

The
Wisconsin Institute for Robotics in Education
And
Milwaukee FIRST Support Organization

PRESENT



MILWAUKEE VEX LEAGUE

**SEPTEMBER 26
THRU
NOVEMBER 14**

DISCOVERY WORLD

2006 FALL ROBOTICS CHALLENGE

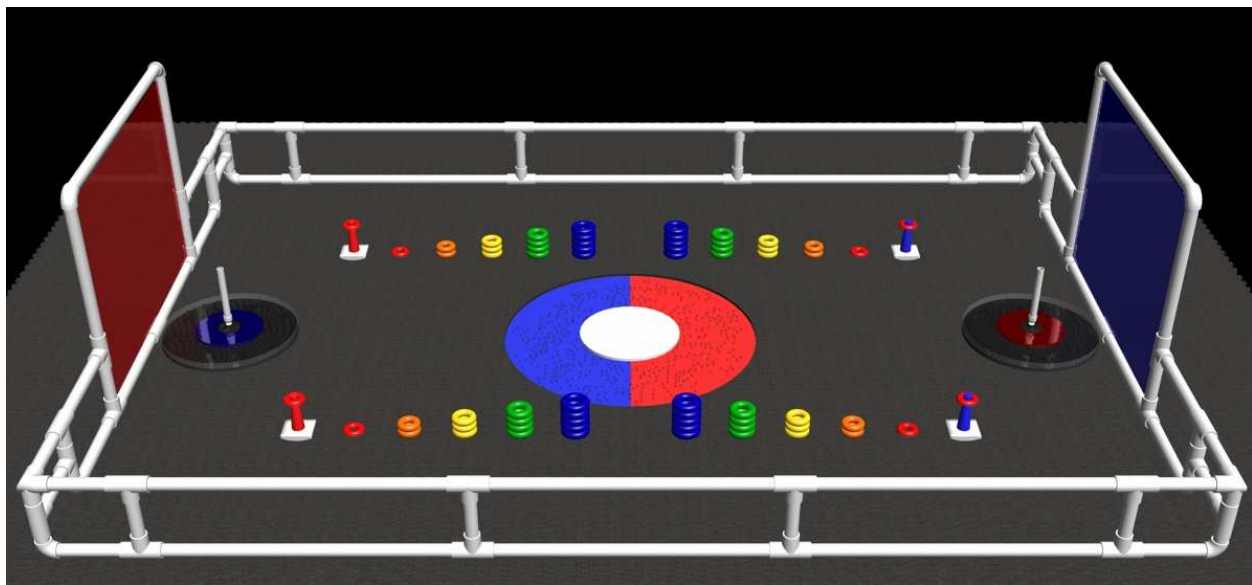
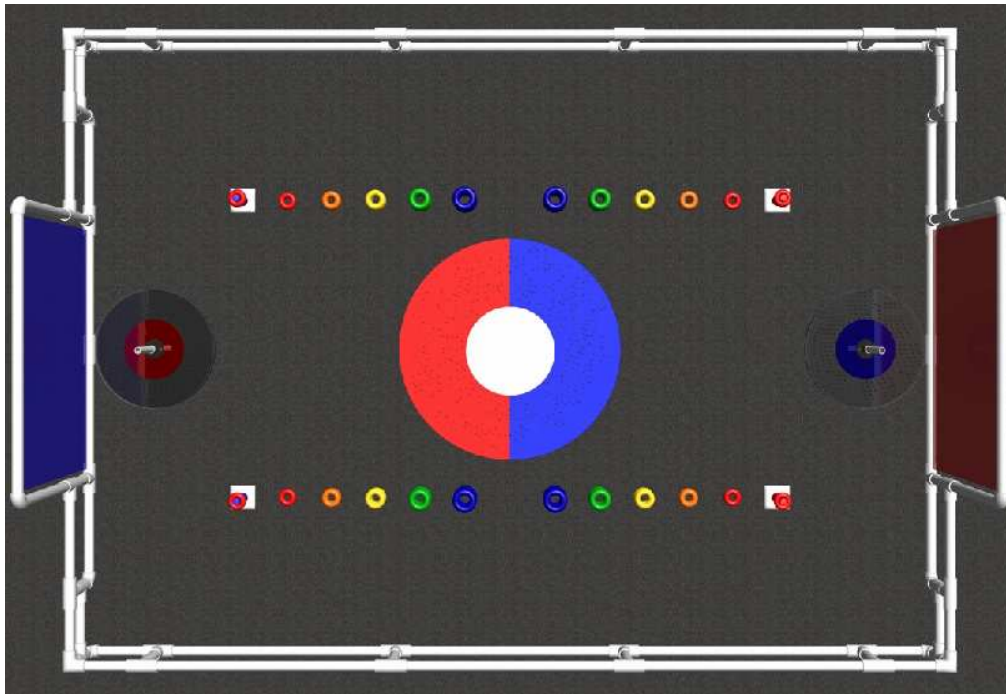
DECEMBER 3RD

MSOE KERN CENTER

1. Objective

The objective of “King of the Rings” is to design and build a radio-controlled robot that will allow you and your partnered team to score a higher point value than the opposing alliance during competition matches.

