

**The Milwaukee Vex League**

**and**

**Rockwell  
Automation**

**PRESENT**



**MILWAUKEE VEX LEAGUE**

**OCTOBER 18<sup>TH</sup>  
THRU  
NOVEMBER 15<sup>TH</sup>**

**FALL ROBOTICS CHALLENGE**

**DECEMBER 2007**

**DISCOVERY WORLD MUSEUM\***

# 2007 Fall MVL Robotics Challenge

## Acknowledgements:



**Innovation First, Incorporated**



and a special thanks to:

<p>Ultimate Protection Squad</p> <p>FRC Team 1675</p> <p>Ultimate Protection Squad</p>	<p>Milwaukee First Support Organization</p>  <p>Milwaukee FIRST Support Organization</p>	 <p>FRC Team 1714</p> <p>MORE Robotics</p>
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# 2007 MVL Robotics Challenge Planning Committee

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The 2007 MVL Robotics Challenge Design Committee reserves the right to modify, update, or clarify any rules up until the day of competition.

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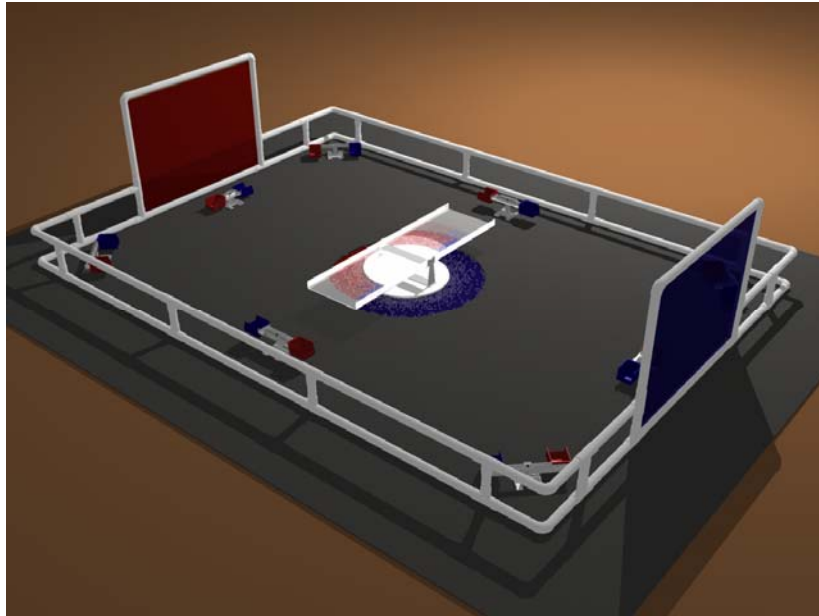
## East League 2007 Meetings Schedule

Date	Time	Location	Topic
October 18 <sup>th</sup>	5:30 pm – 8:30 pm	Discovery World Museum	Introductions, FIRST, Safety
October 25 <sup>th</sup>	5:30 pm – 8:30 pm	*Bradley Tech High School	CNC Machining & Welding
November 1 <sup>st</sup>	5:30 pm – 8:30 pm	Discovery World Museum	Open, Plastic Fabrication
November 8 <sup>th</sup>	5:30 pm – 8:30 pm	Discovery World Museum	Fuel Cell Technology
November 15 <sup>th</sup>	5:30 pm – 8:30 pm	Discovery World Museum	Open, Pneumatics

## 1. Objective

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

## 2. The Game



Visit <http://mfso.groups.msoe.edu/VEX/> to download files containing larger, dimensioned field diagrams and descriptions of each of the elements on the field above.

### 2.1 Field Description:

2.1.1 The playing field is the Official Milwaukee VEX League Field and is viewable on <http://mfso.groups.msoe.edu/VEX/>. The field measures 10' x 14'. The surface of the playing area consists of 2' x 2' interlocking foam floor tiles available from [www.softtiles.com](http://www.softtiles.com). The field will have a border of polycarbonate fencing to help contain field elements.

2.1.2 All official field dimensions will be within +/- 1/2" tolerance. Dimensions for Teeter-Totters will be +/- 1/8"

2.1.3 Starting Areas: Robots will begin the match in one of their three alliance starting areas as shown in the field drawing. The starting areas are designated by the corresponding alliance color and measure 2' x 2' in size. 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.

