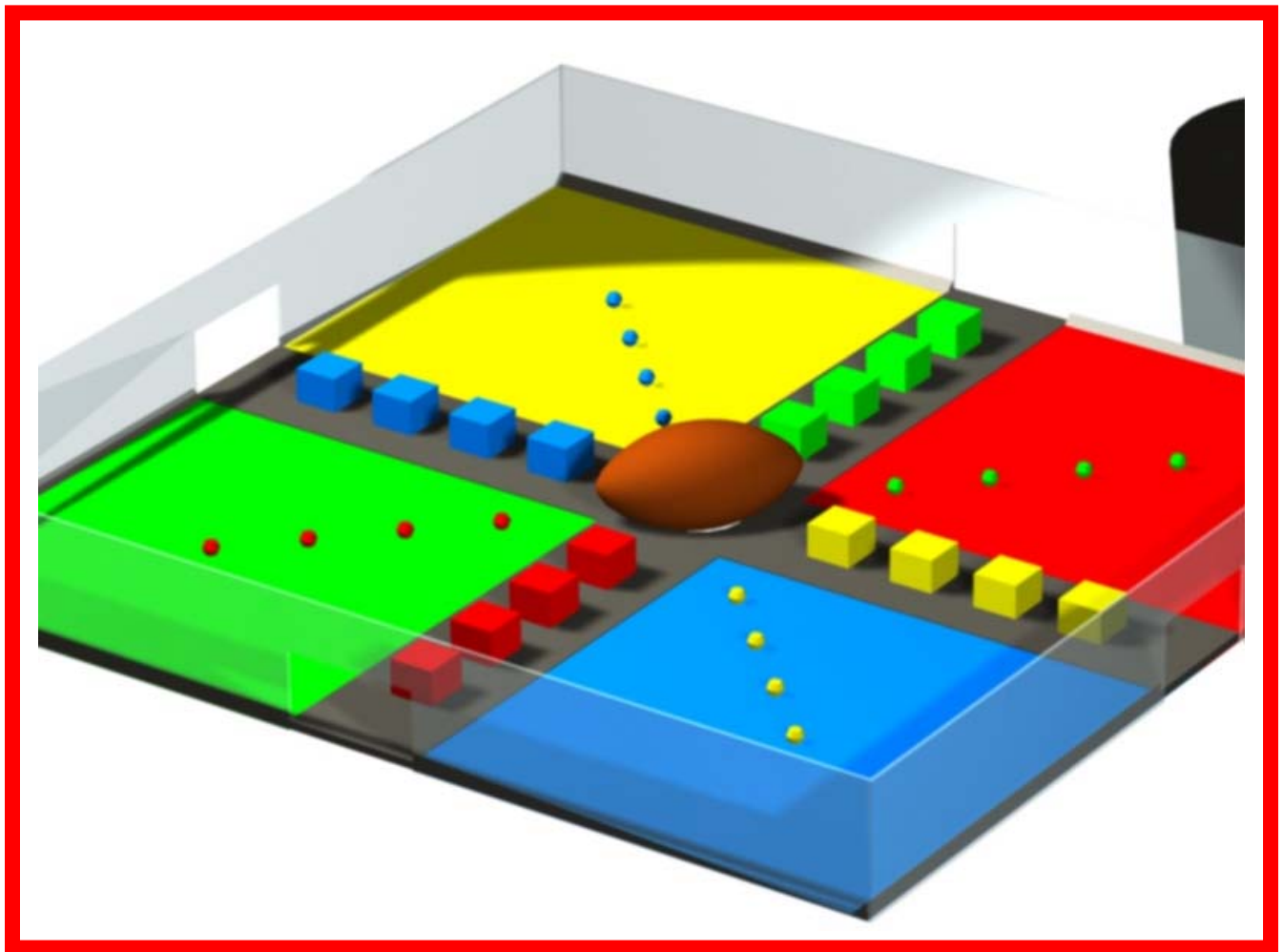


Hi-Lo BattleBall

An Engineering IQ Test That Makes a Game Out of Cleaning Up!



