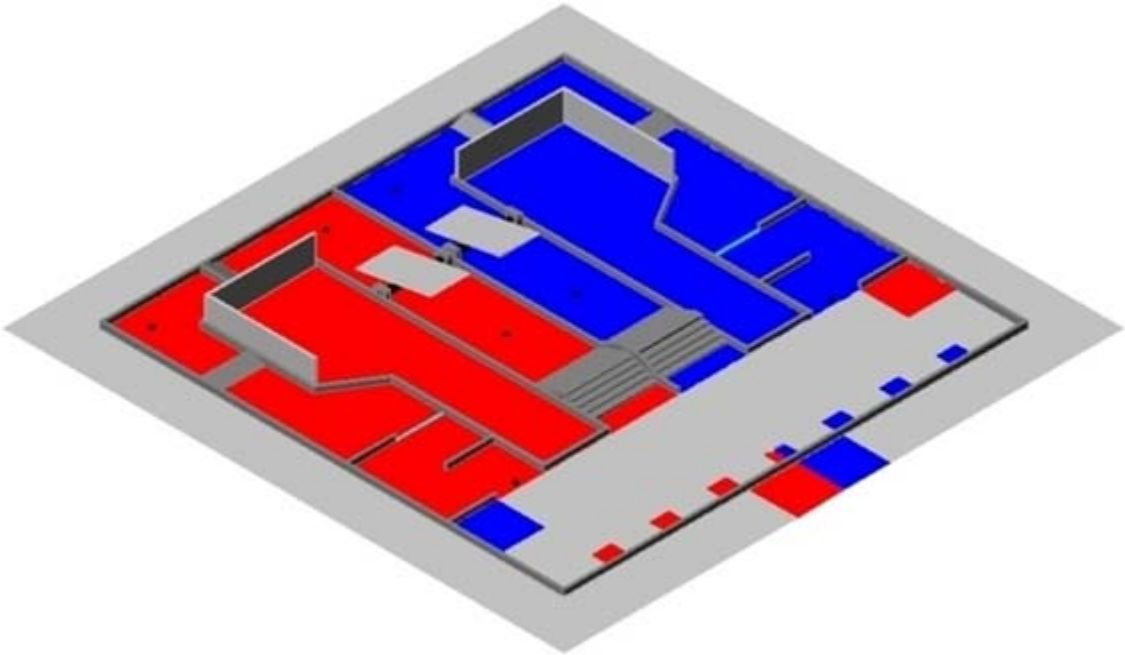
2008 - National Robotics Challenge Scope – Competition 93

Round Up at the Stampede Corral

Date: May 25 to 28, 2008

Calgary, Alberta



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FURTHER COMMUNICATIONS
Questions for clarification of the rules can be made to the Technical Committee Chair abyres@richmond.sd38.bc.ca. Responses to these questions will be posted on the Skills Canada Robotics Competition Website. Participating Teams are expected to periodically check http://www.skillscanada.com for updates.

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2008 - National Robotics Challenge Scope – Competition 93

Level: Secondary School **Duration:** 16 Hours

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.

Mission Statement:

The intent of the Skills/Compétences Canada National Robotics 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. 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/Compétences Canada National Robotics Challenge. Teams may use the design of commercial mechanisms or systems, which can complete some tasks of the Skills/Compétences Canada National Robotics Challenge, 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 Skills/Compétences Canada National Robotics Challenge tasks. Robots will be inspected for adherence to this statement at the Skills/Compétences Canada National Technological Skills Competition.

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 2008 GOLD MEDAL FOUR COMPETITOR MOBILE ROBOTICS TEAM WILL BE SELECTED TO REPRESENT CANADA in Calgary, Alberta, Canada at the 2009 Worldskills Games.

Skills and Knowledge Applied:

- Drafting
- Mechanics
- Electronics
- Metalwork
- Woodworking
- Communications

Equipment and Materials

Supplied by the Competitors:

- Robots - Robot accessories (including batteries, battery charger, spare parts)
- Extension cord and power cord
- Various tools required to modify and repair robots onsite
- Safety equipment including mandatory eye protection

Supplied by the Committee:

