



17TH ONTARIO TECHNOLOGICAL SKILLS COMPETITION

CONTEST NAME: Robotics (*team of 4*)

SECONDARY LEVEL

CHAIR: Bob Tone (bobtone@rogers.com)
COMPETITION TIME: 16 HOURS (2 days)

**** Gold medal team will advance to the Canadian Skills Competition.**

ALL schools with Teams working on a Robot are asked to contact Bob Tone directly at bobtone@rogers.com. This will ensure that they receive ALL information updates and shared Questions / Answers about the competition details during the September to May Competition Period. The Questions and Answers will also be posted on the www.skillsontario.com webpage under the Robotics Scope Link and at www.libermann.tcdsb.org.

PURPOSE OF THE CONTEST:

To create an engineering project to encourage individuals with different skill sets to form co-operative teams to design, fabricate and operate a robot.

SKILLS AND KNOWLEDGE TO BE TESTED:

Drafting, mechanics, electronics, metalwork, wood work & communications

EQUIPMENT AND MATERIALS:

Supplied by the Competitors:

- Robots including robot accessories, batteries, and battery charger
- Extension cord, power bar, various tools required to modify and repair robots on site
- Safety equipment including mandatory eye protection.

Supplied by the Committee:

Playing Field, timer, one 120V power outlet (minimum 100W), one worktable

TIME TABLE

Monday May 1, 2006 – 8:00 a.m.	Registration
Monday May 1, 2006 – 9:00 a.m.-3:30 p.m.	Round Robin Tournament
Tuesday May 2, 2006 – 9:00 a.m. – 3:30 p.m.	Round Robin Tournament and Playoffs

JUDGING CRITERIA:

Robot performance in the specified tasks	95%
Group Presentation	5%

JOB INTERVIEW:

All four team members must conduct a 5-10 minute group presentation on their robot. The presentation should include: why their robot was designed and constructed in that particular way, the process involved, the expected outcomes and performance, and a sales pitch directed at a consumer as to why they should buy this robot. This presentation will be worth 5% of the team's overall mark.

ADDITIONAL INFORMATION:**Mission Statement**

The primary intent of any Ontario Technological Skills Competition (OTSC) – Robotics Contest is to:

- have teams of students independently design and build robots capable of completing the competition tasks
- to compete with robots which are student-fabricated.

Note:

Teams must avoid the purchase, re-use or adaptation of complete systems that were commercially fabricated to address a task set very similar to the OTSC Robotics Contest. Teams MAY use the design of commercial mechanisms or systems, which can complete some tasks of the OTSC Robotics Contest, but they must fabricate the mechanisms themselves. It is expected and acceptable that teams will use some newly purchased and recycled parts or components (motors, gears, etc.) to fabricate mechanisms, which will complete the OTSC Robotics Contest tasks.

Provincial technical committee members will make checks for adherence to this statement at the OTSC – Robotics Contest.

Looking Ahead

Skills/Compétences Canada has been working for several years to bring Mobile Robotics forward as a new WorldSkills Trade category. While at this time it is not yet a certainty it is however quite possible, that during the May 2006 WorldSkills Meetings in Melbourne, Australia, Mobile Robotics will be approved as an Official Demonstration WorldSkills Competition Category. This will result in a team of two competitors being invited to represent Canada at the 2007 WorldSkills Mobile Robotics Challenge. If Mobile Robotics is approved as a 'New Trade', then providing all selection criteria is met as identified in the document titled "Team Canada Selection Criteria" which is available on the Skills/Compétences Canada web site, two team members from the Skills/Compétences Canada 2006 Gold Medal (4 competitor) Mobile Robotics Team will be selected to represent Canada in Shizuoka, Japan from November 14 to 21, 2007 at the 2007 WorldSkills Games.