2. The Game



Visit <http://www.wirobotics.org/vex/2006/> to download files containing larger, dimensioned field diagrams and descriptions of each object as placed on the field above.

2.1 Field Description:

2.1.1 The playing field is the Official Milwaukee VEX League Field and is constructed of PVC pipes and fittings. Please refer to <http://www.wirobotics.org/vex/2006/> for details. The field measures 10' x 14' and the surface of the playing area consists of 2' x 2' interlocking dark gray foam floor tiles available from www.softtiles.com.

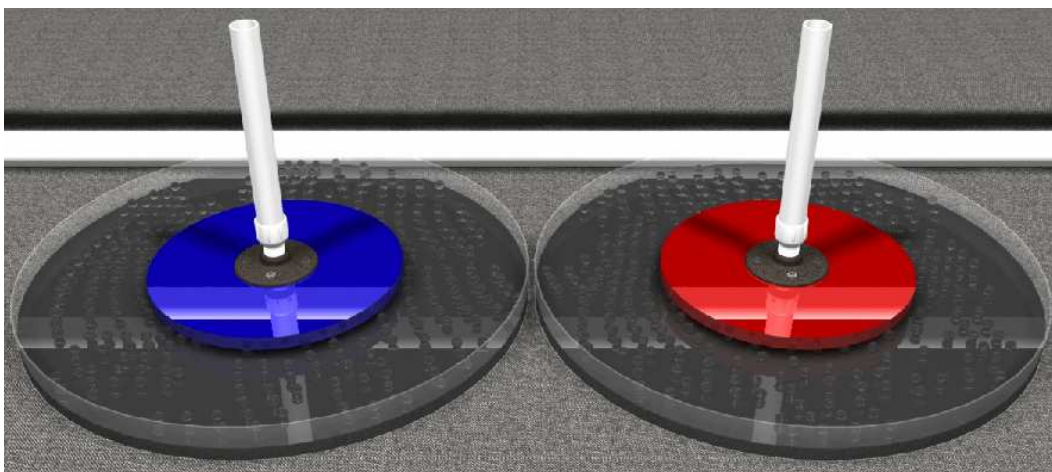
2.1.2 All official field dimensions will be within +/- 1/2" tolerance

2.1.3 Rings: The field will contain a total of 64 colored Rings from [Fisher-Price Rock-a-Stack](#) toys. 60 of these Rings will be stacked on the playing surface in an accumulating fashion, growing as the Rings approach center field. The stacks are centered 30" from the field border and are spaced 9" apart, on center. There are four sets of stacks, each consisting of 5 blue Rings, 4 green Rings, 3 yellow Rings, 2 orange Rings, and 1 red Ring. The center of the blue stack of Rings is located 9" from the playing field centerline. The four remaining Rings will be placed on the Tippy Goals, as described in section 2.1.5.2.

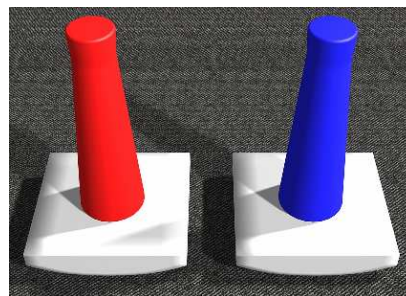


2.1.5 Scoring Areas: The field has six scoring areas divided equally between the alliances. The two types of scoring areas are as follows:

2.1.5.1 Floating Goals: A stationary goal area with a floating platform is located at each end of the field against the alliance wall, colored with the alliance color opposite the nearest Alliance Zone. The Outer Goal is 24" in diameter and has a 1.75" tall lip around the perimeter. The goal surface is filled with approximately 700 1/2" diameter marbles. There is a 12" diameter Inner Platform with a scoring pole centered on top, which rolls over the marble surface. The top of the pole is 12" above the surface of the Inner Platform. Rings that are placed on the surface of the Outer Goal, the Inner Platform, or on the center pole will be scored.