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This is a game that challenges you to use the GEARS-IDS™ Invention and Design System kits, and some extra stuff commonly found around the house, to create a competitive machine capable of scoring either the **highest**, or the **lowest** score in the game of **Hi-Lo BattleBall**. It's a game of engineering smarts and driving skill that will test your mechanical aptitude and manual dexterity.

We think this game is challenging, but not so challenging that you or anyone else can't play it. Winning of course is a different story. Please don't underestimate the amount of time and work it takes to build a competitive machine....start now, the moment you've finished reading this paper.

Overview of The Game of Hi-Lo BattleBall

The playing board is divided into (4) "Rooms", **Red**, **Yellow**, **Blue** and **Green**. Separating the rooms are two **Black** streets that meet at a 4 way intersection. Each street leads from the intersection to a 7" x 12" "Dumping Gate". In the center of the intersection is an 8" inch diameter hole. **The BattleBall sits over the 8" hole at the start of the game.** (See Cover)

Up to 4 machines play simultaneously. Each of the 4 machines is assigned a room and playing pieces of the same color.

The playing field pieces include four 3-1/2" solid wood blocks and four, 1-1/4" diameter solid wood balls. In addition to the playing field pieces each team will be given four (4) Whiffle Balls and four (4) Ping Pong Balls. These game pieces are held by designated team members. All of the game pieces have an inherent value of 2 points. The robots are playing pieces also and each robot is worth 4 points.

Depending on the position or location of the playing field game pieces, at the end of the match, the playing points will be added, or subtracted from your score. (See the rules)

The BattleBall

The BattleBall is a football. Whichever machine possesses the BattleBall at the end of the game can multiply their score by either, 2x or by -2x!. Think about what this might mean.

You can win two ways.

High Score

Score the highest point total by keeping your room clean and clearing **your pieces** from the playing field by pushing or "Shooting" them into the receptacles surrounding the field.

Low Score

Collect all or as many pieces as you can and gather them into your room!. That's right, make your room a mess, and you can win!

Tips for Success

A simple machine that is easily driven and does not break or fail during the game will be successful. The more people you can include in the design and fabrication, the better your chances of completing the machine.

- 1.) Study the kit of parts and understand what the components can be used for.
- 2.) Study the game, read the rules and “Play” the game by pretending what 4 different machines might do in a game. “Play” the game many times, and in many different ways. This will help you develop a game strategy.
- 3.) Think of what a winning machine would do, and then think about how to do it.
- 4.) Using the parts supplied as models, draw sketches of machines with subassemblies and components that can do what must be done to win.
- 5.) Build and test the mechanical systems and subassemblies you invent. These might include catapults, plows, drive trains, lifters or grasping mechanisms.
- 6.) Integrate the systems into a working robot.
- 7.) Put a working machine on the table.

Constraints

| | |
|-------------------|--|
| Time: | Total of 8 – 10 hours of design and build time. |
| Materials | Use only the parts provided, or authorized in the rules. |
| Knowledge: | Use what you know, or can find out in the allotted time. |
| Power | Use only the (one) 12 volt battery included with the kit and an air reservoir filled to 150 psi. max. |
| Weight | Restricted only by how you choose to use the allowable components. NO OTHER COMPONENTS WILL BE ALLOWED. |

Additional materials that will be provided:

Plastic Knife, Fork and Spoon
Plastic Bowl and Cup
5pcs. 3-1/2” Elastic Bands
5’ of Masons Twine
3 Fiddle Sticks
2 12” lengths of Welding Rod
1 Sheet of Construction paper
Scotch Tape

Hi-Lo BattleBall Rules

Additional clarification of these rules will be made when the game is introduced. The referee(s) judgment will be final and uncontestable. Contestants are responsible for obtaining rules clarification from the referee(s).

1.) Match Play

- a. This is a double elimination tournament. Depending on the number of teams in any particular round, the referee(s) will reserve the right to either assign a by or to field a Placebo Robot.
- b. The highest and lowest scoring team in the elimination rounds will advance to the winner brackets.
- c. Teams that do not score either the highest or lowest score will advance to the loser's brackets.
- d. Play will continue in the respective rounds until the two top scoring teams in each bracket are determined. These teams will then compete in the finals where the highest and lowest scoring teams will share 1st place honors.
- e. In the event that only two teams play in a match, the referee will toss a coin before the start of the match to determine if that particular match will be played for high or low score. In this case, both teams will play for either highest or lowest score, depending on the role of the dice.
- f. At the end of timed play, all players must immediately shut off their radios and remove their hands from the controls. Game pieces that are moving at the end of the game will be allowed to come to rest and scored in their resting positions.

