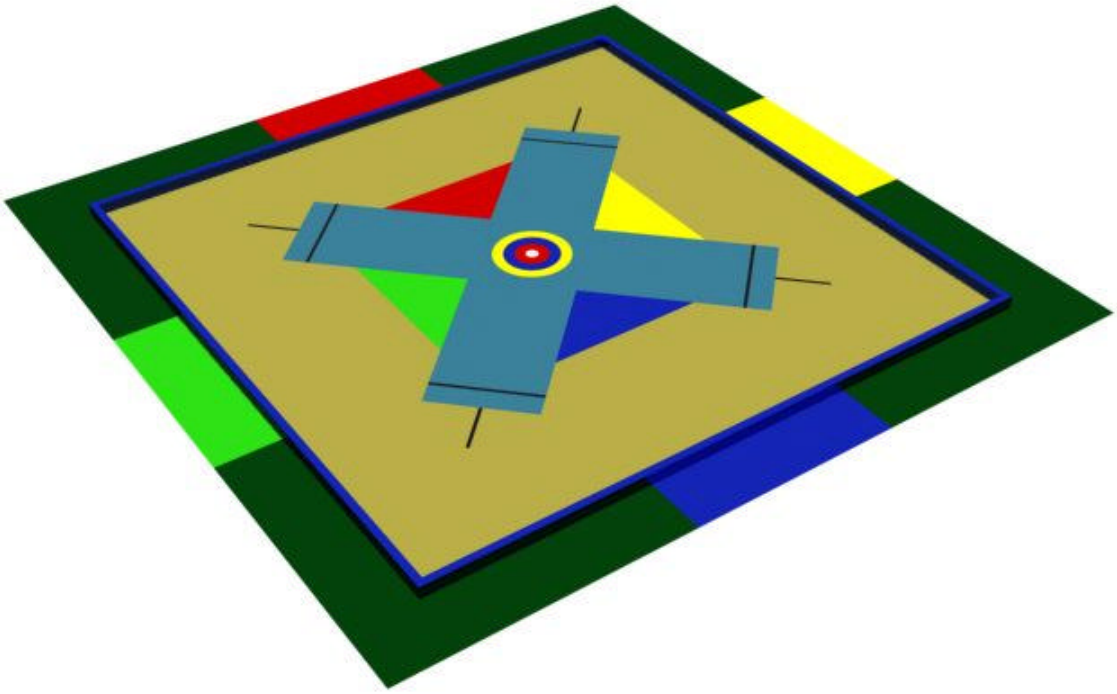
Skills Canada - Saskatchewan

2005 Robotics Challenge Scope

X- Curling

April 7 – April 9 , 2005



The 2005 Skills Canada-Saskatchewan Robotics Technical Committee:

Henry Schubach

Technological Education Teacher

Balfour Collegiate

Regina Public School Board

Bob Burnett - Committee member

Skills Canada-Saskatchewan 2005 Robotics Contest Scope

Level: Secondary

Purpose of the Challenge:	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:	Various: Mechanics, Electronics, Metalwork, Woodwork, and Communications
Equipment and Materials:	
Supplied by the Competitors:	Robots, robot accessories, batteries, battery charger, extension cord, power bar, various tools required to modify and repair robots on site and safety equipment including eye protection.
Supplied by the Committee:	Playing Field, Timer, and Pit Area Work Space with Electrical Power.
Judging Criteria:	On the court performance of the end product (Robot) in the set task.

The Contest – X-Curling

Teams participating in the Skills Canada - Saskatchewan Technological Skills Competition Robotics contest will be limited to a maximum of four students.

The contest is limited to a maximum of 24 teams.