The Hoop Challenge

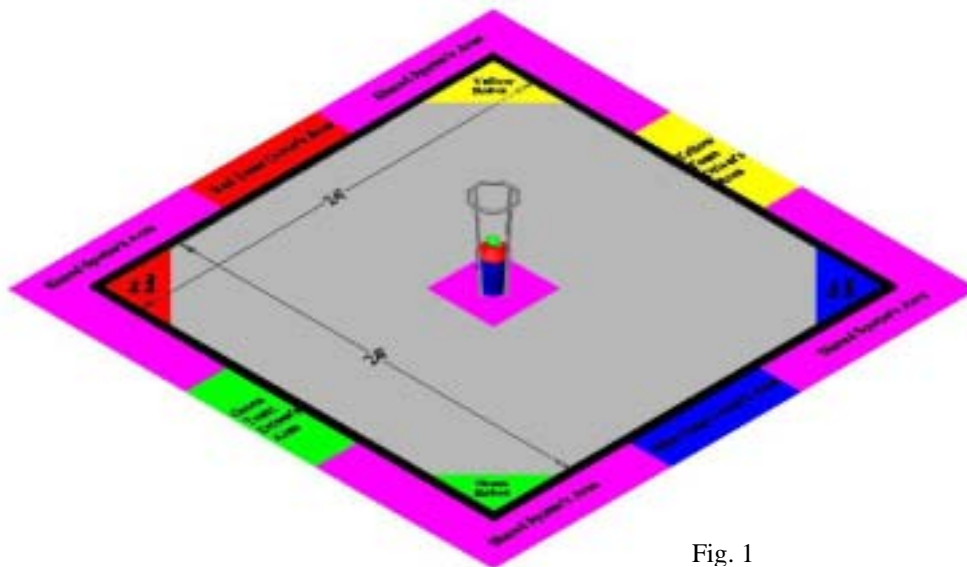


Fig. 1

BASIC OBJECTIVES

1. Radio controlled robots will play a modified game of basketball.
2. Robots will navigate over a smooth hard surface.
3. Robots will start the game in possession of **one** junior sized football (please refer to Appendix I for parts specifications).
4. One additional football will be placed on top of the pail lid that is part of the Center Goal Structure (see Appendix II for image of Center Goal Structure, and Appendix III for dimensions).
5. Robots score points by “delivering” footballs into the net of the Center Target Structure.

GAME RULES

Drivers and Spotters

1. Each team will designate 1 driver and 1 spotter.
2. Drivers use a 6 channel radio control to communicate with their robot and **MUST** remain in their assigned driver's area throughout the game.
3. Spotters may move around the outside of the court, but must **NOT** enter:
 - a) the playing court during a game
 - b) the opponent's driver area
4. No electronic equipment (radios or other signaling devices) may be used to support communication between the drivers and spotters.

Game Play

1. At the start of the game, robots will be placed in their assigned starting positions loaded with 1 football.
2. There will be 1 more football than there are teams on the court.
3. The Single Central Elevated Horizontal Target Ring will have an open ended netting and footballs delivered into this net will fall onto the pail lid and return to the Competition Court Surface making them available for re-use by the ALL Robots.
4. Points will be awarded at the end of each game based on the number of footballs delivered into the net. Every "basket" scored has a value of one point.
 - a) It will be a referee's ruling that decides if an "End of Game Shot" took place before or after the game-ending buzzer sounded.
5. During game play ALL Robots may retrieve any football that is on the Open Court Floor Area and on the Center Goal Support Plate.
 - a) Robots are **NOT ALLOWED** to drive onto the surface of the Support Plate of the Central Goal Structure.
 - b) Robots are **NOT ALLOWED** to have possession of more than one football at a time.
 - c) Robots **MAY NOT** attempt to take footballs that are in the possession of other robots.
6. No part of the robot may enter into the Target Net.
7. Robots must not leave the competition court at any time during a game.
8. Footballs landing outside the court boundaries will be returned to the court by being placed on top of the pail lid by the referee.

Infractions

1. Deliberate damage to the court and/or footballs is illegal.
 - a) If a robot causes damage to the court it will be removed from all games until it can operate without causing damage.
 - b) Games missed while repairs/modifications are made will be forfeited.
2. Deliberate strategies aimed at the destruction, collision, damage, overturning, entanglement or active blocking of competitor robots are not in the spirit of the game and are strictly forbidden. Ramming and pushing are not allowed.
 - a) Forfeiture of, and removal from the match will result with the first occurrence.
 - b) Expulsion from the games will occur after the second occurrence.
3. Competitors may not enter the court surface or make adjustments to their robots during a game. If a robot is mal-functioning and represents a hazard to participants, other robots, or itself, the referee may stop the clock and authorize the removal of the robot from the court. (note: disabled robots, or parts of a robot not generating safety concerns may be left on the court until the game time expires.)