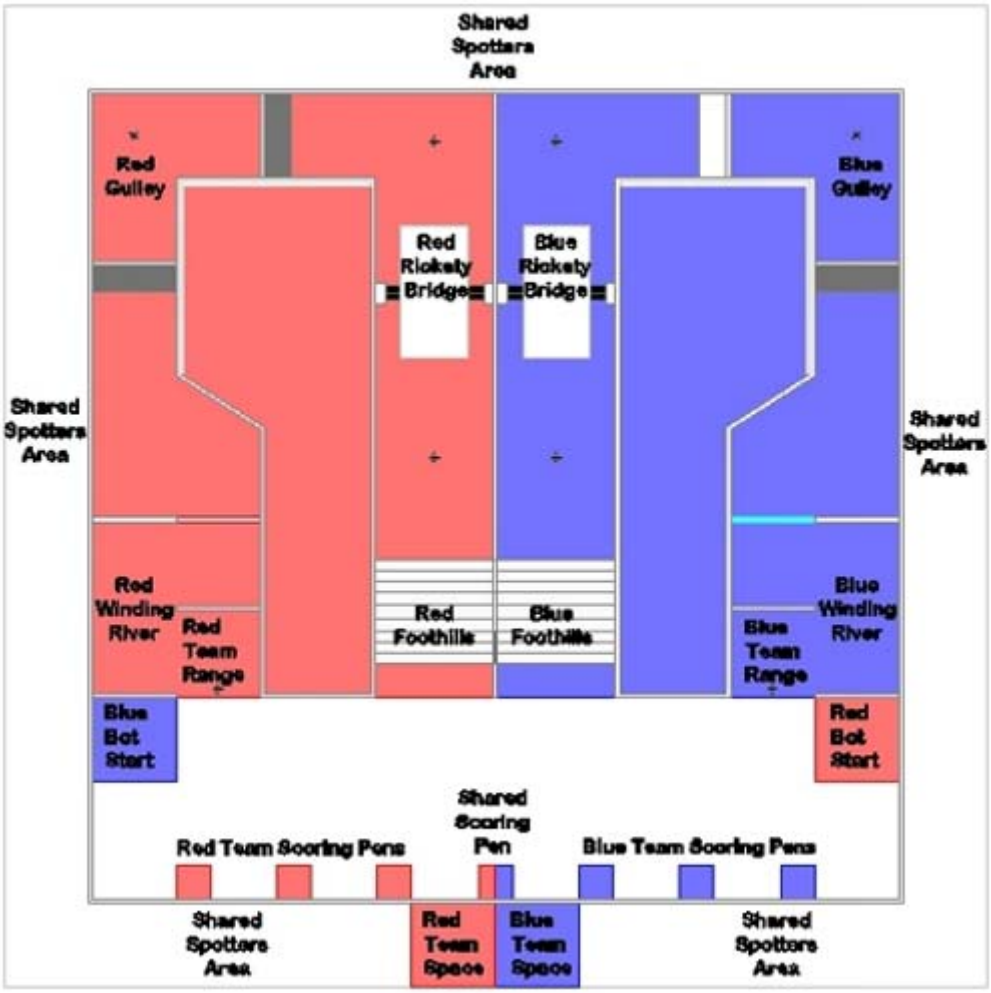
- Playing Field (including game pucks, obstacles, timer etc)
- One worktable with access to a 120 V power outlet (minimum 100W) per team

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

Team Size: **Four** Students maximum

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

THE GAME



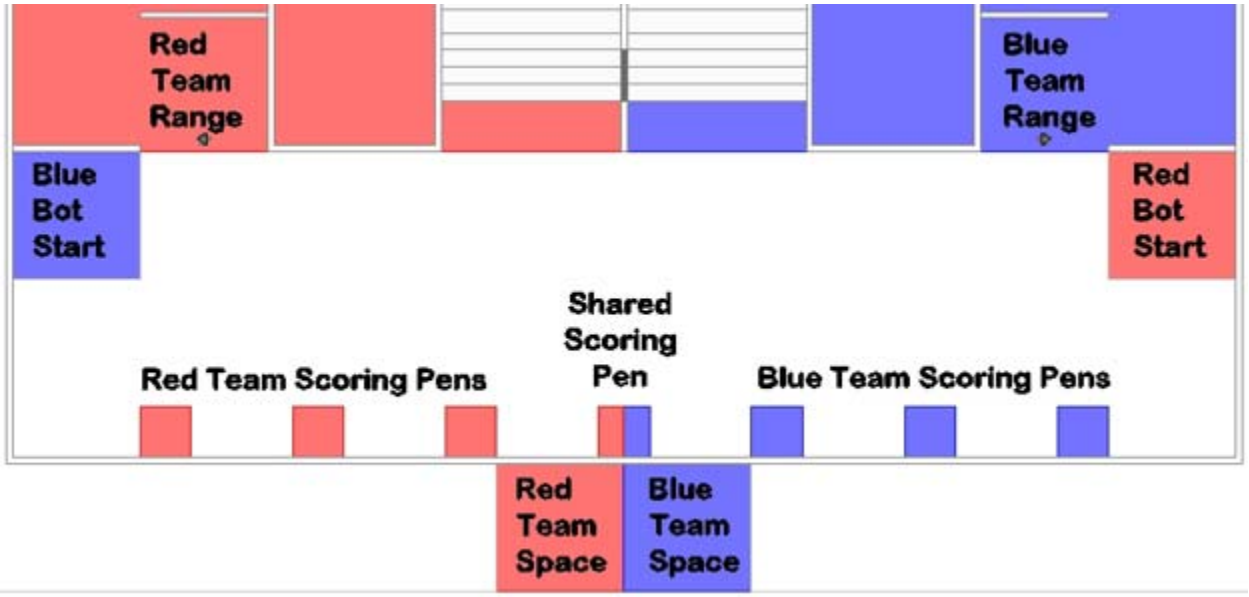
OVERVIEW

The competition involves robots traveling through their Assigned Open Range to retrieve Four Steers (Hockey Pucks) from the locations shown in this image and delivering these Steers into their Assigned Scoring Pens (Painted Target Squares) in the Stampede Corral.

In Tournament Games, Two Robots simultaneously attempt to complete the competition task set.

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 to enter the pit area once the competition has started). Although two robots play on the same court, at the same time they must work to advance their score and not detract from their opponent's scores. Strategies aimed at deliberately interfering with or damaging other robots is not in the spirit of the competition and will not be allowed.

SCORING



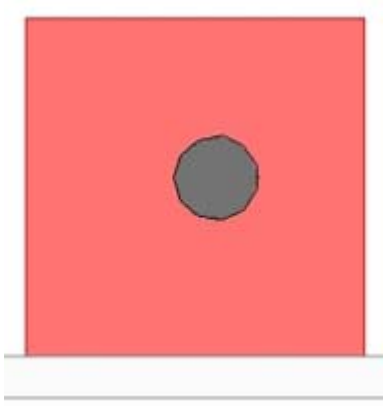
There are Seven Scoring Pens in the Stampede Corral Area. Three assigned for the exclusive use of each Team and One that is a Shared Resource. Robots must deliver a Steer into each of their Assigned Scoring Pens before they are allowed to deliver a Steer into the Shared Scoring Pen.