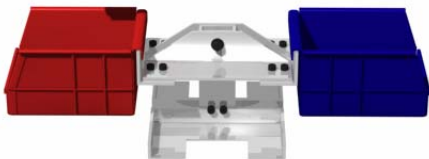
2.1.4. Scoring Areas: Teeter-Totters are made of an Aluminum angle base that will be secured with hoop and loop fastener to the field. Every Teeter-Totter will have a blue and a red parts bin. The field has eight Teeter-Totter scoring areas. The parts bin

orientation and height of the Teeter-Totters will vary depending on the type. The three types of Teeter-Totters are as follows:



2.1.4.1 Player Teeter-Totters: One Player Teeter-Totter will be placed parallel to the Alliance Station wall on each end of the field. The parts bins of the Player Teeter-Totters will face outwards, away from each other. The fulcrum of the Player Teeter-Totters will be located approximately four inches (4") above the playing field surface. The Center of the Player Teeter-Totters will be located twelve inches (12") from the field border.

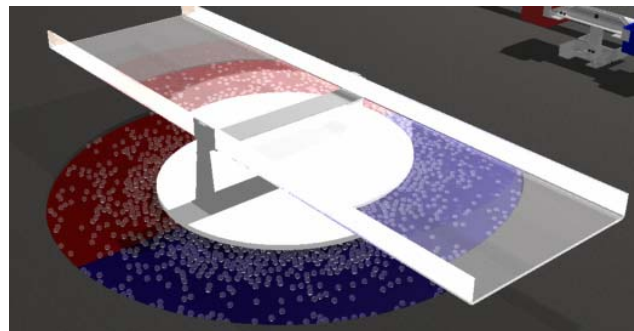
2.1.4.2 Corner Teeter-Totters: One Corner Teeter-Totter will be placed in each of the corners of the field, rotated 45 degrees (45°) from the field borders. The parts bins of the Corner Teeter-Totters will face inward, towards the center of the playing field. The fulcrum of the Corner Teeter-Totters will be located approximately four inches (4") above the playing field surface. The center of the Corner Teeter-Totters will be located sixteen inches (16") from the corner of the field.



2.1.4.3 Side Teeter-Totters: Two Side Teeter-Totters will be placed in the middle of the field parallel to the long field border. The parts bins of the Side Teeter-Totters will face outwards, away from each other, toward the Alliance Stations. The fulcrum of the Side Teeter-Totters will be located approximately six inches (6") above the playing field surface. The center of the Side Teeter-Totters will be located twelve inches (12") from the field border.

2.1.5 Center Pit: A forty- four inch (44") diameter pit will be located in the center of the field. This pit will be filled with marbles. The bottom of the marble pit is divided into the two alliance colors. Note: The Center Pit is the same pit from the 2006 Milwaukee Vex League game, "King of the Rings."

2.1.6 Center Ramp: "Floating" on top of the marbles in the Center Pit is a polycarbonate ramp. The base of the ramp is twenty- four inches (24") in diameter and "floats" on top of the marbles. Robots may interact with the base in any way, provided they do not violate any rules. The base supports the fulcrum of the ramp, which is located approximately six inches (6") above the surface of the base. The ramp itself is a five foot (5') long by seventeen inch (17") wide piece of polycarbonate, with a three and a half inch (3.5") tall wall along both



sides. Alliances may gain points by having robots appropriately placed on the ramp, see Section 5.8. The location of the ramp at the end of the match may provide additional scoring opportunities.

2.1.7 Marbles: The Center Pit will be filled with approximately 3000 half inch (1/2") diameter glass spheres, available from Wal-Mart. Alliances are to place these marbles in the parts bins of the Teeter-Totters to score points. Note: The marbles are the same elements from the 2006 Milwaukee Vex League game, "King of the Rings."

2.1.8 Eggs: The Center Ramp will contain a total of 20 colored eggs which measure 2 3/8" long and 1 5/8" wide. Each egg will be filled with a random amount of marbles, the total of these marbles will not exceed 15. Alliances are to place eggs in the parts bins of the Teeter-Totters to score points.