4. Robots may NOT rest/support a gripper or arm or any other part on the Center Goal Structure, pail lid, supporting legs, top rim, or the net. (incidental touching of the lower section of the pail sides and supporting legs will be tolerated as long as there is no damage being done to the Center Goal Structure). However, robots deemed to be in violation of this rule by the referee will be asked to:
 - a) move away from the Center Goal Structure and return to their original game starting position
 - b) if they are in possession of the football, they will be instructed to release it, and the referee will place the football on top of the pail lid and instruct the robot to rejoin the game

ROUND ROBIN PLAY

1. Up to 4 robots will play on the court in round robin games.
2. Round robin games will last 4 minutes.
3. All robots should expect to play at least 10 round robin games.
4. Teams may use the time between round robin games to change batteries and make necessary repairs to their robots.
5. Teams are responsible to know when their games are scheduled.
 - a) Teams arriving late may not enter a game in progress and will forfeit that game.
 - b) Teams that withdraw from a scheduled game due to mechanical problems are asked to inform the referee of their decision to “forfeit a game” prior to the start of the game.

Round Robin Tournament Standings

1. Round Robin Tournament Standings will be determined by the total number of points scored by a robot in all of their tournament games combined.
2. A game score of zero (0) will be awarded to robots that “default” a game.
3. Total round robin standing ties will be broken by playing a special 4 minute tie-breaker games involving all robots that are tied.

PLAY OFF FINALS

1. 2/3 of the teams participating in the round robin tournament play will advance to the playoffs.
2. 2 robots will play on the court in playoff games.
3. Playoff games will last 8 minutes, comprised of 2, 4-minute periods.
4. There are no ties in a playoff game. If a tie score exists after the 2 period game than additional 4 minute periods will be played (as many as needed) until one team is declared the winner.
5. Between the periods in a playoff game:
 - a) batteries can be changed
 - b) no repairs can be made
6. Team numbers will be assigned by rankings from the round robin tournament. Playoff games will follow the pattern below:

Playoff Round I

Game 1: Team 1	vs.	Team 8
Game 2: Team 2	vs.	Team 7
Game 3: Team 3	vs.	Team 6
Game 4: Team 4	vs.	Team 5

Round I winning teams advance, defeated teams are eliminated.

Playoff Round II

Game 1: Winner of 1 vs. 8	plays	Winner of 4 vs. 5
Game 2: Winner of 2 vs. 7	plays	Winner of 3 vs. 6

Round II winning teams advance to the Gold/Silver Medal Game

Round II defeated teams advance to the Bronze Medal Game

Playoff Round III

Bronze Medal Game:	Round II's defeated teams
Gold/Silver Medal Game:	Round II's winning teams

Please note the pattern above is based on a playoff field of 8 teams. If there are more than 8 playoff teams the pattern will be adjusted accordingly. (for example: if there are 16 teams in the playoffs, Round I Game becomes Team 1 vs. Team 16.)

Please refer to Appendix IV for a sample scoring sheet.

GAME PLAY AREA (ONTARIO COURT LAYOUT)

Please note: Although great pains will be made to keep the court in compliance with the drawings, some inaccuracies in construction may occur. Efforts will be made to build the game area according to the specifications but that teams are responsible for examining the actual play area and adapting their robots if necessary.

1. The game play area consists of the main 24' x 24' floor area plus the Central Goal Structure.
2. The main floor area is a large flat space detailed as below and shown in Fig. 1. The surface will be either:
 - a) the facility floor (concrete)
 - b) or Masonite Sheets with their smooth side up with taped seams
3. The Central Goal Structure has (refer to Appendix II and III for diagram and dimensions):
 - a) 4' x 4' support base plate – made of $\frac{3}{4}$ " thick plywood
 - b) a Single Central Elevated Horizontal Target Ring – made of 1 $\frac{1}{2}$ " ABS Piping, 60" tall, with an open ended net hanging from the Target Ring Opening (24" inside diameter, 27" outside diameter)
 - c) a 27.5" tall garbage pail with a lid (refer to Appendix I for parts specifications)