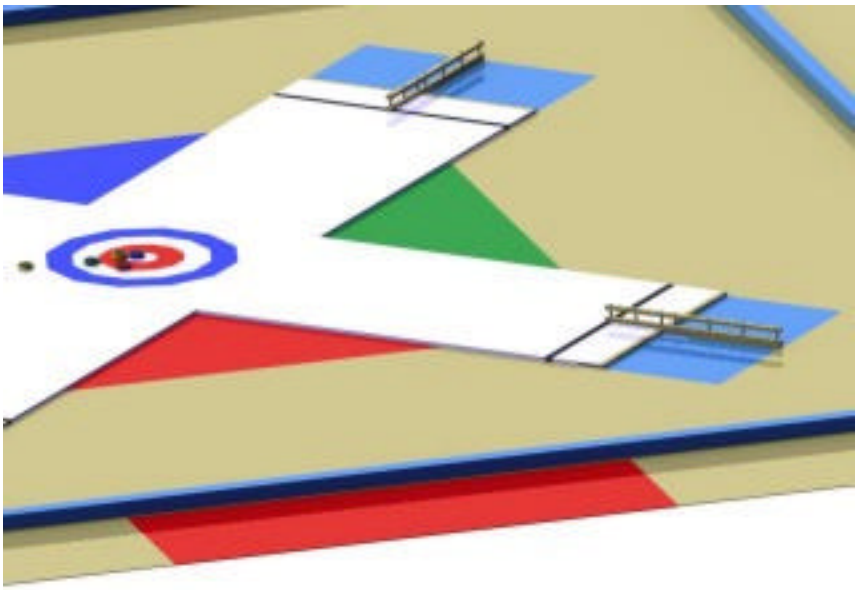
Mission Statement

The primary intent of the Skills Canada - Saskatchewan Technological Skills Competition Robotics contest is to have teams of students independently design and build robots capable of completing the competition tasks. 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 Skills Canada-Sask Robotics contest. Teams may use the design of commercial mechanisms or systems, which can complete some tasks of the Skills Canada - Saskatchewan 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 (see Robot Construction Constraints Section of the scope for examples) to fabricate mechanisms able to complete the Skills Canada – Sask. tasks.

The Overall Court is a 24 by 24 foot smooth playing surface with a central X-shaped Melamine Platform.

The following descriptive information is being provided to enable competitors to understand the intent of 'Curling Terminology' used to describe the X-Curling competition.

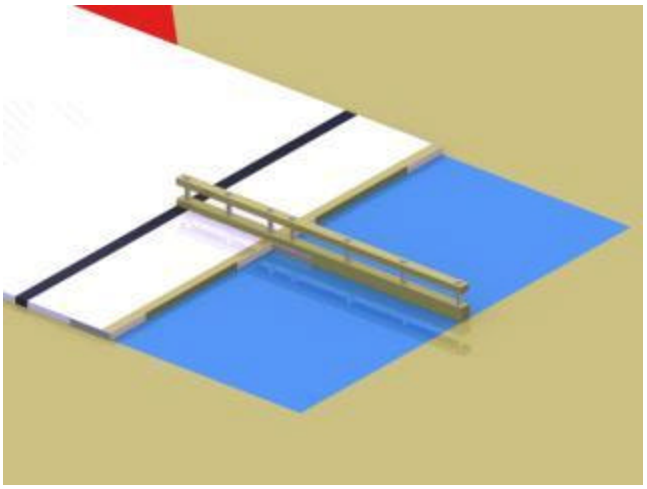
The Competition Objects, Standard Ice Hockey pucks, are refereed to as 'Rocks'.



The four arms of the X establish the Triangular Spaces shown in the image to the left. These are the Starting Position for each Robot,

Team Driver's are positioned in the Rectangular Spaces directly opposite their Robot's Starting Position.

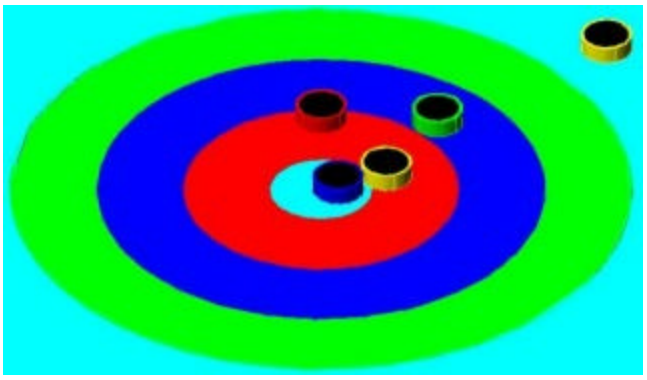
The Open Space of each Arm establishes one of the Ice Sheets.