2.1.9 Auto-Loaders: Two auto-loaders, one for each alliance, will be located on the scoring table side of the field. Each Auto-Loader will contain 10 eggs. When activated the Auto-Loaders will dispense an egg filled with a random number of marbles ranging from 5 to 10. Auto-Loaders will be activated by robot engagement.

### **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 primary scoring method will be to weight the Teeter-Totters so that the robot's alliance color parts bin is down. There are different methods and bonuses of doing this as listed below:

3.2.1 Owning a Teeter-Totter: Alliances will be awarded 5 points for each Teeter-Totter that is owned. Refer to Section 5.10 for more details.

3.2.2 Tic-Tac-Toe: Owning three Teeter-Totters in a row will be worth a total of 25 points per row. Rows may be scored vertically, horizontally, or diagonally. The Center Ramp will count as the center scoring object.

3.2.3 Weight: At the end of the match, all marbles and eggs inside of the alliance's parts bins will be combined together. The alliance's score of all field elements, excluding the score of the robots on the Center Ramp, will be multiplied based on the collective weight of the parts bins. If the weight is between 0 and 120 grams then the total score will be multiplied by 1. If the weight is between 121 and 240 grams then the total score will be multiplied by 2. If the weight is between 241 and 320 grams then the total score will be multiplied by 3. If the weight is between 321 and 440 grams then the total score will be multiplied by 4. If the weight is between 441 and 520 grams then the total score will be multiplied by 5.

3.3 Center Ramp: The Center Ramp can also be used as a scoring method. Points for the Center Ramp will be awarded even if the Center Ramp is no longer located within the Center Pit.

3.3.1 Robots on the ramp: Each alliance will receive 15 points per robot properly supported by the ramp. Refer to Section 5.8 for details on properly supported robots.

3.3.2 Owing the Center Ramp: The Center Ramp can be owned in the same manner as a Teeter-Totter and is worth 5 points. “Ownage” of the Center Ramp will be determined by the location of the tip that is tilted more towards the direction of the alliance’s side. Refer to Section 5.9 for details on how to own the Center Ramp.

3.4 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 Teeter-Totters owned.
- The alliance with the most eggs scored in their colored parts bins.
- The alliance with the most robots on the Center Ramp.
- The alliance that owns the Center Ramp.

#### 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.

4.2 Field Crew: Alliances will consist of three field crews. Each team is allowed to bring one driver and one coach to the field. The coach and driver may switch positions at any time during the match, provided that the coach is also a student. The driver must be pre-college age. Both 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 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. It is recommended that teams bring extra safety glasses to events for any team visitors.

#### 4.4 Qualifying Matches

4.4.1 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.

4.4.2 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.

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

## 4.5 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 the Center Ramp counting towards your alliance's score.

## 4.6 Elimination Matches

4.6.1 The number of teams participating in elimination matches will be no less than 24 but may be increased prior to the start of the event based on the number of teams participating.

4.6.2 Alliance selection procedure for the elimination matches will be run like FRC elimination alliance selection, in which during the first round of selections, the 1<sup>st</sup> place team will pick first and the 8<sup>th</sup> place team will pick last and during the second round of selections, the 8<sup>th</sup> place team will pick first and the 1<sup>st</sup> place team will pick last. If a team ranking in the top 8 places is picked, then the next seeded team will pick. A top 8 team may refuse an invitation from a higher seeded team, but may not then accept an invitation from a different picking team. A team outside of the top 8 may not accept an invitation from any team if a previous invitation is refused.

4.6.3 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 which 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 partners of a disqualified robot will still receive the score earned by all robots during 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. The disqualification of one robot during the Elimination Matches will disqualify the entire alliance.

### 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 pinning team must back off for at least five seconds before they can resume. Failure to do so will result in a 10 point penalty of the aggressor. If a robot continues to engage in this behavior, they may be disqualified.

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 Starting Area: At the start of the match, teams may place their robot anywhere inside the designated robot start area corresponding to their team color. The starting area is defined by the taped boundaries and the planes extending from it. Alliances must make a joint decision as to which alliance-colored starting area their robots will be placed in before each match.