There are Eight Steers in play during a Game and only SEVEN Scoring Pen Points available, which leaves No Points available for the EIGHTH Steer delivered into the Corral Area.

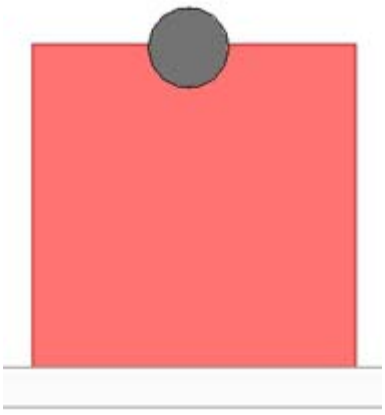
Only ONE Steer may be delivered into each Scoring Pen.

Each Steer delivered fully into a Scoring Pen will be assigned a value of one point.

Each Steer delivered partially into a Scoring Pen will be assigned a value of Zero points.



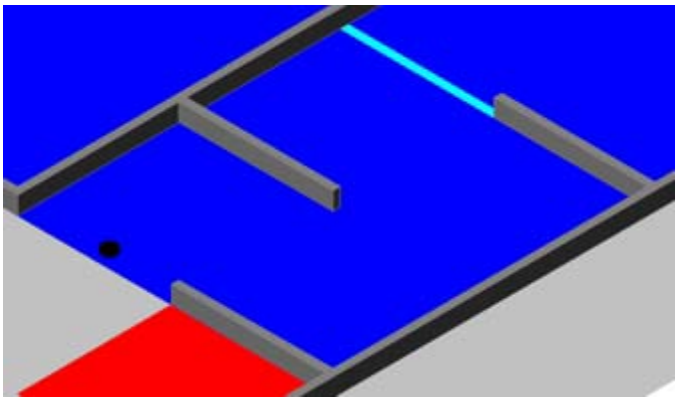
Single Point



Zero Points

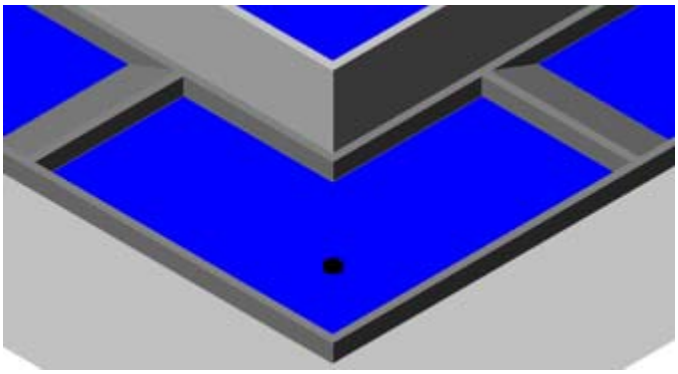
Obstacle Completion Points will only be awarded ONCE per game. No points will be awarded for traveling over an obstacle a second time during a game.

Robots must enter their Assigned Open Range along the Winding River, travel through the Gulley, over the Rickety Bridge and exit on the Stampede Corral side of the Foothills. One Point will be assigned for each obstacle that a Robot overcomes based on the following definitions:



The Winding River Obstacle requires the Robot to travel over a flat surface in a Zig Zag pattern.

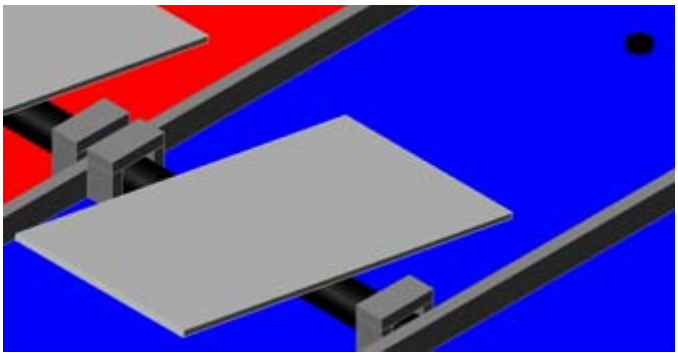
The Winding River Obstacle is complete once a Robot has crossed the Winding River End Line, defined as no part of the Robot touching any part of the Winding River Obstacle End Line.



Robots enter the Gulley by traveling up a 20 Degree Entry Ramp, Dropping 3.5 inches to the smooth Gulley Floor.

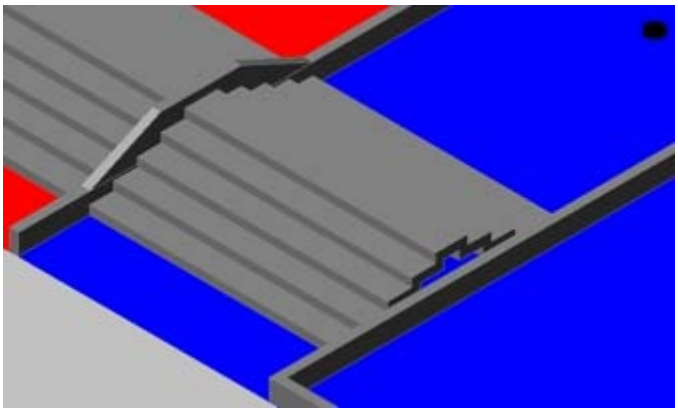
Robots exit the Gulley by climbing a 3.5 inch Vertical Wall and traveling down a 20 Degree Exit Ramp.

