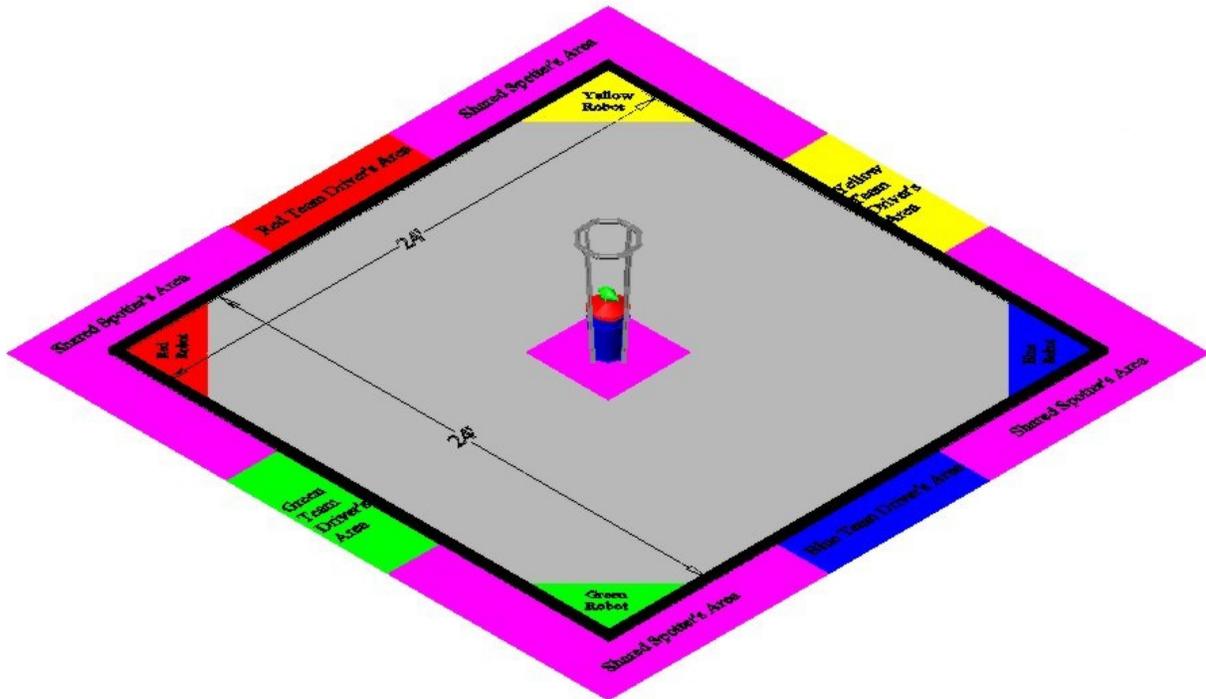


BC Skills Canada 2006 Robotics Challenge Scope  
Competition 93

# The Hoop Challenge



**April 26 200**  
**Tradex Abbotsford BC**

**The 2006 Skills Canada BC Robotics Technical Committee:**

Allan Byres, Technical Committee Chair  
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Teams will compete at the Provincial competition, there is no regional event

# Skills Canada 2006 Robotics Challenge Scope

Level: High School

Duration: National (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.

Tested Skills and Knowledge: Drafting, mechanics, electronics, metalwork, wood work & 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 mandatory eye protection.

Supplied by the Committee: Playing Field, timer, one 120V power outlet (minimum 100W), one worktable.

Judging Criteria: On the court performance of the end product (Robot) in the set task.

Team Size: 8 Students maximum

Number of Teams: This has not been an issue in BC before ,however , we would ask that if you have more than one team to let the chairperson know as soon as possible in order to make necessary arrangements. We reserve the right to restrict this number depending on the number of participants.

## Mission Statement

*The primary intent of any Skills Canada Robot Challenge is to have teams of students independently design and build robots capable of completing the competition tasks and to compete with robots which are student-fabricated. 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 Challenge. Teams MAY use the design of commercial mechanisms or systems, which can complete some tasks of the Skills Canada 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 Canada tasks.*

Please see list of the acceptable parts in the robot construction constraints section.

Provincial technical committee members will make checks for adherence to this statement, at their provincial competition, before any team advances to national level competition.