2.1.5.2 Tippy Goals: Four short Rock-a-Stack bases coded in alliance colors will begin the match placed 30" away from the Alliance Zone wall, in line with the stacked rings. The goals are 8" in height and have a rocking base. One small ring with the red side up will be placed on each Tippy Goal at the start of each match.



2.1.6 Center Pit: A 44" diameter circle is cut out of the foam tiles in the center of the playing field. The resulting pit is filled with approximately 2000 marbles, on top of which sits a floating acrylic platform, ¼" thick, with a diameter of 18", which will offer one robot a "King of the Hill" opportunity at the end of the match. The marble pit is divided by the two alliance colors, and will offer additional scoring opportunities depending on the location of the platform.

2.1.7 Human Player Goal Box: Each team will have a Goal Box where robots may deposit Rings for Human Players. The Goal Boxes will be positioned in the corners of the field and will be 12" W x 6" H. Each Goal Box will extend 10" into the Alliance Zone. Robots may enter this area to deposit Rings; however, Human Players may not reach into the area until robots have exited completely. Failure to comply may result in Human Player removal for the match.

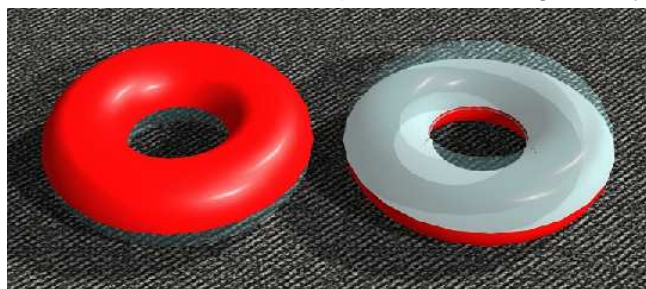
3. Scoring

3.1 All scoring will occur at the end of each two minute-thirty second match, after all robots and scoring objects have come to rest.

3.2 The five different scoring Rings are assigned the following point values:

Blue Ring:	1 pt.
Green Ring:	2 pts.
Yellow Ring:	3 pts.
Orange Ring:	4 pts.
Red Ring:	5 pts.

3.2.1 Lock Rings: The smallest, red-colored Ring has a value of 5 points as stated above, but it can also lock any Rings placed below it on any of the goal poles. This Ring can only lock Rings when the clear side is up. Once a Lock Ring is placed on a goal pole, neither alliance may remove the Lock Ring, or the Rings below it on the pole. For example, at the start of the match each Tippy Goal has one of the red Rings on top of it and since the red side is up they are not Lock Rings and can be removed at any time. Rings may still be scored or de-scored on top of a Lock Ring on any goal.



3.2.2 Scoring in Order: If the blue, green, yellow, orange, and red Rings are scored on any goal in that order, a bonus of 20 points will be awarded to the alliance that the goal belongs to. The stack must remain in this order at the end of the match or the bonus will not be awarded.

3.3 Ring Scoring Opportunities and Multipliers:

3.3.1 (1x) Multiplier: Rings on a Floating Goal Outer Goal will be worth their point value. To be considered on an Outer Goal, Rings must be supported by the surface of the goal, the marbles on the surface of the goal, or the outside lip around the goal; may be resting against the field border, the Inner Platform, or other Rings on the Outer Goal; and may not be touching an alliance robot or the playing field surface.

3.3.2 (2x) Multiplier – Floating Goal: Rings on a Floating Goal Inner Platform will be worth twice their value. To be considered on an Inner Platform, the Rings must be supported by the Inner Platform itself or the base of the Floating Goal pole; may be resting against the field border, the goal pole, or other Rings on the Inner Platform; and may not be touching the Outer Goal, the marbles, a Ring on the Outer Goal, or an alliance robot.

3.3.3 (2x) Multiplier – Topsy Goals: Rings on a Topsy Goal pole will be worth twice their value. Rings must be only supported by other rings on the pole or the base of the pole and must be around the pole to be considered. See 5.13 for clarification.

3.3.4 (3x) Multipliers: Rings on the Floating Goal pole will be worth thrice their value. Rings must be only be supported by other rings on the pole or the base of the pole and must be around the pole to be considered. See 5.13 for clarification.

3.4 Center Platform: The center platform allows a King of the Hill opportunity for one robot. At the end of each match 20 points will be awarded to the alliance that is represented by the robot that maintains control of the platform. An additional 15 points will also be awarded to the alliance whose color the majority of the platform rests on once the platform has come to a rest. If majority cannot be determined, no points will be awarded for platform position.