The Gulley Obstacle is complete once a Robot is on the court floor, not touching any part of the Gulley Exit Ramp.



The Rickety Bridge Obstacle is a 24 inch wide ‘Teeter Totter’ which sits at an approximate angle of 11 degrees.

The Rickety Bridge Obstacle is complete once a Robot has exited off the Far End of the Rickety Bridge, is back on the court floor, no part of the Robot touching any part of the Rickety Bridge structure.



The Foothills Obstacle is a set of Up and Down Steps with a Rise of 1.5 inches and a Run of 4 inches.

The Foothills Obstacle will be considered complete once a Robot has exited off the Stampede Corral Side of the Foothills, is back on the court floor, not touching any part of the Foothills structure.

Medals will be awarded based on:

- Robot on the court performance in the competition task set as identified through the results of tournament play and playoffs.

RULES AND REGULATIONS

1. Each robot will be assigned a starting position in the corner of the Stampede Corral.

2. Each team will be assigned a Team Space along the courtside behind the Shared Scoring Pen.

3. There will be **Four Steers (**Standard Hockey Pucks) per robot in each Range Area of the court at the start of each game. The Steer locations will be as displayed in the various images included in this document.

4. Robots must deliver their Steers to their Three Assigned Scoring Pens (12 inch Painted Squares located along the back wall of the Stampede Corral area) before they can deliver their Fourth Steer into the Shared Center Scoring Pen.

5. Robots may deliver a maximum of ONE Steer to a Pen.

6. Robots may reposition their own Steers after they have initially delivered them to a Pen.

7. Robots may NOT touch or disturb in any way the Steers delivered into a Pen by their opponent.

ROUND ROBIN TOURNAMENT PLAY

1. Teams will play in tournament games.
2. Tournament Standing will be based on the total number of points scored by a team in all of their tournament games combined.
3. All teams will advance to the playoff rounds.
4. Two Robots will play on the court in round robin games.
5. Round robin 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 round robin.
7. Between round robin games, battery changes and repairs to robots may be completed at the team's assigned Pit Area Worktable.
8. During the competition, students must maintain safety at industry standards such as the wearing of safety glasses when performing cutting or stock removal chipping tasks and maintaining a clean pit area workspace.
9. During game play, referees will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.
10. Damaging the **court** and or the **hockey pucks** is illegal. If a robot's design causes damage to the court or the hockey pucks then it will not be allowed to compete until it can operate without causing damage. Games missed due to this situation will be forfeited.
11. 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. Forfeiture of, and removal from the match will result with the first occurrence. Expulsion from the games will occur after the second. Ramming and pushing are not allowed.
12. 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.
13. 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 Default 'Forfeit the Game'.
14. Competitors cannot enter onto the court surface or make adjustments to their robot during a game.
15. 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 may 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 may be left on the court until the game time expires.
16. Teams will be allowed **two** competitors in the courtside area. Drivers and spotters may switch roles during a game. The driver is the competitor holding the radio and controlling the robot. The spotter is the competitor providing navigational guidance to the driver through verbal instructions and hand gestures.
17. Drivers must remain in their assigned team area throughout the game.
18. Spotters may move freely within the shared spotter's areas.
19. Spotters may **not** enter an opponent team's area.

20. At the start of a game, robots must be in their assigned starting positions.
21. Competitors must remain outside the court boundaries.
22. Robots must remain on their assigned Open Range and may NOT enter onto their opponent's Open Range or into the Center Space of their own Range.
23. Robots must not leave the competition court at any time during a game.
24. It will be a referee's ruling that decides if an 'End of the Game Puck Delivery' took place before or after the game-ending buzzer sounded.
25. Steers landing outside the court boundaries will **not be returned** to the Competition Court.
26. Robots may not park in front of a Stampede Corral Pen (Painted Square Target Area) or the sole purpose of blocking access to it by an opponent.
27. Deliberate ramming of an opponent robot will **not** be allowed.

ROUND ROBIN TOURNAMENT STANDING

Round Robin Tournament Standing will be determined by the total number of points scored by a robot in all of their tournament games combined.

a) A game score of zero (0) will be awarded for robots that do not show up for (default) a game.
b) Total Round Robin Standing ties will be broken by playing special 4-minute tiebreaker games involving the robots that are tied.

PLAYOFF PLAY

1. All teams will advance to the playoffs following the Round Robin Tournament.
2. Two Robots will play on the court in playoff games.
3. Playoff games will last 8-minutes, comprised of two 4-minute periods.
4. There will be 5-minutes between periods in playoff games.
5. Teams will need to keep their robot in their Court Side Team Space between the periods of a playoff game.
6. Teams may make repairs to their robots between the periods in playoff games and batteries may be exchanged between the periods in playoff games.
7. Finals games cannot end in a tie. If a tie score exists after the 2nd 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. Note: Rules 5 and 6 remain in effect meaning repairs can be made and batteries changed between the extra periods of playoff games.

Playoff games will be held based on the Final Round Robin Tournament Standings using the following pattern. The example below is based on six teams advancing to the playoffs and will be altered if more then six teams participate in the Calgary competition.

Playoff Round One

The 1st Place Tournament Team and the 2nd Place Tournament Team will be given a First Playoff Round 'Bye'.