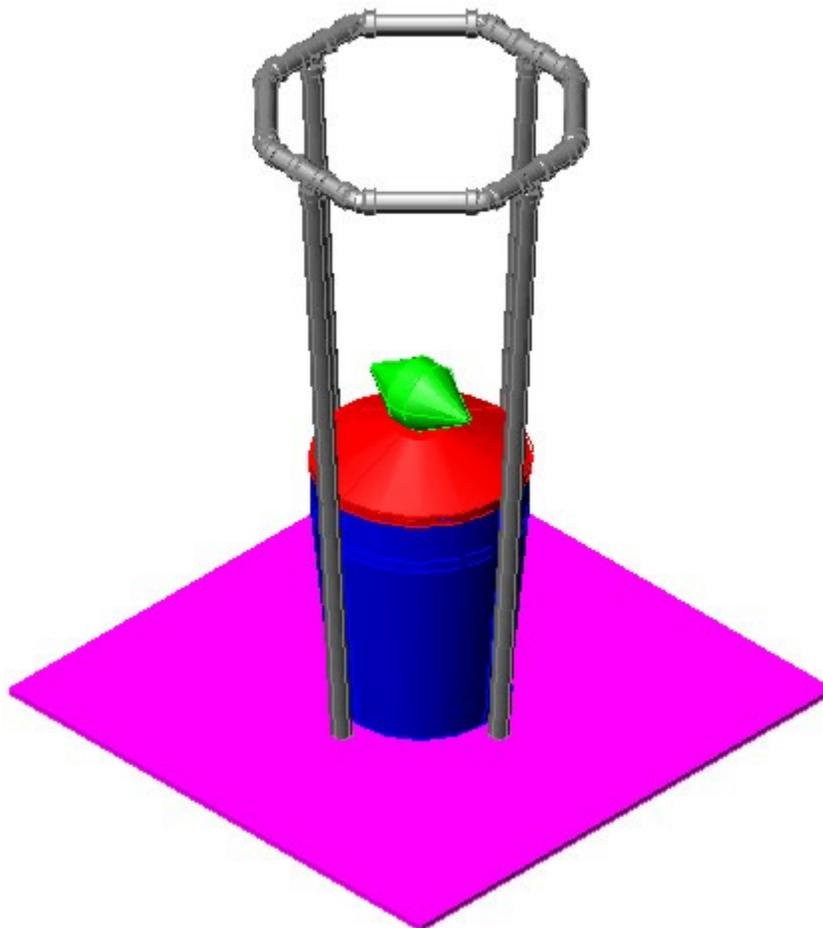
## Looking Ahead

*Skills 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 CANADA 2006 GOLD MEDAL FOUR 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 Game

## Basic Objectives

1. Robots will navigate over a smooth hard surface. This surface will be raw plywood.
2. Robots will play a modified game of Basketball.
3. Robots will start the game in possession of ONE Target Object (Junior Sized Footballs).
4. ONE additional Target Object (Football) will be placed ON TOP of the Pail Lid that is part of the Center Goal Structure. See image below.
5. Robots are NOT ALLOWED to drive onto the surface of the 4 by 4 foot Base Plate of the Central Goal Structure.



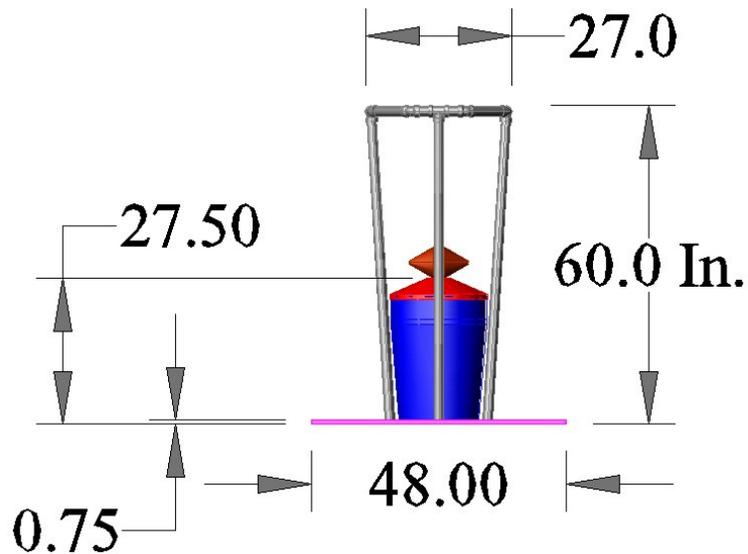
6. Robots are NOT ALLOWED to have possession of more than ONE Target Object (Football) at a time.
7. During game play ALL Robots will share the Target Objects (Footballs) that are on the Open Court Floor Areas and on the  $\frac{3}{4}$  inch thick Center Goal Support Plate.
8. Robots MAY NOT attempt to take Target Objects (Footballs) that are in the possession of other Robots.
9. Robots must deliver their Target Objects (Footballs) into the NET hanging from the Ring located at the top of the Center Target Structure. The Target Ring Opening will

be approximately 24 inches in diameter. The net will hang down to the height of the garbage can top