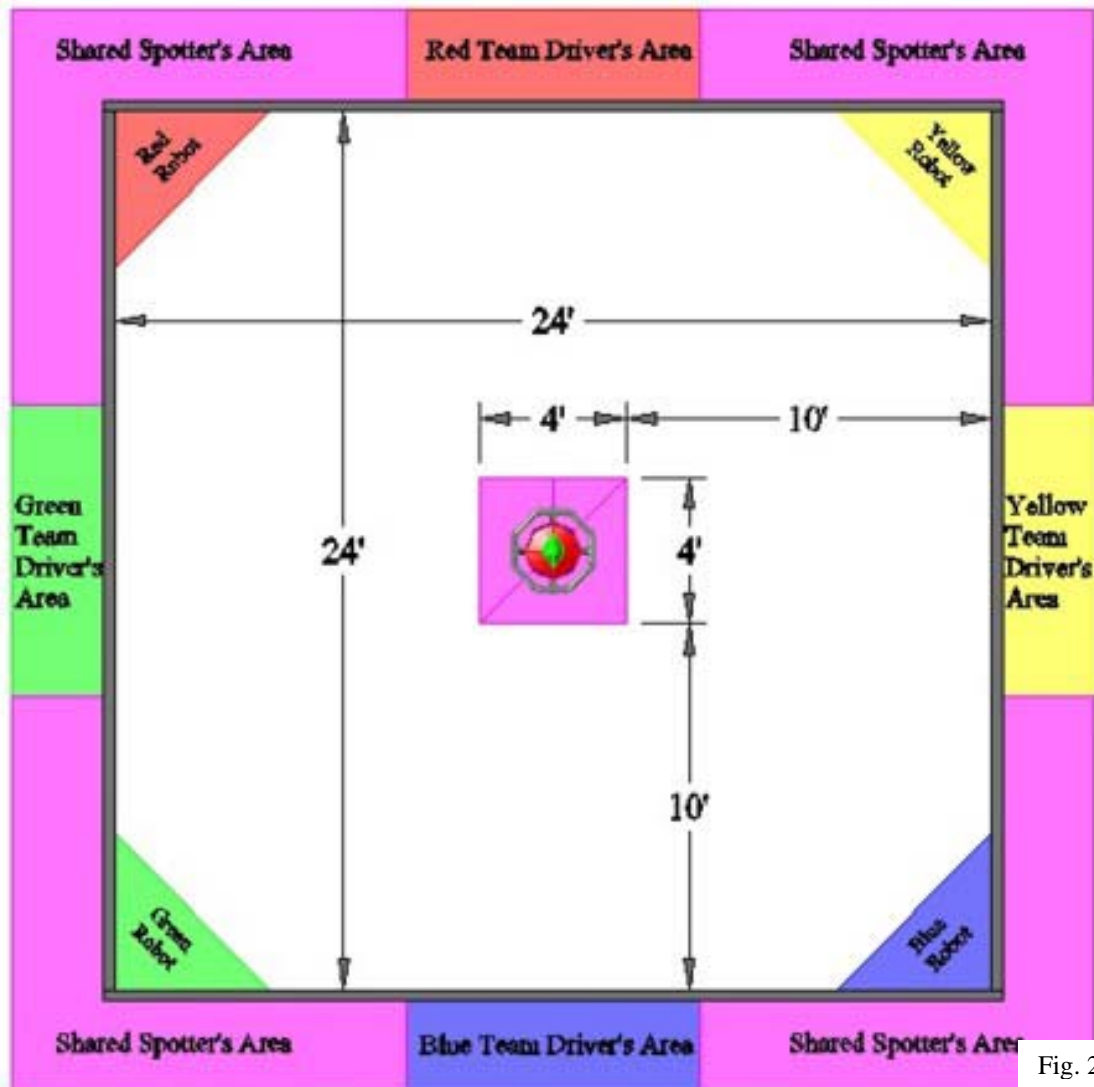


Fig. 2

ROBOT DESIGN CRITERIA AND RESTRICTIONS

All Robots MUST pass a pre-competition inspection for compliance with the safety and design rules. 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.