Playoff Round One Game One: 3rd Place Tournament Team vs. 6th Place Tournament Team
Playoff Round One Game Two: 4th Place Tournament Team vs. 5th Place Tournament Team

Playoff Round One Winners advance.
Defeated Playoff Round One Teams are eliminated from the competition.

Playoff Round Two

Round Two Game One:
The 2nd Place Tournament Team vs. Winner of Playoff Round One Game One
Round II Game Two:
The 1st Place Tournament Team vs. Winner of Playoff Round One Game Two

Playoff Round Two Winners advance to the Gold / Silver Medal Game.
Defeated Playoff Round Two Teams advance to the Bronze Medal / Fourth Place Game.

Playoff Round Three

Bronze Medal / Fourth Place Game:
Defeated Playoff Round Two Game Two Team vs. Defeated Playoff Round Two Game Three Team
Gold / Silver Medal Game:
Winner of Playoff Round Two Game One vs. Winner of Playoff Round Two Game Two

THE COURT

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. Please make your robot designs allow for a possible ½" tolerance.

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

1) The open court surface consists of masonite sheets smooth side up with duct taped seams, OR, the smooth facility floor.
2) The perimeter court wall is made from 2 by 4 inch planks laying on their narrow edge.
3) The Foothills Obstacle is made from standard 2 by 6 inch planks.
4) The Gully and Rickety Bridge Ramps are Good One Side Plywood.

Detailed court information has been included in the Appendix Section of this scope document.

Note: An AutoCAD drawing of the court is available on www.skillscanada.com.

GAME PUCKS

The competition Hockey Pucks will be Standard 0.99 cent Practice Pucks.

THE ROBOT

RESTRICTIONS

All 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 ROBOT 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:

- The Robot must be stationary in its assigned starting location.
- All systems may be ON.
- All required System Start-up Adjustments must be completed.
- All Electrical / Mechanical Systems and Student Made Electronic Circuits must be under the control of a Kill Switch(es).
- Air System Circuits may be fully charged to 90 PSI and their compressors can be ON.

OVERALL ROBOT SIZE

Robots must not exceed an overall size of 8 cubic feet (13,824 cubic inches) at the start of each game. Robots may expand to a larger size once a game has started.

Overall robot size will be calculated by using the maximum single dimension in each category (length / width / height) of the robot not average dimensions.

This overall size maximum will allow a robot to be any of the following example sizes, or indeed some other variation that does not exceed 13,824 cubic inches:

(a) an overall dimension of **24 by 24 by 24-inches, (**13,824 cubic inches), or
(b) an overall dimension of **42 by 18 by 18-inches,** (13,608 cubic inches), or
(c) an overall dimension of **36 by 21 by 18-inches,** (13,608 cubic inches), or
(d) an overall dimension of **48 by 24 by 12-inches,** (13,824 cubic inches.

NOTE: The top of your radio antenna may be a maximum of 48" above the court floor. The radio antenna is not considered when defining the overall robot size.

Metric Robot Size Conversion:

24 inch = 60.96 cm

61 cm x 61 cm x 61 cm = 226,981 cubic cm

8 cubic foot = 226 534.773 693 507 cubic cm

OVERALL ROBOT WEIGHT

- No weight restriction is imposed on the robots.
- 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.

ALLOWED PARTS LIST

A quick note about 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 transmitter / receiver
- servo motors
- batteries
- harvested gearboxes from mechanical devices
- PLC unit and interface

Examples
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 power drill where the complete motor/gear box/clutch/chuck is used.
- An automobile power headrest motor/flexible drive shaft/linear gear assembly are used.
- A photocopier chain drive involving the motor/drive shaft/drive chain sprocket is used.
- A photocopier gearbox to be used to manage a non-photo-copier motor.
- An electric scooter or wheelchair motor mounted on a student designed and created frame.

It is a team's responsibility to ensure robot compliance to standard.

Note: It is not acceptable to use complete 'out of the box systems' such as a Track Drive System where all components (motors, wheels, track belts, mounting frame, tension wheels etc) were manufactured to work together.

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. Example: 12Volts*20 Amps=240 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 current branch path from the battery must include either an **in-line fuse, circuit breaker** or be connected to a dedicated fuse in a rack.
5. Teams must use a wire gauge, which is appropriate to the current values in each circuit.
6. Batteries must be complete sealed commercial battery packs.
7. All **wires** and **batteries** are to be mounted **securely** to the robot taking into consideration that they must be protected from damage due to abrasion when the various robot elements move.
8. 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.
9. 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.
10. Robots must be able to be turned off with a single motion. Radio receivers may be in an independent circuit.
11. Teams must submit a wiring diagram of their robot's circuits.
12. Teams may use new or re-cycled motors. See list of allowable parts.
13. There is no restriction on the number of motors used on a single robot.
14. No explosive materials of any kind may be used (ether, gunpowder, acetylene etc.).

NON-ELECTRICAL (BATTERY) ENERGY SOURCES

1. Pressure based energy sources (air or other) may be pre-charged to a maximum of 90-PSI pressure in their reservoirs (cylinders) at the start of each game.
2. Competitor-made or modified air pressure systems are permitted as long as they do not exceed a maximum pressure of 30 PSI and they include a pressure relief valve set to trigger at 30 PSI.
3. All pressurized tanks on robots must have a pressure gauge to indicate the stored pressure and a form of automatic overpressure safety relief.
4. The pressure tanks and related gauges / controls must be shielded from damage due to collisions or flying target objects.
5. The stored pressure in the tank must not exceed a maximum of 90 PSI at any time.

6. 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.
7. Laser devices are prohibited.