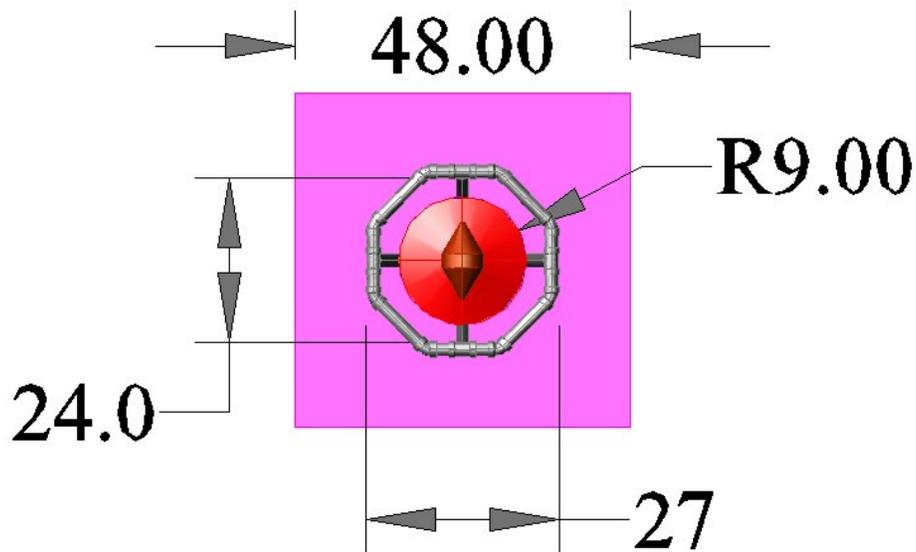
10. The Single Central Elevated Horizontal Target Ring (made out of ABS Piping) will have an Open Ended Netting and Target Objects (Balls) delivered into this net will fall onto the Pail Lid and return to the Competition Court Surface making them available for re-use by the ALL Robots.

Approved Target object  
Made by: Wilson  
Called: Mini Wilson Football  
Cost: \$11.99  
UPC Number 84-1506-2

Side View Center Target Structure



Top View Center Target Structure



## Game Standards

1. During the competition, students must maintain safety at industry standards. Team members without required safety equipment will not be permitted into the competition area.
2. During game play, referees will have ultimate authority over game rulings, and will have full authority over team conduct in the court area.
3. Damaging the **court** and or **target objects** is illegal. If a robot's 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 forfeited.
4. 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.
5. 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.
6. 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'.
7. Competitors cannot enter onto the court surface or make adjustments to their robot during a game. NOTE: 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.

## Game Play

**NOTE: This year's Robot Game requires the robots to compete directly for a scarce resource (One more Target Object (Football) available than the number of robots on the court).**

**NOTE: Deliberate Ramming of an Opponent Robot will not be allowed. HOWEVER, ALL Robots must be built in a robust and durable manner given that it is expected Robots may collide when moving towards the same Target Object (Football) on the Open Court Floor. This is comparable to two competitors colliding going for the ball in Basketball or Soccer.**

1. From their assigned areas, one **driver** and one **spotter** will direct their team's robot.
2. At the start of a game, robots will be placed in their assigned starting positions loaded with One Target Object (Football).
3. Competitors (both drivers and spotters) must remain outside the court boundaries.
4. Drivers must remain in their assigned driver's area throughout the game.
5. Spotters can wander around the 4 Shared Spotter's Areas.
6. Spotters may NOT enter an Opponent's Driver Area.
7. No electronic equipment (radios or other signaling devices) may be used to support communication between the Drivers, and Spotters.
8. Robots must not leave the competition court at any time during a game.
9. 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.
11. Robots may retrieve any Target Objects (Footballs) from the Open Court Areas for replay.
12. Target Objects (Balls) landing outside the court boundaries WILL BE RETURNED to the court (Placed on Top of the Center Goal Structure's Pail Lid) by the referee.
13. Robots may NOT touch the Center Goal Structure or Net.
14. Robots may reach onto the  $\frac{3}{4}$  inch thick Center Goal Structure Support Plate to retrieve Target Objects (Footballs) that land there. Robots may not drive onto the  $\frac{3}{4}$ " thick 4' x 4' surface on which the target rests.
15. No part of the Robot may enter into the Target Rim Area.