Overall Robot Size

1. Robots must not exceed an overall size of 8 cubic feet (13,824 cubic inches) at the start of each game.
2. Robots may expand to a larger size once a game has started.
3. Overall robot size will be calculated by using the maximum single dimension in each category (length / width / height) of the robot not average dimensions.
4. Some examples of robot dimensions include but are not limited to:
 - a) an overall dimension of 24" x 24" x 24", (13,824 cubic inches), or
 - b) an overall dimension of 42" x 18" x 18", (13,608 cubic inches), or
 - c) an overall dimension of 36" x 21" x 18", (13,608 cubic inches), or
 - d) an overall dimension of 48" x 24" x 12", (13,824 cubic inches).
5. The top of the radio antenna may be a maximum of 48 inches above the court floor. The radio antenna is not considered when defining the overall robot size.

Overall Robot Weight

1. No weight restriction is imposed on the robots.

Robustness

1. Robots should be built with a robustness in mind as accidental bumps and scrapes will happen. Deliberate ramming is not allowed. However, it is expected that robots may collide when moving towards the same football on the court floor.
2. Teams must consider protection of sensitive components and durability of exposed parts.

Hazardous Materials and Devices

1. No explosive materials of any kind may be used (ether, gunpowder, acetylene, etc).
2. Laser devices are prohibited.

Power Sources and Management

1. Batteries must be completely sealed commercial battery packs.
 - a) The total voltage in any individual circuit cannot exceed 24 volts.
 - b) All batteries and wires must be securely mounted taking into consideration that they must be protected from damage during collisions or upsets.
 - c) Teams are responsible for charging their own batteries. It is recommended that a spare set be available.
2. All robots must have an easily accessible main power "kill" switch.
3. Maximum circuit rating of 216 W in any circuit. (example: 12 volts*18 amps = 216 watts)
 - a) All circuits must be fused below this maximum power rating using:
 - i) an in-line fuse, or
 - ii) a circuit breaker, or
 - iii) be connected to a dedicated fuse in a rack
 - b) All circuits must use a wire gauge, which is appropriate to the current values in that circuit.

4. Teams may apply voltages to a motor up to 150% of the motor's marked rating. Note: Teams attempting this must thoroughly test their systems to ensure the motors do not "smoke" under all possible conditions.

Pressure Based Energy Sources

1. The stored pressure in the tank must not exceed a maximum of 90 PSI at any time.
 - a) All pressurized tanks on robots must have a pressure gauge to indicate the stored pressure.
 - b) All pressurized tanks must have an automatic overpressure safety relief.
 - c) May be pre-charged to a maximum of 90 PSI at the start of each game. **(NEW for 2006)**
2. No competitor-made or modified pressure tanks (cylinders) are permitted.
3. The pressure tanks, gauges, and controls must be shielded from damage due to collision or flying footballs.

Tension Based Energy Source

1. Elastics, springs or tension based energy source may be in either a relaxed at rest state or in a tense / compressed state at the start of each game. **(NEW for 2006)**

Motors

1. Teams may use new or recycled motors.
2. There is no restriction on the number of motors used on a single robot.

Allowed Parts List

1. It is impossible to create a comprehensive list of all acceptable parts. The following list is intended to provide guidance for teams. Acceptable components include:
 - a) electronic speed controllers
 - b) DC motors, servo motors, stepper motors
 - c) gears, sprockets, chains, belts, pulleys, gearboxes
 - d) tires, tubes, hubs, rims, bearings
 - e) compressed air tanks, gauges, tubing connectors
 - f) RC transmitters / receivers
 - g) batteries
 - h) PLC unit and interface.
 - i) Power plants, this could involve complete core systems. The intention is to enable power to be delivered to student created mechanisms.
 - i) A Power Drill where the complete Motor / Gear Box / Clutch/ Chuck is used.
 - ii) An Automobile Power Head Rest Motor / Flexible Drive Shaft / Linear Gear Assembly.
 - iii) A Photocopier Chain Drive involving the Motor / Drive Shaft / Drive Chain Sprocket
 - iv) A Photocopier Gear Box to be used to manage a non-photo-copier motor.
2. It is a team's responsibility to ensure robot compliance to standard. Members of the provincial and national technical committees will avail themselves as a confidential "sounding board" for team's design/parts choice.