3.5 Human Player Scoring: At the beginning of each match, each team's Human Player will be given 6 Rings (1 green, 2 yellow, and 3 orange), with which they may attempt to score by tossing the Rings at any pole or scoring platform. Robots may pass additional Rings to the Human Players throughout the duration of the match. Goal Boxes will be positioned in the corners of the field and will be 12" W x 6" H. Each goal box will extend 10" into the Alliance Zone. Human Players may not retrieve Rings from the Goal Boxes while an alliance robot is within this boundary. Each Human Player will be given two empty Rock-a-Stack bases for storage of collected Rings.

3.5.1 Human Player Bonus: If a Human Player successfully tosses a Ring onto their alliance's Floating Goal pole, a bonus of 50 points will be awarded to the scoring alliance. The bonus will count towards the score even if that Ring is removed during the match.

3.6 Tie Breakers: In the event of a tie, the winner of the match will be determined by the following criteria, in this order:

- The alliance with the most Rings scored “in order.”
- The alliance with the most Lock Rings successfully placed on any goal pole.
- The alliance that attained “King of the Hill.”
- The alliance whose color is under the Center Platform.

4. Matches

4.1 The competition will consist of Qualifying Matches followed by Elimination Matches. Each match is two minutes and thirty seconds long. There is no autonomous period and the robot will remain under the control of one individual for the duration of the match.

4.2 Field Crew: Each team is allowed to bring one driver, one human player, and one coach to the field. Each person will be required to display the proper badge, which will be provided by the event staff. The driver and human player must be pre-college age. All three members must remain in the alliance zone for the entire duration of the two minute and thirty second match. Failure to do so will result in a 10 point penalty. Teams are expected to be present for each of their scheduled matches; however, if a robot is unable to compete for a scheduled match, the team is required to send one representative to stand in the driver’s area for the duration of the match.

4.3 Match Safety: Safety glasses are required at all times during the matches to ensure the maximum possible eye protection. Safety glasses are also required at all times in the pit area and on the competition field. Teams will not be permitted to compete unless all team members on the competition field are wearing safety glasses. Teams must provide their own safety glasses for the event; no safety glasses will be supplied by the event coordinators.

4.4 Starting Zones: Robots will begin the match in the four corners of the field in front of the Human Player Goal Boxes. At the start of the match, a robot must be in contact with the back and side rails of the playing field. Robots will start in one of the starting areas nearest their alliance zone. Alliances will be designated as either “Red” or “Blue” on a match-by-match basis as noted on the match schedule distributed and posted at the competition.

4.5 Qualifying Matches

4.5.1 All teams will play in approximately the same number of Qualifying Matches (the number of matches will differ by no more than one match). The number of qualifying matches at each event will be determined by the length of the event and the number of teams competing. Teams playing in extra matches will be deemed surrogate teams and the results of that extra match will not affect their ranking.

4.5.2 Teams will be given their schedule of qualification matches before the start of the first match. The qualification match schedule will show the match number, the alliances competing in each match, and the color that each alliance is assigned for that match.

4.5.3 At the end of each qualifying match, the total number of points scored by each alliance will be considered their Qualification Points.

4.6 Ranking

At the end of the qualifying matches, teams will be ranked from 1 to N (N being the total number of teams present) based on the following:

- Total number of Qualification Points.
- Most wins.
- Most matches with “King of the Hill” counting towards your alliance's score.
- Most matches with Lock Rings counting toward your score.

4.7 Elimination Matches

4.7.1 The number of teams participating in elimination matches will be no less than 16 but may be increased prior to the start of the event based on the number of teams participating.

4.7.2 Alliance selection procedure for the elimination matches will be run like FRC elimination alliance selection, in which the 1st place team will pick first and the 8th place ranked team will pick last. If a team ranking in the top 8 places is picked, then the next seeded team will pick.

4.7.3 During elimination matches, the #1 ranked alliance will play the lowest ranked alliance entering the elimination matches (i.e. if there are 4 alliances in the elimination matches, #1 will play #4, and the #2 ranked team will play the second-lowest ranked team, and so on.)

5. General Rules

5.1 Disqualification: Robots may be disqualified based on their actions that violate the rules of the game. If a referee calls for a disqualification during a match, the robot will be disabled and they will receive a score of zero for the match. If disqualification is not determined until the completion of the match, the offending robot will receive a score of zero for the match. The alliance partner of a disqualified robot will still receive the score earned by both robots for their duration in the match, provided that they are also not disqualified. In both situations the opposing alliance will receive a score based on the points that they earned.