## Game Scoring

- a) Points will be awarded at the end of each game based on the number of Target Objects (Footballs) delivered into the Target Net located at the top of the Central Goal Structure.
- b) Each Target Object (Football) carries a value of ONE Point.

## Match Scoring

Matches in the round robin will be scored by the following table:

## **Game Result Round Robin Tournament Standing Points**

**1st Place Team 4 Tournament Standing Points**

**2nd Place Team 3 Tournament Standing Points**

**3rd Place Team 2 Tournament Standing Points**

**4th Place Team 1 Tournament Standing Point if a minimum of 1 Game Point has been scored or 0 Tournament Standing Points if no Game Points have been scored**

- a) A round robin standing score of zero (0) will be awarded for robots that do not show up for a game.
- b) Total round robin scores resulting in a tie will be broken by comparing the total number of points collected in all games.
- c) Ties not resolved by point (b) will be settled by playing a single special 4-minute tiebreaker game.

## **Round Robin Play**

1. Up to four Robots will play on the court in round robin games.
2. Round robin games will last 4 minutes.
3. 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.
4. Between round robin games, battery changes and repairs to robots may be completed.
5. All robots should expect to play at least 10 games in the round robin

## **Finals Play**

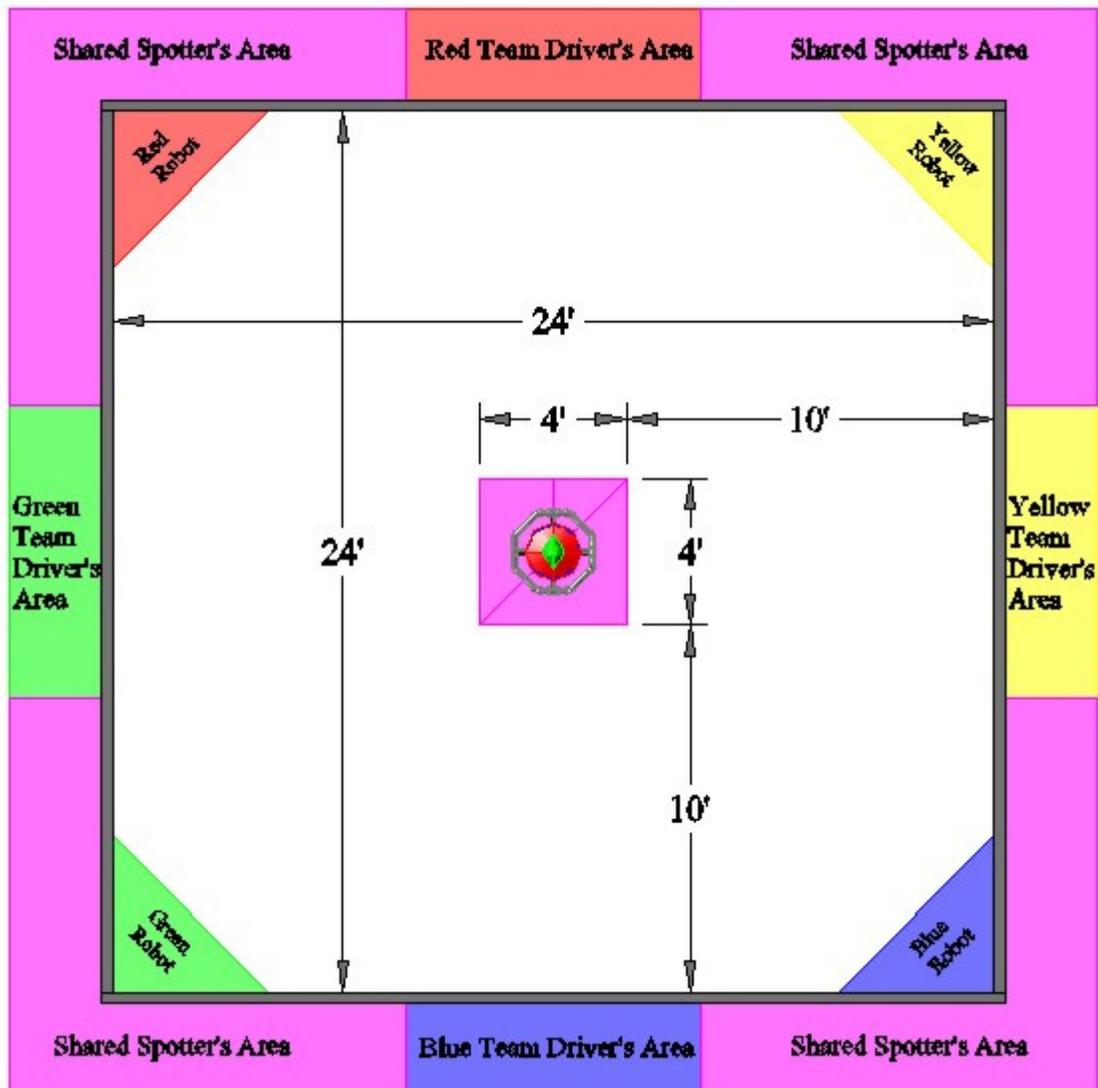
1. Top 4 teams will advance to the finals.
2. Two Robots will play on the court in finals games
3. Finals games will last 8-minutes, comprised of two 4-minute periods.
4. The amount of time between games will be determined by the amount of available time left in the competition. This information will be provided to teams at the start of the finals.
5. Between finals games, no repairs may occur to the robot. Batteries may be exchanged between games and periods.
6. Finals 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.
7. Finals games may be adjusted to allow for time adjustments and all changes will be announced prior to the finals rounds starting.