5.8 Robots on the Center Ramp: A robot is considered on the Center Ramp so long as the robot is not supported by any other field elements. Therefore, a robot that it is resting on eggs, marbles, or any other field elements will not be considered to be on the ramp. However, if the robot is being supported by another robot then the robot will be considered to be on the ramp but the supporting robot will not be.

5.9 Center Ramp Ownage: Unlike the Teeter-Totters, the Center Ramp does not have a designated Red side or Blue side. "Ownage" of the Center Ramp will be determined by the location of the tip that is tilted more towards the direction of the alliance's side.

5.10 Teeter-Totter Ownage: For an alliance to own a Teeter-Totter, their parts bin must be closest to coming in contact with the playing field surface.

5.11 Auto-Loaders: Teams may only use the Auto-Loader on their alliance's half of the playing field (the Auto-Loader located closest to their Alliance Station). There is no limit to how often a team may visit their Auto-Loader. Intentional use of the opponent's Auto-Loader will result in a 10 point penalty. Repeated violations may result in a disqualification. Once the contents of an Auto-Loader have been exhausted, they will NOT be replenished.

5.12 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.

5.12.1 Teeter-Totters outside the Field Area: If a robot removes a Teeter-Totter from the field during play, that robot's team will forfeit the match.

5.13 Tipped Teeter-Totter: If a Teeter-Totter is knocked over during normal play, the Teeter-Totter will not be returned to an upright position by the referees. The tipped Teeter-Totter and any scoring elements which may fall off of the Teeter-Totter will not be counted in the final score. Teeter-Totter may be re-righted by robots and then re-scored at any time.

5.13.1 A tipped Teeter-Totter is one that no longer relies on the gravity vector to determine ownage. This will be determined by a visual inspection of the base of the Teeter-Totter; if the flat portion of the base is no longer parallel with the plane of the playing field surface, the Teeter-Totter will be considered tipped.

5.13.2 Teeter-Totter Tipping: The tipping of a Teeter-Totter will result in a 10 point penalty and is not a way to exercise gracious professionalism. Intentional tipping may result in a disqualification.

5.14 Removed Bins: Removing an opposing alliance's parts bin from a Teeter-Totter during play will result in a 10 point penalty and is not a way to exercise gracious professionalism. Removal of any object contained within an opponent's parts bin may occur as long as the bin is not removed from the Teeter-Totter. A bin will be considered to be removed if it is no longer connected to the Teeter-Totter.

5.14.1 Tipped Teeter-Totter Removal: If a bin is removed as the result of a Teeter-Totter tipping over then a 10 point penalty will be assessed just for the tipped Teeter-Totter.

5.15 Hanging Robots: Robots may interact with the Teeter-Totter in any manner so long as they are not suspended from the Teeter-Totter or in violation of another rule. If the robot is being supported solely by the Teeter-Totter, the points associated with that Teeter-Totter for the offending robot's alliance will be void and the opposing alliance will automatically own the Teeter-Totter. If this occurs multiple times, disqualifications may result.

5.16 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.

5.17 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.

5.18 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 Red or Blue alliances with a color insert or flag. Inserts must be provided by the team and must not be a functional part of the robot. Flags are not required to be within the 15" x 15" starting dimensions of the robot so long as they are not a functional part of the robot.

5.19 Rule Clarification: All questions or requests for rule clarifications should be submitted via the Team Discussion Board on the event website <http://mfso.groups.msoe.edu/VEX/>. Questions and answers will be publicly posted on the event website. Any questions or clarifications resulting from league nights will also be posted on the event website <http://mfso.groups.msoe.edu/VEX/>.

5.20 Referee Rulings: All referee decisions regarding rules of play and scoring are final. If there is a question regarding a referee decision the driver may approach the head referee for clarification immediately following that match.

## 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 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 Only parts from the VEX Robotics Design System Starter Kit are permitted unless specified on the additional materials list below.

6.5.6 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](http://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.

6.5.7 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 or Vexplorer accessories from Innovation First ([www.vexlabs.com](http://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 Vexplorer: Any Vexplorer parts maybe used so long as the parts are accounted using the equivalent cost of the VEX parts. These pieces will be considered as part of the \$200 VEX accessories.

6.9 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.