The space at the end of each Ice Sheet is called the 'Hack'.

Each of the four Hacks has two Individual Rock Launching Areas separated by a raised barrier.

The Shot Line is a line positioned 12 inches from the end of the Ice Sheet.



The ‘House’ is the Target positioned at the center point of the X-Curling Platform.

Game Objective

The core objective is to have the student designed and fabricated robots launch 12 Rocks (Standard Hockey Pucks) along the Four available paths (Simulated Curling Ice Sheets) leading to the House (4 Ring Center Target).

Note: The vertical faces of the Rocks (pucks) will be painted bright colors; Red, Blue, Yellow, and Green, to identify to which team the Rocks belong.

The core objectives involve three Primary Task Sets:

(a) Task Set One: The robots must be able to navigate over a hard, smooth court surface intended to simulate the ice surface a curler must move on. This surface will either be the smooth concrete, tile or terrazzo floor of the host facility, or, a surface comprised of Masonite sheets, smooth side up with the seams duck taped.

(b) Task Set Two: The robots must be able to position themselves in one of the Rock Launching Areas then launch their Competition Objects ‘Rocks’ (Standard Hockey Puck) along the Ice Sheets towards the House (Center Target Rings) without traveling onto the Curling Ice Sheet Surface and without having any element of their robot extend beyond the Designated Shot Lines.

(c) Task Three: The Robots may retrieve their own Rocks (Pucks) from the Open Court Floor and re-shoot them. Robots may not retrieve their assigned Competition Objects (Pucks) from the X-Curling Ice Sheet. Robots may not retrieve competitors Rocks from anywhere.

Game Play

(1) Games will be organized on a Round Robin format.

(2) Individual games will be four minutes long.

(3) One Driver and one Spotter will direct their team’s Robot.

(4) Four Robots will play on the court in Round Robin Tournament Games.

(5) Two Robots will play on the court in Playoff Games.

The Rules

(1) During the contest, students must maintain safety at industry standards. Team members without required safety equipment will not be permitted into the contest area.

(2) Robots deemed unsafe by the referees / judges will not be permitted to compete until all safety issues have been addressed.

(3) During game play, referees will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.

(4) Deliberate strategies aimed at the destruction, collision, damage, overturning, entanglement or obstruction of competitor robots are not in the spirit of the game and are strictly forbidden.

(5) Damaging the court is illegal. If a robots' design causes damage to the court then it will not be allowed to compete until it can operate without causing damage. Games missed due to this will be forfeit.

(6) All Robots must PASS a Pre-inspection for compliance with the safety and design rules. 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.

(7) Competitors cannot enter onto the court surface or make adjustments to their Robot during a game. If a Robot is mal-functioning and represents a hazard to participants, other robots or itself in the opinion of the Referee, then, the referee can stop the clock and may authorize the removal of that Robot from the court 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.

(8) Games will start on time. Teams are responsible to know when their games are scheduled. Teams arriving late will forfeit the game. They cannot use the remainder of the time in the game.

(9) The amount of time between games will be determined by the number of participants. This information will be provided to teams prior to the start of the Round Robin Tournament.

(10) All Robots should expect to play approximately 8 to 10 games in the Round Robin Tournament. (time permitting)

(11) At the start of a game, each Robot will be positioned directly in front of their Driver's Area.

(12) If Teams must withdraw from a scheduled game due to mechanical problems then they are asked to inform the Referee as promptly as possible of their decision to 'Forfeit the Game'.

(13) Two to Four Robots will be on the court during each game.

(14) At the start of a game, one Robot will be positioned in each of the V-shaped spaces formed by the arms of the X-Curling Ice Sheet.

(15) Competitors (both Drivers and Spotters) must remain outsides the Court boundaries during game play.

(16) Drivers must remain in the designated area at the mid-point of the courtside directly opposite where their robot starts from throughout the game.

(17) Spotters can wander around the complete perimeter of the court but may not enter into Drivers Areas. The space at each corner of the court is designated for shared used by all spotters.