PIT AREA

1. Teams will be provided with a Pit Area Workspace which includes:
 - a) A project table. (teams may be asked to share a 60" x 30" table with another team)
 - b) A 120V AC power outlet (minimum of 100W)
 - i) Teams are requested to bring a 25 foot multi-outlet extension cord / power bar.
2. Teams must provide/build a Table Top Stand for holding their robot while in the Pit Area.
 - a) This stand must hold the Robot securely and prevent the Robot from moving off of the table in the event of motor activity (random or during testing)
3. Only 'Registered' Robot Competitors are permitted:
 - a) In the Pit Area.
 - b) To make any repairs and modifications to their robot.
4. Designated Teacher / Industry Team Advisors:
 - a) Are permitted in the Pit Area ONLY to inspect the work table setup of their team prior to the start of the tournament.
 - b) Are NOT allowed in the Pit Area during tournament and playoff play.
 - c) Must serve only an advisory role.
 - d) Are NOT permitted to handle tools or robot parts.

RADIOS

Radios

1. All teams must use ground frequencies (75 MHz) for their RC transmitters.
2. To prevent interference with other robots, teams must use only their assigned channel.
3. Only 6 channels of an RC radio can be used.
4. No radio telemetry from the robot is allowed.
5. New prototype RC controllers developed by Skills Canada British Columbia TC will be permitted.

Radio Control

1. All robot devices must be managed only using the 6 radio channels either directly or in combination with internal to the robot devices (programmable boards or limit switches etc.).
 - a) There can be no other 'Telemetry' (such as 'Blue Tooth Technology') taking place between a robot and the driver (or other team members).
 - b) There is no limit placed on the number of "channels" internal to the Robot control systems used.
 - i) PLC's may be used with one of the PLC inputs used to receive information (an ON / OFF Signal) from the Radio Controller. All of the additional ON / OFF channels that exist within the PLC to control a sequence of events can be used.
 - ii) Lap tops or other computing devices within the robot may be used to perform internal tasks as long as the task is initiated under the control of the radio.
2. All robot components (compressors, motors, cameras or other devices) must be started under radio control. The main power switch may not be used (at the start of a game) to start these devices.

SAFETY AND TEAM CONDUCT

1. During the competition, students must maintain safety at industry standards.
2. Team members without required safety equipment (safety glasses) will not be permitted into the competition area.
3. During game play, referees will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.

COMMITTEE MEMBERS:

Bob Tone, Technical Chair
Technological Education Teacher
Francis Libermann Catholic High School, TCDSB

Mario Blouin, Committee Member
Chef des Études Technologiques
École Secondaire de Hearst, Conseil Séparé Catholique de District des Grandes Rivières