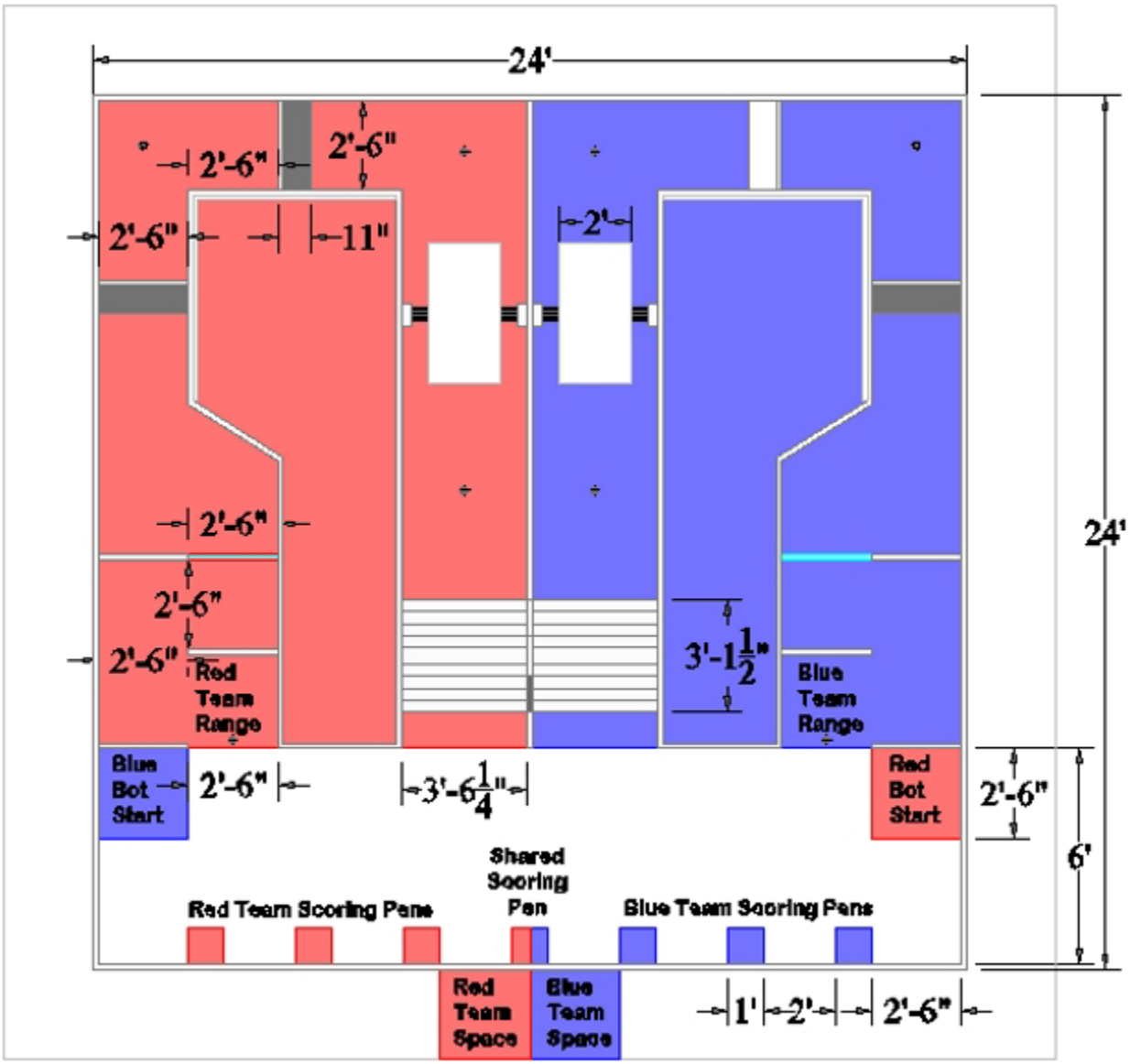
RADIOS

1. All teams must use ***ground frequencies*** (**75 MHz**) for their RC transmitters or Park Flyer Radio Control units (ones with a limited performance range, 500 feet) which use 2.4GHz Spektrum DSM technology such as those described at http://www.modelflight.com.au/rc_model_radio_control/spektrum_dx6.htm. **Note:** If any signal interference issues arise with WAN's or Phones when using the 2.4 GHz units then it is a team responsibility to resolve not the Robotics Challenge Technical Committee.
2. **Only six channels of a Single RC radio / Single Receiver Set can be used.**
3. Robots may not transmit information or a signal of any type to 'Off the Robot' devices.
4. All teams must report their radio information to the Skills/Compétences Canada National Robotics Challenge Technical Committee in advance of the competition so that potential signal conflicts can be identified and resolved prior to the competition. It is a team responsibility to ensure that their radio does not interfere with an opponent's radio.

PIT AREA

1. Only registered robot competitors are permitted in the pit area.
2. 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.
3. Designated teacher/industry team advisors are **not** allowed in the pit area during tournament and playoff play.
4. Teachers and industry advisors are not permitted to handle tools or robot parts. Students must affect all repairs and modifications on their robot.
5. 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.
6. 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.
7. It is required that teams fabricate a **tabletop 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 the table in the case of either deliberate motor testing during repairs or due to random, unexpected motor activity.