(18) Robots may not add any form of lubricating agent to either the Face of the Rocks or the Surface of the Ice Sheets.

(19) The six-channel programmable Ground Frequency Radio Control Unit is the only communications device allowed to support contact between the Robot and the Team. No supplementary telemetry devices such as on-board cameras etc are permitted.

(20) No alternate control units from other competitions are allowed.

(21) Robots must not leave the contest court at any time during a game.

(22) Robots may not deliberately shoot at other robots. However, it may happen that robots will be struck by Rocks (Pucks) that have collided with other Rocks (Pucks) on the Curling Ice Sheets and as a result enter the Open Court Area in a Random Pattern or by Rocks (Pucks) that have traveled the full length of the Curling Ice Sheet. It is the responsibility of all teams to ensure that their robot's sensitive components are protected from damage by these random hits.

(23) Robots may not travel onto the Curling Ice Sheet. This restriction means that the wheels / tracks or other mobility mechanisms must stop at the edge of the 3/4-inch high Melamine Curling Ice Sheet. However, it is permissible for portions of your robot to overhang the first 12 inches of the Curling Ice Sheet, but, no part of your robot can pass the 12 inch Shot Line at any time.

(24) It will be a Referee's ruling that decides if an 'End of the Game Shot' took place before or after the game ending Buzzer sounded.

(25) Robots may take a Maximum of Two Shots from a Launch Area then they MUST move to a Launch Area in another Hack (not the Launch Area immediately beside their current location) before they can shoot again.

(26) Robots cannot remove Rocks (Pucks) from the Curling Ice Sheet by mechanical means, but they may knock Rocks (Pucks) off the Ice Sheets using their own Rocks (Pucks).

(27) Robots may retrieve their OWN Rocks (Pucks) that have landed on the court surface but

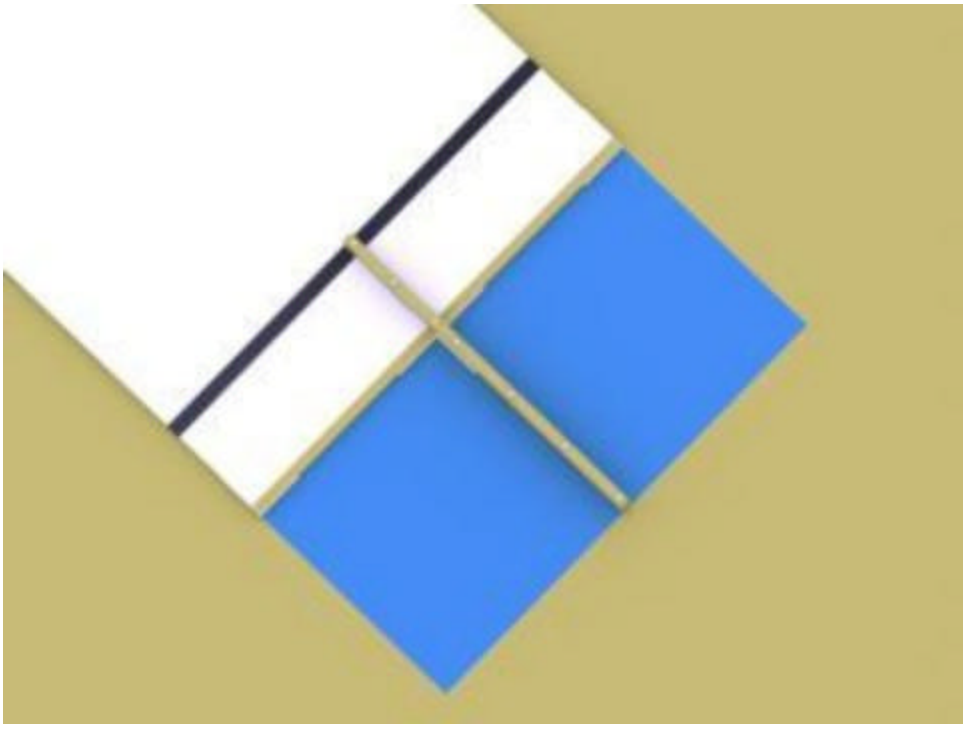
Robots may NOT retrieve opponents Competition Objects (Pucks).