APPENDIX I

Parts Specifications

Football

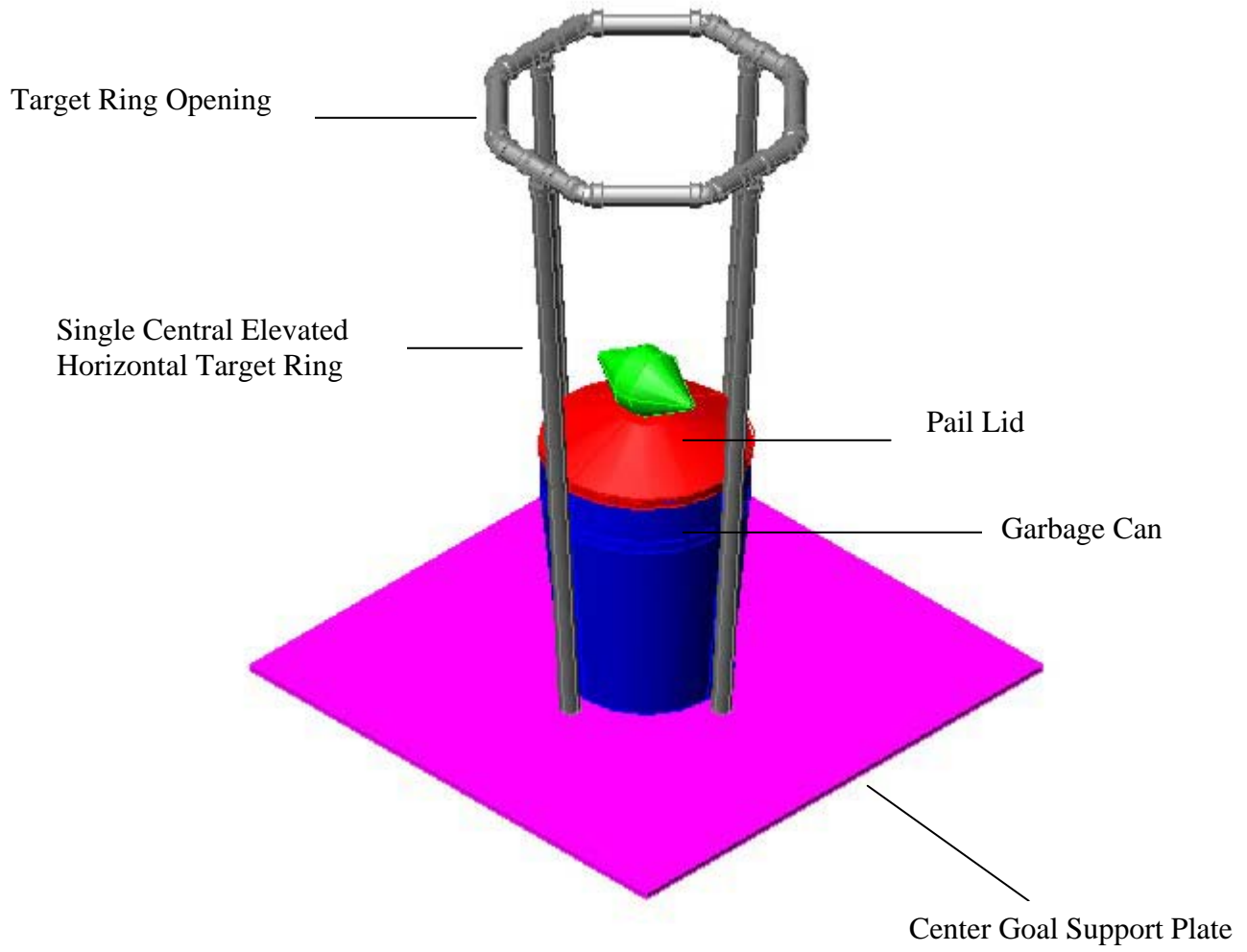
- Rawlings Football Jr.
- 11” long, 6” in diameter
- Available at Canadian Tire for \$14.99 - Bar code: 0-83321-86872-6.

Garbage Pail

- Standard Gracious Living Industries Brand
- 80L pail with a curved lid
- Available at Canadian Tire for \$9.99 – Bar code: 64594 16001