5.2 Safety Hazards:

5.2.1 Referees may request that teams alter any portion of their robot that is considered a safety hazard. It is the right of the referees to prevent teams from playing in matches until such changes are made to the robot.

5.2.2 Referees will disqualify any robot that they deem to be a repeat safety hazard. A safety hazard is any direct action of, or mechanical failure on said robot which may increase the possibility of immediate damage to other robots, field objects, or personnel.

5.3 Loss of Parts: All parts of the robot must remain attached to the robot for the duration of the match and must not cause any hazard of entanglement to any other robot, or else that robot's team may run the risk of disqualification. Minor pieces which unintentionally become detached from the robot and do not affect the outcome of the match will not cause a disqualification.

5.4 Pinning: Pinning occurs when an opposing robot is held against an obstacle and cannot move, in any direction, because of your robot's presence. Pinning will be visibly counted out by the closest referee, for a duration of five (5) seconds. If a robot is being pinned for five seconds, the team doing the pinning must back off for at least five seconds before they can resume. Failure to do so will result in the disqualification of the aggressor.

5.5 Flipping: Robots may not intentionally flip an opposing team's robot. The flipping robot will be disqualified from the match if in the referee's decision they initiated a lifting action which results in flipping. In incidents where the flipped robot initiates action or both robots are in motion, disqualification may not occur and will be at the discretion of the referees.

5.6 Intent to Destroy: Strategies aimed solely at the destruction of or damage to an opponent's robot or the field is not in the spirit of the competition and will not be allowed.

5.7 Human Player Actions: Human Player's actions will be closely monitored during the match, and the following actions will result in penalty:

5.7.1 Throwing Rings: Human Players will not be allowed to throw Rings at robots, opponents, or field crews. Any Human Player caught doing so will be removed from the field for the remainder of the match.

5.7.2 Ring Retrieval: If a Human Player removes a Ring from the Human Player Goal Box while an alliance robot occupies the Goal Box, the Human Player will be removed from the field for the remainder of the match.

5.7.3 Robot Interaction: If a Human Player comes into contact with a robot at any time during the match, both the Human Player's team and the robot's team will immediately be disqualified.

5.7.4 Red Rings: Due to the harder material of the red Rings, Human Players will not be allowed to throw red Rings. If a red Ring is returned to a Human Player by a robot, the Human Player may gently return the red Ring to play in the area immediately in front of him/her. Any other actions with the red Ring may result in the removal of the offending Human Player from the playing field for the remainder of the match.

5.8 Starting Area: At the start of the match, teams may place their robot in any orientation that satisfies the starting conditions. The robot must remain the size of a 15" cube and must be touching the back and side rails of the playing field border. Alliances must make a joint decision as to which alliance-owned starting area their robots will be placed in before each match.

5.9 Center Platform: A robot is considered on the Center Platform if it is completely supported by the platform. Robots resting on rings not on the platform, marbles, or being supported by an alliance robot will not be considered to be on the platform.

5.10 Lock Ring Removal: A Lock Ring or any Ring below a Lock Ring may not be removed by any team from any pole. If a robot removes a Lock Ring, that team will receive a 15 point penalty for EACH locked Ring that is removed. The alliance that lost the locked Rings will not be compensated and the Rings are eligible to be rescored by any team.

5.11 Scoring Objects: Any scoring object which leaves the playing area during a match will not be returned to the field and is ineligible to be scored.

5.12 Tipped Goals: If a goal is knocked over during normal play, the goal will not be returned to an upright position by the referees, and any Rings which fall off of the goal will not be counted in the final score. Goals may be re-righted and re-scored at any time.

5.12.1 Goals Outside the Field Area: If a robot removes the opposing alliance's goal from play, that alliance will forfeit the match.

5.12.1 Goal Tipping: The tipping of an opponent's goal will result in a 15 point penalty and is not a way to exercise gracious professionalism.

5.13 Ring Pole Scoring: Rings will be counted toward scoring if they are seeded around the pole. A Ring is considered 'seeded' and will count towards scoring when it is around the pole and supported only by the base of the pole or other seeded rings. The following scoring circumstances will be determined by the referees as needed:

5.13.1 All poles will be considered infinite. If Rings are stacked on top of Rings that are seeded on the pole and supported only by the 'scored Rings', then those Rings will be considered seeded or around the pole as well and count towards the score.

5.13.2 If a robot is touching any of its alliances' Rings at the end of the match, those Rings will be considered void and will not count towards the score. Any Rings above this Ring will be considered void as well.

5.14 Robot Control: Team members may interact with their robot during a match only through the normal operation of the VEX control system. Only designated drivers may be in contact with the controls during the match.