APPENDIX



Overall Roundup at the Stampede Corral Court Dimensions:

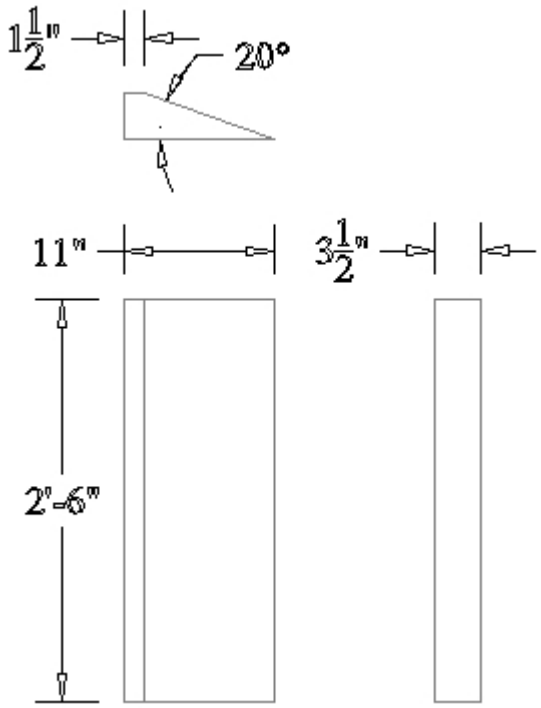
- The Court Playing Surface will be 24 by 24 feet.
- The Perimeter Court Wall and Obstacle Course Walls will be made using 2 by 4 inch planks.
- This wall will as a result be approximately 3.5 inches tall.
- The wall separating the Foothills Barriers will rise above the height of the steps.
- The Perimeter Obstacle Course Pathways will be 30 inches wide.
- The Central Obstacle Pathways and the Foothills Barrier will be 42 inches wide.
- The Foothills Barrier will include steps with a run of 4 inches and a rise of 1.5 inches leading to a total height of 7.5 inches.

- The Rickety Bridge Barrier will be 24 inches wide and present an entry angle of approximately 11 degrees.
- The Gully entry ramps will present an entry angle of approximately 20 degrees and a 3.5 Inch Vertical Drop.
- The Gully exit presents a Vertical Barrier of approximately 3.5 inches.

The Winding River Obstacle Details:

The Winding River obstacle sets out a 30-inch wide Zig Zag passageway on the smooth court surface.

This obstacle ends with a 1.5-inch wide finish line.

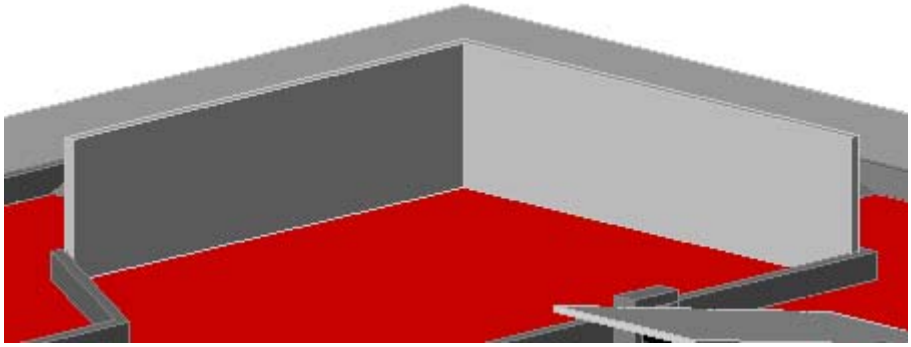


The Gully Obstacle Details:

The Gully obstacle has a 20-degree entry ramp leading to a 20-degree ramp down onto the court floor in the obstacle.

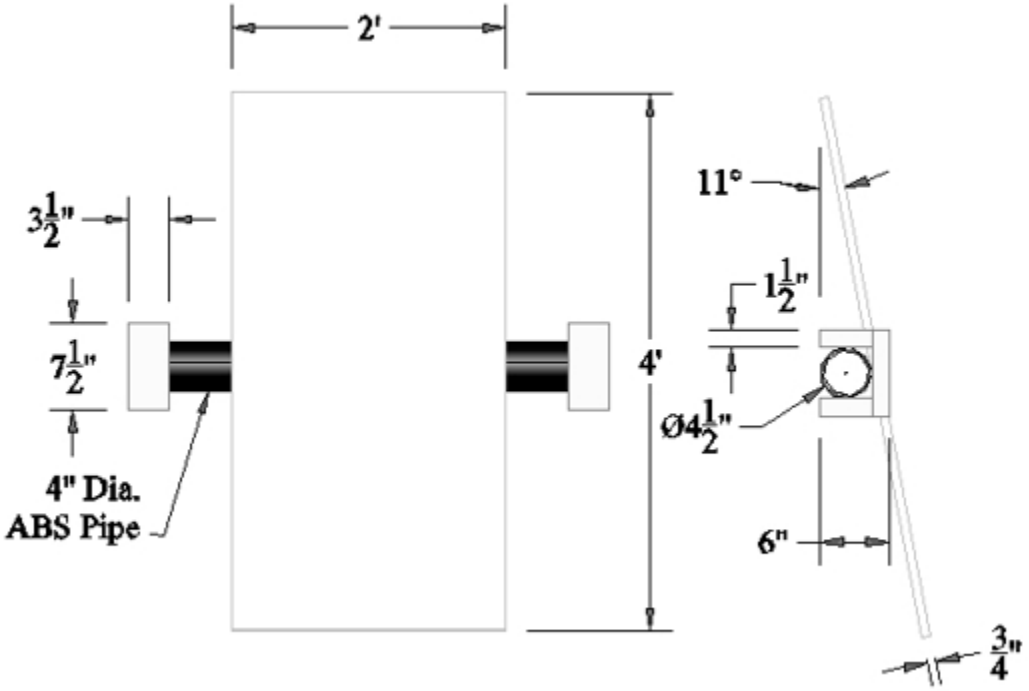
The exit path includes a 3.5-inch vertical barrier leading to a 20-degree exit ramp.

