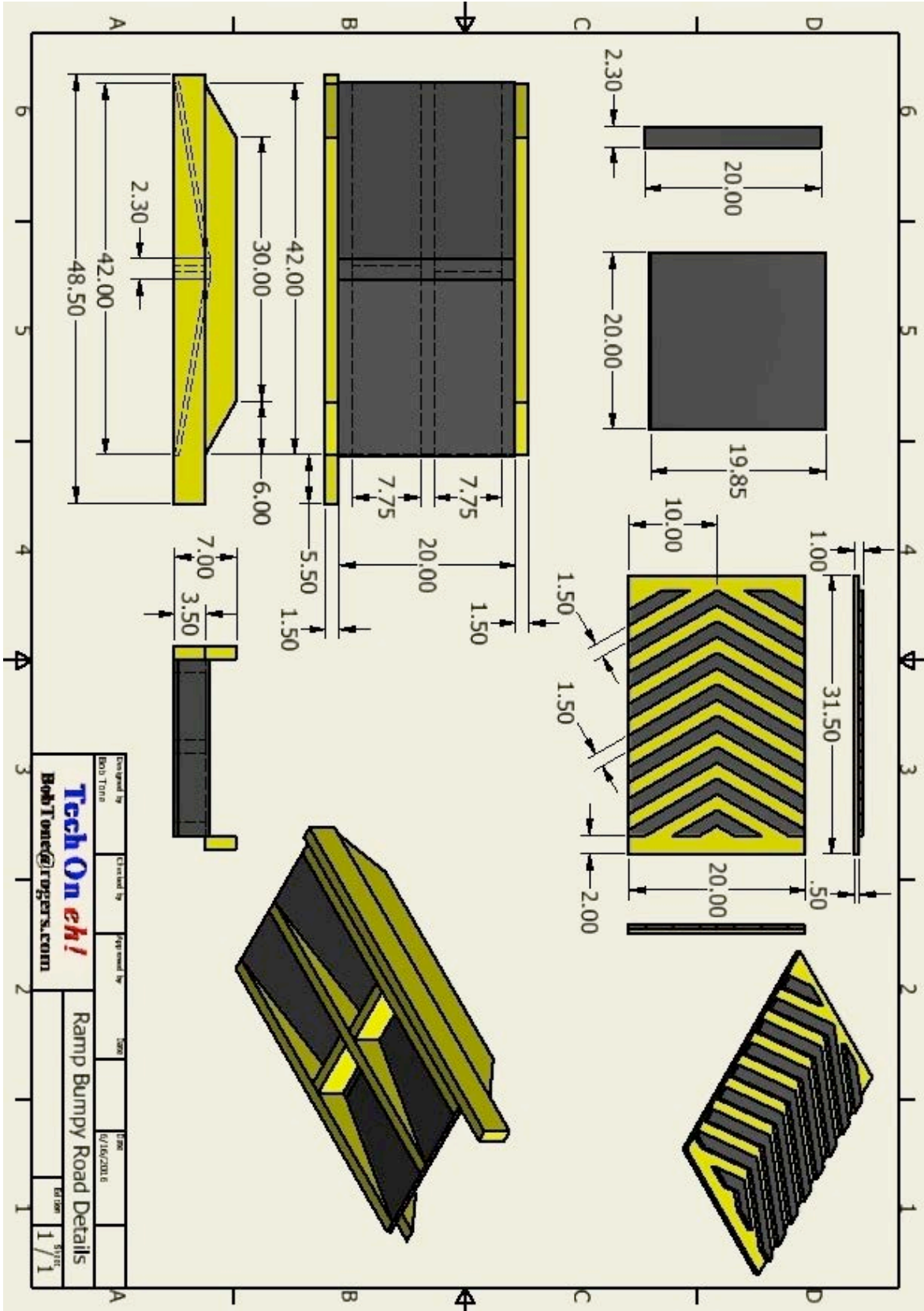
Team Representative Signature











Day 2 Competition Overview

- In Winnipeg, competitors will be provided, at no cost to the teams, with a Competition Component Collection during the Orientation Meeting.
- A description of the Competition Component Collection will be posted to Studica.ca in September 2016.
- On Day 2 competitors will build on-site dual system RC / Autonomous Robots using the provided common set of components. However, competitors will be allowed to start their 'On-site Robot Build' on Day 1 if their time / work management skills enable them to make Day 1 time available.
- RC mode performance is intended to confirm mechanical and electrical systems work independent of the autonomous programming quality
- Autonomous mode is the primary focus of Day 2.
- Competitors will demonstrate their robots performance in a court composed of a 4 ft. by 8 ft. sheet of white melamine floor surface with 6 in. tall perimeter walls either white foam art board or ¼ in. white hardboard

At the start of Day 2 the competitors will be told the specific robot behaviors their built on-site robots need to complete.

The suggested performance items listed below reflect the type of core isolated robot performance elements competitor robots will need to complete:

- Follow wall perimeter,
- Navigate a maze,
- Navigate around obstacles,
- Follow a colored tape line on the floor,
- Locate and touch an object on the floor,
- Follow a metal track in the floor,
- Pick up a small object and move it to a new location

Competitors must understand the list above represents **samples ONLY** and does not present a final or complete list of the potential robot behaviors they might be asked to create.

Teams need to develop an understanding of the performance capabilities of ALL components in the competition collection and prepare to be able to use any of these components effectively.

On the Court Performance Evaluation

Evaluation will involve isolated performance elements one at a time as in the example below.

Example: Follow the wall task in the open rectangular court may be marked as follows:

1 Mark per wall followed to its' end under radio control for a maximum of 4 marks
3 Marks per wall followed to its' end under autonomous control for a maximum of 12 marks
Total marks if a team completes the task under both control formats maximum of 16 marks

At the start of Day 2 when competitors are provided with the actual competition performance requirements collection they will also be provided with the evaluation details related to each requested performance sequence.

Competitors need to be prepared to beyond the initial single stage performance requirements to multi-stage performance requirements as the culminating end of the day experience.