(28) Rocks must be fully off the Ice Sheet Surface to be considered available for retrieval by a Robot. Rocks leaning on or hanging over the edge of the Ice Sheet will be considered NOT available for retrieval by Robots.

(29) Robots must stop movement required to launch Rocks (Pucks) at the sound of the Buzzer. However, Rocks (Pucks) sliding on the Curling Ice Sheet will be allowed to continue sliding on-to or off-of the Target Rings / Curling Ice Sheets after the Buzzer.

(30) Rocks (Pucks) landing outside the Court boundaries will not be returned to the court until the end of the game and cannot be retrieved by the robots.

(31) Blocking: Yes, but only as a secondary activity. Robots must at all time focus on actions intended to improve their own score not interfering with their opponent's ability to complete the competition task. However, if a robot is either actively attempting to retrieve a Rock (Puck) from the court floor or is traveling to a new Hack (Launching Area) and happens at the same time to be blocking an opponent then this is acceptable non-contact blocking.



(32) Robots in the Launch Areas may not expand in size to prevent another robot from passing behind them.

(33) Robots may Enter / Exit the Launch Areas either from the rear or from the side.

(34) If two Robots are attempting to enter a Launch Area at the same time then a Referee's Ruling will be required. The referee will either define one Robot as having arrived first and award possession of the Launch Area to that Robot and direct the other Robot to move to another

Launch Area, or, rule a 'Tie' regarding Arrival Time and direct BOTH Robots to seek other Launch areas.

(35) Ramming or Pushing: Is not allowed.

SCORING

1) Points will be awarded at the end of each game based on the position of the Competition Objects (Pucks) sitting on the Center Scoring Rings.

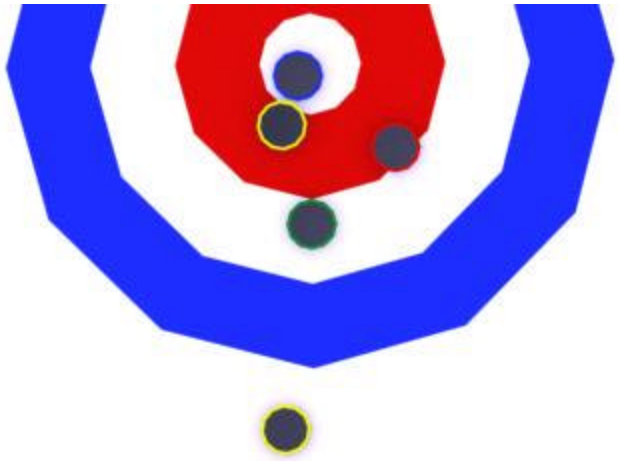
2) Each Scoring Ring has a different point value, which is assigned to ALL Rocks (Pucks) on that ring.

    a. The Radius 3 Inches Center Button is worth 5 Points

    b. The Radius 8 Inches First Ring is worth 3 Points

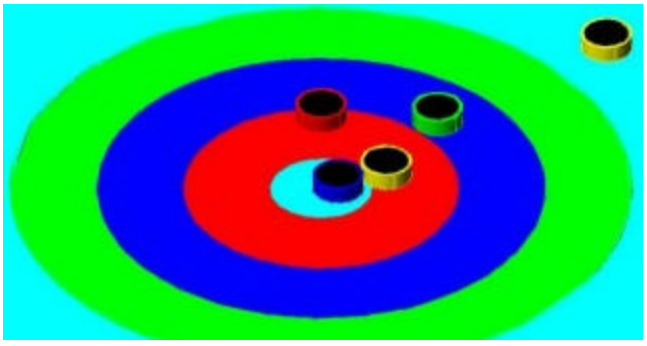
    c. The Radius 13 Inches Second Ring is worth 2 Points