The Vision Barrier Details



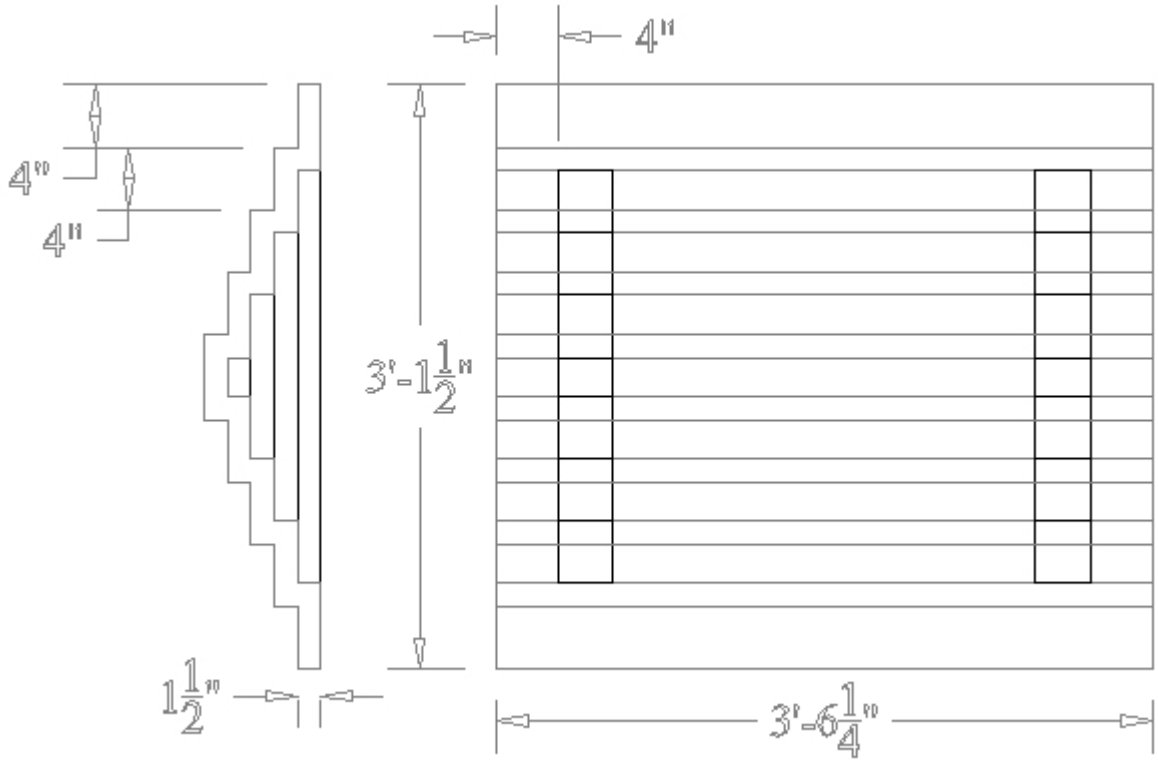
There will be an 18 inch tall Vision Barrier along the inner side of the Gulley obstacle. This will cause the robot to be out of the Driver's direct line of sight. This will mean a team's robot is either completely out of sight or that the driver may be able to see the top of their robot.

The driver will not be able to see either of the Gully entry or exit barriers nor will they be able to see the Steer positioned in the Gully.



The Rickety Bridges Obstacle Details:

The Rickety Bridges are Teeter Totters with 24 by 48 inch wide platforms that present an approximately 11-degree entry angle. This bridge will tip as the robot passes over it.



The Foothills Obstacle Details:

- The Foothills Obstacles are a set of steps, formed using 2 by 6 inch planks that the Robots must travel over.
- Each individual step is comprised of a 1.5 inch Rise (Vertical Front Edge) and a 4 inch wide Run (Horizontal Step Surface).
- There are two Supports, made from 2 by 4's laying on their wide side, under the Foothills obstacle.

The Scoring Pens Details:

- The Scoring Pens are a set of Seven 12 by 12 inch painted squares positioned along the End Wall of the Corral Area.

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PRE-INSPECTION FOR COMPLIANCE WITH SAFETY AND DESIGN RULES

- ❑ Overall volume ≤ 8 ft^3 (Antenna not counted) (or 13,824 in^3)
- ❑ Antenna < 4 ft from court floor

- ❑ 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)
- ❑ All circuits have a fuse or breaker (breakers must have **DC rating**)
- ❑ Appropriately gauged wiring for each circuit
- ❑ Wires and connections are in good physical condition
- ❑ Wires and connections are not exposed to physical abrasion
- ❑ Motors not over-voltaged by more than 50% (a 12V motor can be run at 18V)
- ❑ Wiring diagram provided.

- ❑ Competitor-made or modified air pressure systems do not exceed a maximum pressure of 30 psi and includes a pressure relief valve set to trigger at 30 psi
- ❑ Pressure tanks (cylinders) commercially manufactured if pressure in system exceeds 30 psi
- ❑ Pressure indicator
- ❑ Pressure in tanks does not exceed 90 psi (6.2 bar)
- ❑ 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 may be in an independent circuit.
- ❑ Only 6 channels of a single radio control unit are used for communications
- ❑ Demonstrate robot functionality with rated fuses

- ❑ Additional concerns:

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Robot Evaluator Signature Team Representative Signature