5.15 Robot Modification: Teams are allowed to modify their robots in between matches as long as the robot remains compliant with all specifications and rules after the modification. Any modification should be brought to the attention of the referees or head inspector prior to the start of the team's next match. Teams may be subject to re-inspection at the discretion of the referees/head inspector.

5.16 Robot Identification: Teams must have their team number clearly marked on four sides of their robot, such that it is visible from 15 ft. away. Teams must also have the ability to designate either Blue or Red alliances with a color insert or flag. These inserts must be provided by the team and must not be a functional part of the robot.

5.17 Rule Clarification: All questions or requests for rule clarifications should be submitted via the Team Discussion Board on the event website (www.wirobotics.org). Questions and answers will be publicly posted on the event website.

5.18 Referee Rulings: All referee decisions regarding rules of play and scoring are final.

5.19 Entering the Field: Team members will not be allowed to enter the playing field at any time. If robots cannot be retrieved from the edge of the field, a field rest crew member will be instructed to handle your robot only by the chassis. The majority of field reset crew members will be former FIRST participants, however, be sure to build a robust robot!

6. The Robot

6.1 Size Restriction: At the start of each match, every part of the robot must fit, unconstrained, in a stable position, within a cube with 15" sides. The robot may only contact the surface of the field in starting position. Robots will be measured before the beginning of qualification and elimination matches.

6.2 Weight Restriction: There is no restriction on the robot's weight, and it will not be measured at the competition.

6.3 Controls: Teams will be required to use one (1) competition remote control. Frequency modules will be provided by the competition coordinators and are not allowed to be brought to the competition site. Each team's remote is required to be tethered to a field disable tether during matches.

6.4 Pit Operation: Teams must bring a tether for robot control in the pit area. Robots may not be operated outside of the competition field or pit area. Failure to follow this rule may result in forfeiture of the next round of competition.

6.5 Construction Restrictions:

6.5.1 A robot must be designed to operate by reacting only against features within the confines of the playing field boundaries and may not interact with anything outside the boundaries of the playing field.

6.5.2 Gaining traction by use of adhesives or by abrading or breaking the surface of the playing field is not allowed and will be considered to be damaging the playing field and is subject to disqualification.

6.5.3 A robot may not intentionally contaminate the playing field or an opponent's robot with lubricants or other debris.

6.5.4 Each team will be expected to use parts only from the VEX Robotics Design System Starter Kit unless specified on the additional materials list below. Teams may use 7.2V NiCd batteries of any manufacture, but only one battery (six cells) may be used on the robot at a time. The battery cost does not count towards the cost limit listed below.

6.5.5 Modifications are permitted to the mechanical parts of the kit. Teams may opt to buy their own replacement or spare parts from www.vexlabs.com, but these may not be used as part of the robot until the part fails. Teams may NOT intentionally modify any of the kit electronics. Modification of items on the additional materials list is also permitted.

6.5.6 A parts outline form the VEX Robotics Design System Starter Kit can be found at <http://www.vexlabs.com/vex-robotics-design-system-2.shtml>

6.6 Materials: Teams are restricted to the contents of two (2) VEX Robotics Design System Starter Kits. Additional materials may be used as outlined below. Each team must submit a Bill of Materials outlining their parts and expenses before their first match. We ask that the Bill of Materials distinguish between starter kit materials and additional materials.