    d. The Radius 18 Inches Third Ring is worth 1 Point

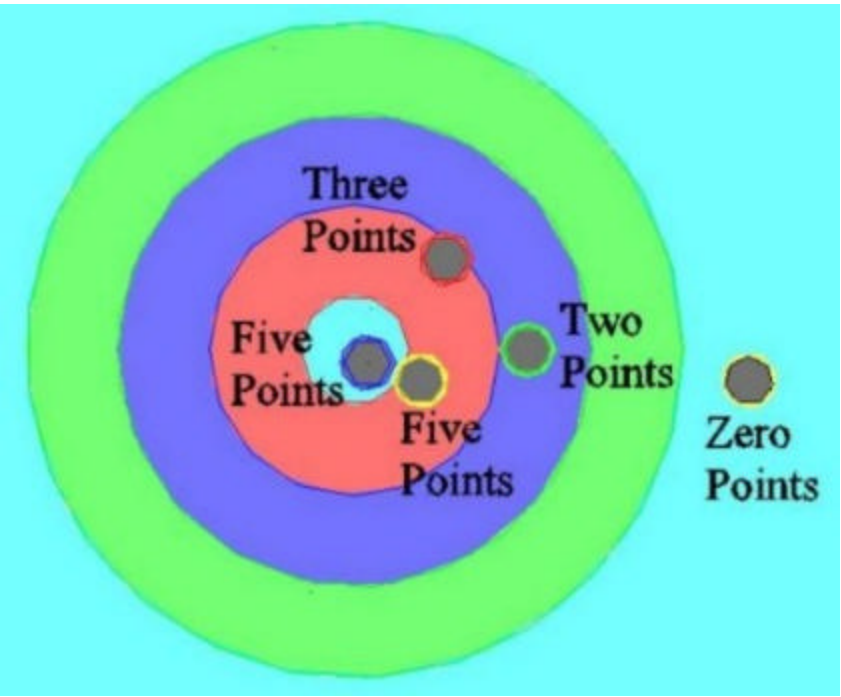


3) The Referee will determine which Scoring Ring each Target Object (Puck) is on at the end of the game. Competition Objects (Pucks) need to only be biting the Scoring Ring to be considered 'On the Scoring Ring'.

The following images are provided to clarify what is meant by 'On the Scoring Ring'.



All of these images display the same scoring situation



The Green Rock scores only Two Points given that while it may be touching the 3 Point Blue Ring it has not crossed into the Blue Ring at all.

The Yellow Rock would be defined as having 'Bitten' the Center Button and as a result would be awarded Five Points even though it has not fully entered into the Center Ring (Button).

The Referee's ruling will be final in situations of this type.

Round Robin Tournament Standing Points

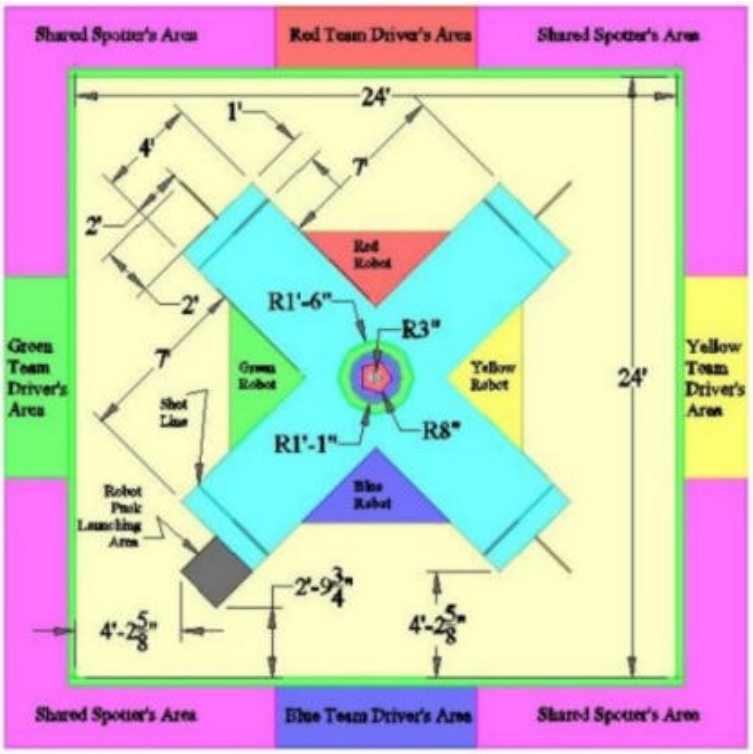
Individual Game Results	Round Robin Standing Points Awarded
First Place Team	4 Points
Second Place Team	3 Points
Third Place Team	2 Points
Fourth Place Team	1 Point (if a minimum of one Competition Object (Puck) has been delivered to the One Point Outer Scoring Ring)