## **BC 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 1/2" tolerance. The court will be surrounded by a 2x6 wall.

The Center Target is to be a 24 inch diameter Horizontal Ring mounted 60 inches above the court floor over a 48 inch square base that has a Pail with a Lid Core Unit.

### Top View Plus Robot, Driver & Spotter Positions



### Robot Restrictions

All Robots must PASS a pre-competition 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.

## 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 inches above the court floor. The Radio Antenna is not considered when defining the Overall Robot Size.

## 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 transmitters / receivers,servo motors, batteries, harvested gearboxes from mechanical devices....

## 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.

1. A Power Drill where the complete Motor / Gear Box / Clutch/ Chuck is used.
2. An Automobile Power Head Rest Motor / Flexible Drive Shaft / Linear Gear Assembly are used.
3. A Photocopier Chain Drive involving the Motor / Drive Shaft / Drive Chain Sprocket is used.
4. A Photocopier Gear Box to be used to manage a non-photo-copier motor.

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.

## **Power Sources / Management**

1. The total voltage in any individual circuit **cannot** exceed **24 Volts**.
2. **Maximum** power rating of **216 W** in any circuit. Which will be limited by voltage and fuse selection. Example:  $12\text{Volts} \times 18\text{ Amps} = 216\text{ Watts}$
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** 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. Robot must have an easily accessible main power **"kill" switch**.
11. NO Robot components (compressors, motors, cameras or other devices) can be started by the Main Power Switch directly at the start of a game. All devices must be managed through the SIX Radio Channels either directly or in combination with internal to the Robot devices (programmable Boards or Limit Switches etc.). Note: There is no limit placed on the number of Internal to the Robot control systems used.
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, gun powder, 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. No competitor-made or modified pressure tanks (cylinders) are permitted.
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.
2. Only six channels of an RC radio can be **used at a time**.
3. No radio telemetry from the robot is allowed.
4. New prototype RC controllers developed by Skills Canada British Columbia TC will be permitted.

### **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 Work Table 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 will have purely advisory role in the pits. They 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 **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.

### **Further communications**

All participating teams are expected to check the 2005 Skills Canada BC website for updated information beyond this paper. [www.skillscanada.bc.ca](http://www.skillscanada.bc.ca)

Further updates to this scope or questions and answers will be posted at

<http://public.sd38.bc.ca:8004/~abyres/>

Questions for clarification of the rules can be made to the B.C. Technical Committee (see cover page for e-mail contact addresses). Responses to these questions will be posted on the above site. Teams participating are expected to periodically check this site for updates.