6.7 Additional Materials List

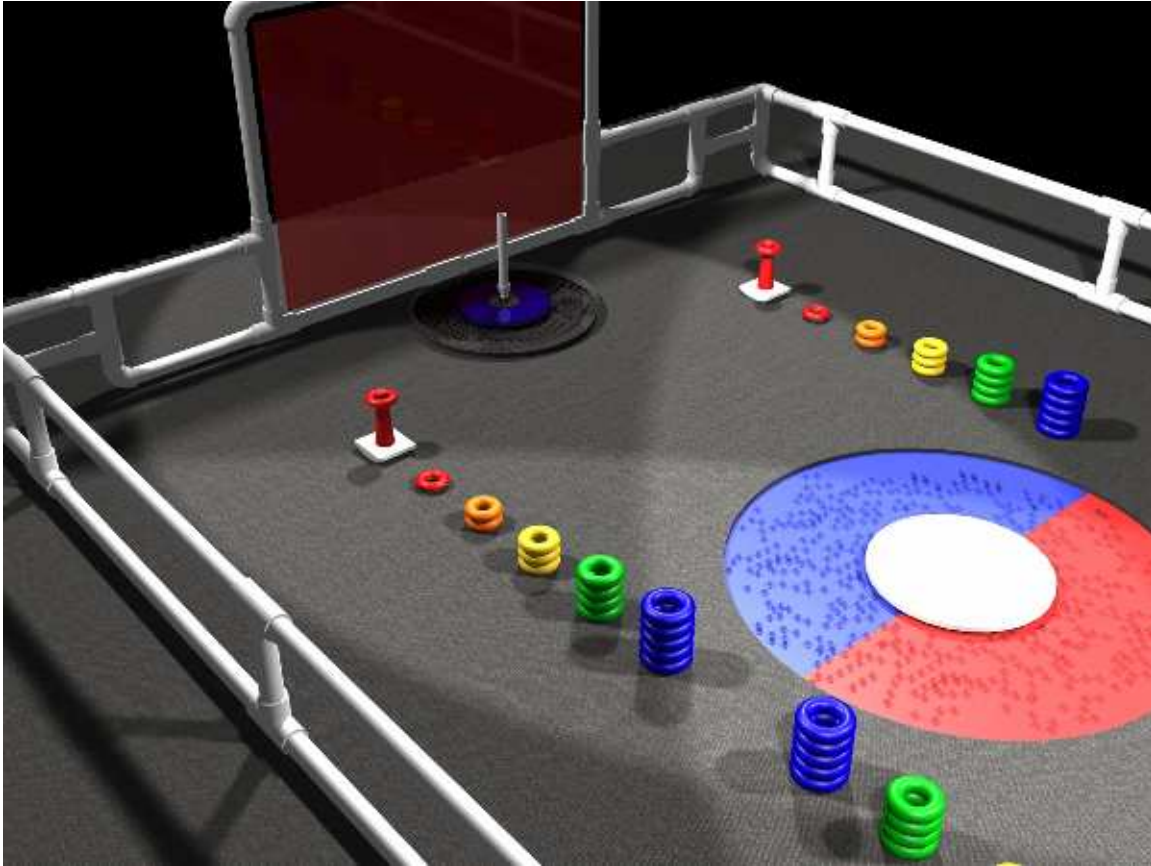
- String of no more than ¼" in diameter.
- Rubber bands of no more than 1" in width.
- Non-functional decorations
- A maximum of \$200 in additional VEX accessories from Innovation First (www.vexlabs.com).
- This competition does not use autonomous mode. However, you may choose to program certain functions in your robot. The programming kit may be used to program custom functions to your robot but does not count against the \$200 maximum listed above.

6.8 Energy Sources: The energy used by the devices in the competition must come solely from:

- A change in altitude of the center of gravity of the device.
- Electrical energy delivered by the battery to the electronics and motors provided with the kit.

7. Awards

Please keep checking the official website (<http://www.wirobotics.org/vex/2006/>) for updates as the award list is finalized.



Appendix

Field Items

Quantity	Item	Description
20	Blue Ring	4 Stacks of 5 on the field, 2 to each human
20	Green Ring	4 stacks of 4 on the field, 2 to each human
20	Yellow Ring	4 stacks of 3 on the field, 2 to each human
20	Orange Ring	4 stacks of 2 on the field
8	Red Ring	4 on the field, 4 on the tipsy goals
4	Rock-a-Stack Base	Tipsy Goals, 2 red, 2 blue. Base is wrapped in vinyl for color
3400	Marbles	700 in each floating goal, 2000 in center pit
48	Foam Tiles	Minimum amount to cover the 10'x14' playing field, optional
2	Goal Base	24" diameter circle, 1/2" thick. Acrylic will be used, plywood can be substituted
2	Floating Goal Lip	1.75" high, 1/8" thick, fastened to the edge of the Outer Goal. Clear acrylic will be used, chipboard cardboard can be substituted, but inner goal bounce may not be the same
2	Floating Goal Platform	12" diameter circle, 1/2" thick. Acrylic will be used, plywood can be substituted
2	Steel Flange	Standard 1" Steel Flange, attached to the center of the inner platform
2	Adapter	1" PVC male adapter, screwed into steel flange
2	PVC Pipe	Approximately 10.25" in length, but adjusted to achieve the proper height. Attached to adapter
8	1/4-20 1" Machine Screw	Counter-sunk into the bottom of the inner platform to provide a flat face for rolling
8	1/4-20 Nut	Attached to the machine screws on top of the steel flange