(1) In the case of Teams tying in a game the total points available for their combined positions will be shared. Example: If two Teams are tied for second place in a game then each Team will be awarded 2.5 points.
(2) There will not be any Round Robin Standing Points awarded to Teams involved in Zero to Zero Game Score Ties. Teams MUST deliver a minimum of One Target Object (Puck) into the Scoring Rings to qualify for Round Robin Standing Points to be awarded.

Playoffs

The Top 4 Teams in the Final Round Robin Standings will move forward to the playoffs.

(a) The Total Number of Points Scored Overall by a Team in All Games Combined will be used to break any ties that exist in the Final Round Robin Tournament Standings.
(b) Playoff games will be 8 minutes long and scored based on total points accumulated over two 4-minute periods. Teams will be permitted to change batteries between Playoff Game Periods BUT they may not do any other repair work to their robot between Playoff Game Periods.
(c) Playoff Games cannot end in a Tie. If a Tie Score exists after the 2 Period Game then additional 4 minute Periods will be played (as many as needed) until one of these extra Periods ends with one Team ahead.
(d) Second and Third Round Playoff games will have 2 teams on the court at a time



Court Layout

a) The Court is a 24 by 24 foot square.

b) The X-Curling Ice Platform is made using '(19 mm) 3/4-inch thick 4 by 8 Ft. Melamine Sheets' identified at Home Depot as:

Melamine
006 White

Columbia
Forest Products

Item Number 117180

Cost: $29.78 per Sheet

The Competition Target Objects ‘Rocks’ are:

Standard Ice Hockey Pucks, which are approximately 3 inches in diameter and 1 inch thick.

Robots will start the game with 12 Competition Objects ‘Rocks’ (Pucks) loaded on board.

The Vertical Faces of the Competition Objects (Pucks) will be painted bright colors. The flat Top and Bottom surfaces will not be painted.

Power Sources / Management

1. The Total Voltage in any individual circuit cannot exceed 24 volts.
2. The Maximum power rating is 216 W in any individual circuit. Example: 14.4 V. Battery * 15 Amp Fuse = 216 Watts.
3. Teams are reminded that it is the purpose of a fuse to protect the students themselves and the equipment in their circuits. It is recommended that teams develop circuit diagrams, and calculate the appropriate values for all circuits on their robot.
4. Each individual circuit must include either an in-line fuse or be connected to a dedicated fuse in a rack.
5. Teams are to use a wire gauge appropriate to the current values in each circuit.
6. Batteries must be complete commercial battery packs.
7. Batteries of different voltages and amperages cannot be wired in series. Teams using mixed voltage sources must establish independent circuits for each voltage source.
8. All wires are to be mounted securely to the robot taking into consideration that these wires must be protected from damage due to abrasion when the various robot elements move
9. All batteries must be securely mounted.
10. Teams are responsible for charging their own batteries and must have a complete replacement set of batteries. Teams are responsible for charging their own batteries and must have a complete set of batteries. It is recommended that a spare set be available.

11. Teams are responsible for charging their own radio and receiver batteries.

12. Teams may 'under power' a motor by delivering 12 volts to a 24 volt motor but teams may not 'over power' a motor by delivering 24 volts to a 12 volt motor. Teams may over power a motor by delivering a maximum voltage to a motor that does not exceed 150% of the motor's stated rating. For example a maximum of 18 volts may be delivered to a 12 volt motor.

13. The Radio Receiver ON/Off switch must be positioned where it can be easily reached.

14. Robot must have a main power kill switch.

15. Teams may use new or re-cycled motors such as motors from cordless portable tools, small motors from cars (seat / wind shield), motors from 12 volt accessories (cigarette lighter based) intended for use in cars or boats, motors from remote control models.