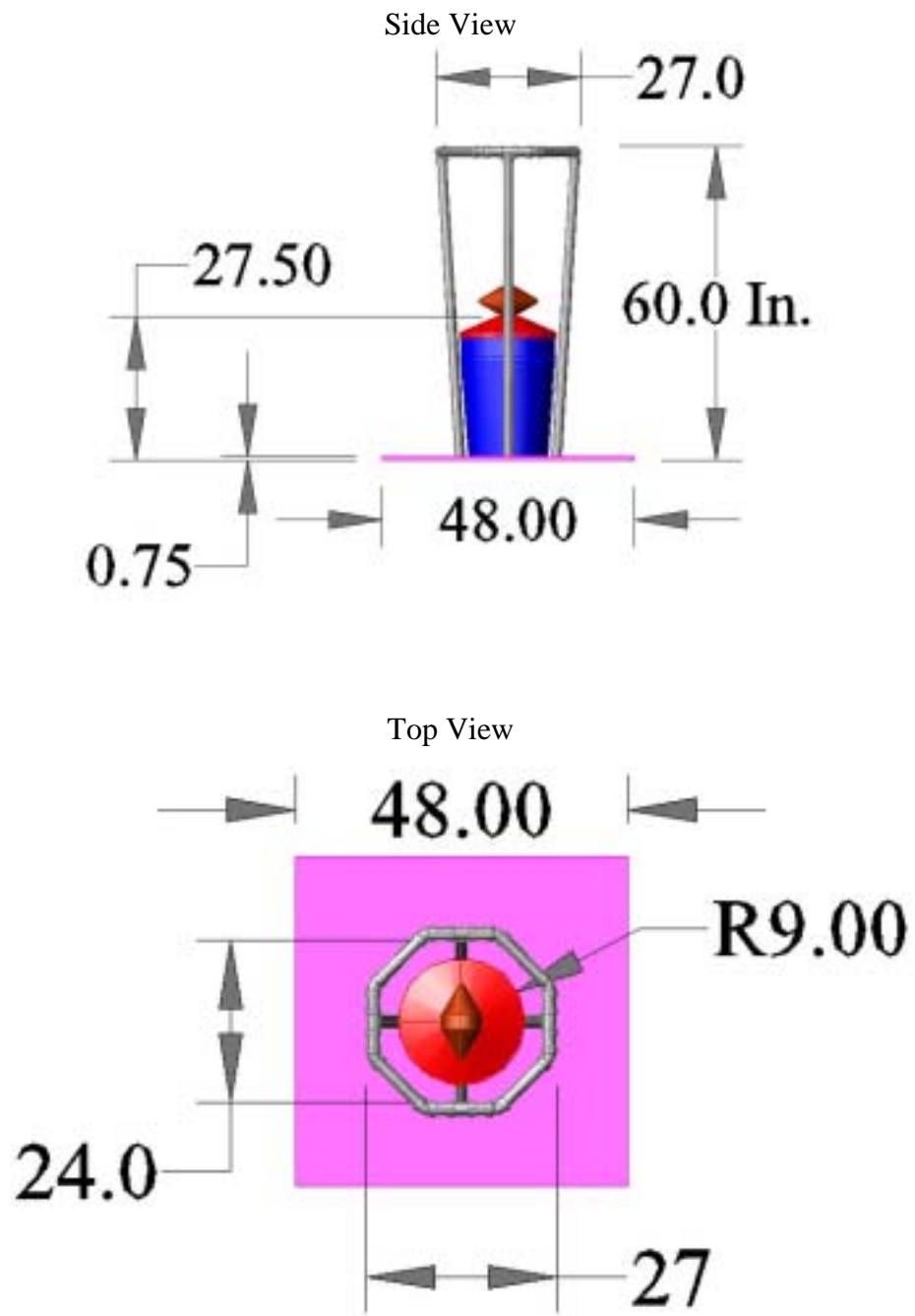
APPENDIX II

Centre Goal Structure



APPENDIX III

Dimensions of Centre Goal Structure



APPENDIX IV

Sample Score Sheets

Game Score Summary Sheet EXAMPLE			
Team	Points Scored	Game Placement	Game Number
A	6	First	1
B	3	Third	1
C	5	Second	1
D	Default	Did Not Place	1
E	2	Fourth	2
F	5	Second	2
G	7	First	2
H	3	Third	2
A	4	Third	3
C	7	First	3
E	3	Fourth	3
G	6	Second	3
B	5	Third	4
D	7	First	4
F	4	Fourth	4
H	6	Second	4

Tournament Standing Summary Sheet EXAMPLE				
Team	Points Scored Per Game	Game Placement	Total Points Scored in All Games	Tournament Standing
G	Game 1 (7 Points)	First	13	1 st PLACE
	Game 2 (6 Points)	Second		
C	Game 1 (5 Points)	Second	12	2 nd PLACE
	Game 2 (7 Points)	First		
A	Game 1 (6 Points)	First	10	3 rd PLACE
	Game 2 (4 Points)	Third		
F	Game 1 (5 Points)	Second	9	4 th PLACE TIE
	Game 2 (4 Points)	Fourth		
H	Game 1 (3 Points)	Third	9	4 th PLACE TIE
	Game 2 (6 Points)	Second		
B	Game 1 (3 Points)	Third	8	6 th PLACE
	Game 2 (5 Points)	Third		
D	Game 1 (0 Points)	Did Not Place	7	7 th PLACE
	Game 2 (7 Points)	First		
E	Game 1 (2 Points)	Fourth	5	8 th PLACE
	Game 2 (3 Points)	Fourth		