Field Bill of Materials

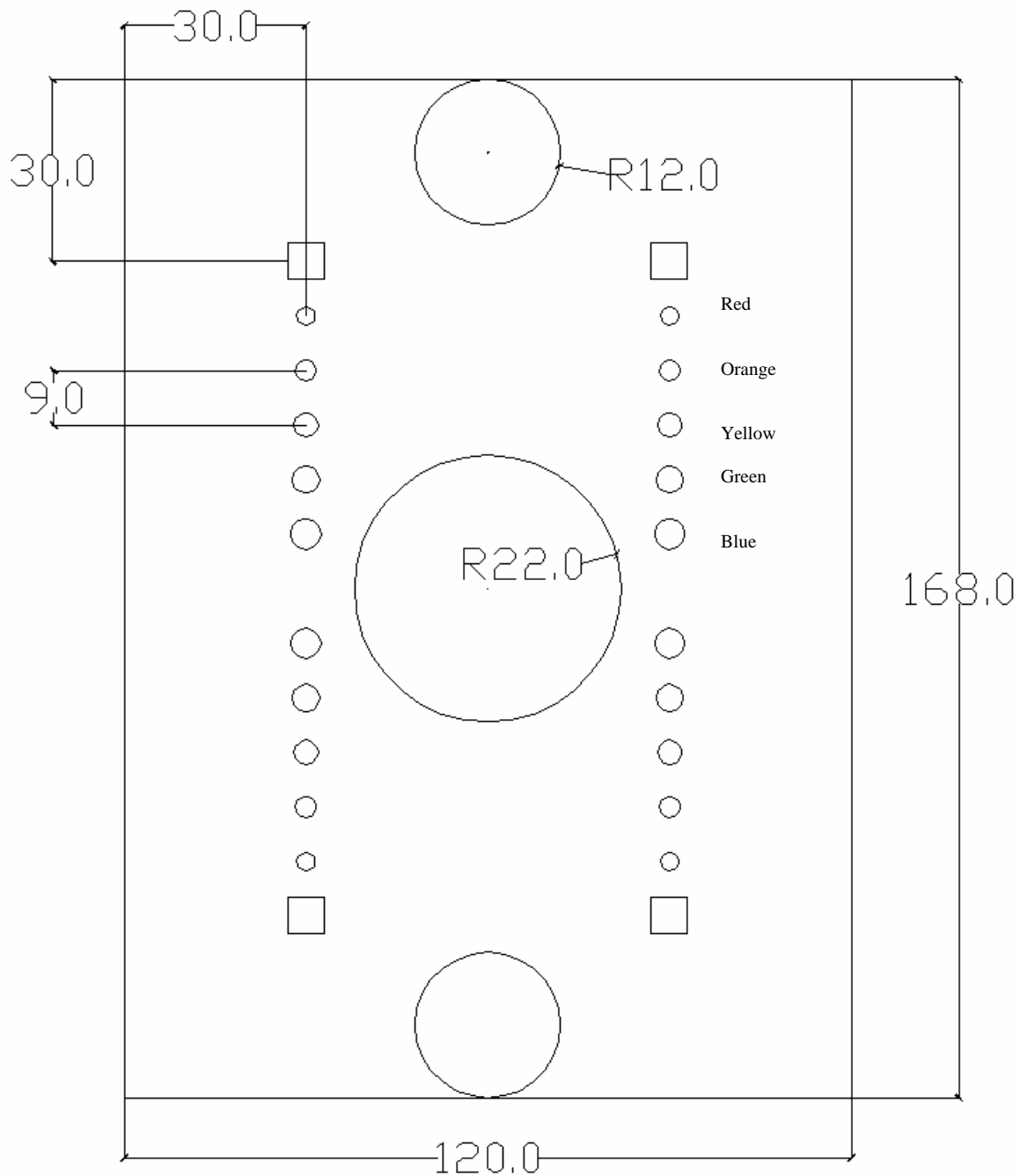
ID	Item	Description	quantity	price	total cost
71050	Rock-a-Stack	Available at Wal-Mart, Target, etc.	20	\$4.96	\$99.20
70251	Marbles*	Available at Wal-Mart, about 350 per pack, in the craft isle	10	\$2.97	\$29.70
40715	Steel Flange	1" black steel pipe flange, available at Home Depot	2	\$2.98	\$5.96
62605	1" Male Adapter	Available at Home Depot	2	\$0.48	\$0.96
28761	1/4-20 1" Machine Screw	Flat head slotted, 4 per pack, available at Home Depot	2	\$0.98	\$1.96
					\$137.78

Prices for the goal base, inner platform, PVC, and foam tiles are not included because other materials may be substituted.

*Marbles are also available in packs of 100 from most dollar stores for \$1.00.



Playing Field Layout



All dimensions are in inches

Floating Goal Detail