16. There is no restriction on the number of motors used on a single robot.

17. No explosive materials of any kind may be used (ether, gunpowder, acetylene etc.).

Conversion of Electrical (Battery) Energy to other forms:

1. Pressure based energy sources (air or other) must have ZERO pressure in their reservoirs (cylinders) at the start of each game. The pressure required by these systems must be introduced by the actions of on board battery-based systems or by other actions of the robot itself during the 4-minute game.

2. The use of competitor made pressure tanks (cylinders) are not permitted.

3. All pressurized tanks on robots must include use of the manufacturer's gauges and control equipment.

4. The pressure tanks and related gauges / controls must be shielded from damage due to collisions.

5. The stored pressure in the tank must not exceed a maximum of 90psi.

6. Tension based energy sources (elastics, springs or other) must be in what their manufacturers would describe as their default energy state at the start of each game.

Radios

1. All teams must use Ground Frequency Radios.

2. New teams purchasing their Land Frequency Radios are encouraged to select a six channel programmable R/C Kit (includes: four servos, transmitter / receiver NiCad's, charger, wiring harness and hardware).

3. IF your radio has more than six channels then only six channels of an RC radio can be used at a time.

Robot Restrictions

All Robots must PASS a Pre-inspection for compliance with the safety and design rules.

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.

(a) Overall Size: Robots must not exceed an overall dimension of 24 by 24 by 24-inches at the start of each game. Robots may expand to a larger size once a game has started.

(b) Overall Weight: No weight restriction is imposed on the robots.

(c) Robots should be built with robustness in mind. Accidental bumps and scrapes will happen. Teams must consider protection of sensitive components and durability of exposed ones when designing all elements of their robots.

A few notes regarding the use of manufactured parts. Although it is impossible to create a comprehensive list of all acceptable parts, a list has been made to provide guidance for teams.

Acceptable Components:

Electronic speed controllers, motors, gears, sprockets, chains, belts, pulleys, tires, rims, bearings, compressed air tanks, gauges, tubing, connectors, RC transmitters / receivers, servo motors.

Wheel assembly "tire, tube, hub, bearing".

Power Plants, this could involve complete core systems. The intention is to enable power to be delivered to student created mechanisms.

(a) A Power Drill where the complete Motor / Gear Box / Clutch/ Chuck is used.

(b) An Automobile Power Head Rest Motor / Flexible Drive Shaft / Linear Gear Assembly are used.

(c) A Photo-copier Chain Drive involving the Motor / Drive Shaft / Drive Chain Sprocket is used.

(d) A Photocopier Gear Box to be used to manage a non-photo-copier motor.

It is a Team Responsibility to ensure their Robot is in compliance with the competition standards. Teams are encouraged to 'Ask the Technical Committee' when they are uncertain regarding the use of particular items.

Pit Area

(a) All Competitors must follow established Safety Rules and Procedures when working on their Robots in the Pit Area.

(b) Teams will be provided with 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.

(c) Each Pit Area Table will have access to an electrical outlet provided. Teams are requested to bring a multi-outlet extension cord / power bar as part of their equipment.

(d) It is recommended that teams fabricate a Table Top Stand for holding their Robot in the Pit Area. This stand should hold the Robot securely and be capable of preventing the Robot from driving on or off of the table in the case of either deliberate motor testing during repairs or due to random, unexpected motor activity.

(e) Only registered Robotics contest competitors and their designated registered Teacher/Advisors are permitted in the Pit Area.

(f) Teachers/Advisors are not to have tools in hand performing any level of repairs or modifications

to Robots at any time during the competition.

Communication

All teams must provide a contact e-mail address to hschubach@rbe.sk.ca.. These e-mail addresses will be placed in a 2005 Skills Canada-Ontario Robotics contest E-Mail Group used to ensure that ALL participating teams receive ALL information updates throughout the September 2003 to May 2005 competition period.

The Francis Libermann Catholic High School web site, www.libermann.tcdsb.org will be used as an information distribution platform. This will enable the sharing of large files (CAD or multi-media) through a combination of on-line viewing and file downloading.

Committee Members:

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