2.) Timing

- a. Each round of play will last 120 seconds.
- b. There will be approximately 3 minutes between rounds. Contestants must be capable of setting up or removing their machines in 60 seconds. This game is about who can field a working machine, not about how well you can build a machine during game time.
- c. Since the **Hi-Lo BattleBall** games will precede the already scheduled BattleBotsIQ event, it is especially important that the games are not unduly delayed. Machines must be ready to play at the start of each match.

3.) Scoring and Winning

- a. The winner is the contestant with either the highest score or the lowest score at the end of a round in which 3 or more machines compete.
- b. All teams have a score of zero (0) at the start of the match.
- c. The value of playing pieces remaining in direct contact with the surface of the table after the end of the match are **subtracted** from the respective team's score.
- d. The value of playing pieces NOT remaining in direct contact with the surface of the table after the end of the match are **added** to the respective team's score.
- e. The value of each game piece is a function of its inherent value multiplied by its position value. The inherent values and position values are listed below.
- f. Playing pieces and their Inherent Value
 - i. 1-1/2" Wood Balls = 2 pts. 4 pieces per team

- ii. 3-1/2" Wood Blocks = 2 pts. 4 pieces per team
- iii. Ping Pong Balls = 2 pts. 4 pieces per team
- iv. Whiffle balls = 2 pts. 4 pieces per team
- v. Robot = 4 pts. 1 piece per team
- vi. BattleBall 2 or -2 Multiplier**

g. Subtractive Position Values

- i. Any team playing piece in direct contact with the playing surface = the inherent value subtracted from your team score.
- ii. Any piece of any color or shape, judged by the referee to be in your Room Position = 2x the inherent value subtracted from your score. If you don't want the lowest score, then keep your room clean. This score is in addition to the previous rule.

h. Additive point values

- i. Any team playing pieces not in direct contact with the playing surface = 2x their inherent value added to the team score.

Note: This means any playing pieces that have been lifted, stored, dumped or removed from the playing field in some manner BY ACTION OF THE MACHINES. Team players are NOT allowed to cause playing pieces to leave the playing field in any manner either by bouncing rolling or lofting the pieces.

- ii. Team playing piece(s) lofted by a machine into any of the 4 large trash barrels surrounding the playing field will multiply the team score 2X.

Note: This means just what it says, the score is multiplied by 2, even if the score is negative.

- i. Note: Any playing pieces that exit the playing field at any time during the game are out of bounds and cannot be put back into play for any reason. Playing pieces that land on the floor should be retrieved and turned over to the referees who will total their value at the end of the game.

4.) The BattleBall

- a. The BattleBall represents either a positive 2 or a negative -2 multiplier.
- b. The team that "Possesses" the BattleBall at the end of the match earns the option of using the multiplicative advantage of the BattleBall. However, the team judged by the referee to have possession of the BattleBall at the end of the match must declare how they intend to use the multiplier within 30 seconds of the end of match play.
- c. Possession is defined by the position of the BattleBall with respect to a Team's "Room". **To possess the BattleBall, the machine must be in contact with the BattleBall at the end of the match**, and the BattleBall must be "In" the respective team's Room. In the room is defined as completely contained within the space of the room. The test of "in the room" is simple. The footprint of the colored rectangle that defines the area of the room is projected vertically. If any part of the BattleBall is judged to be outside this projected volume, then the BattleBall is NOT inside the room. Referees will make the final call with respect to position of the BattleBall.

Example: At the end of the match, the Blue team possesses the BattleBall. They may elect to use the BattleBall to multiply their score by either +2 or –

2. Remember, teams start the game with a 0 score. If you multiply a negative number by a negative number, the answer is positive!

5.) Whining Rule

- a. Mechanical sports are still in their infancy. It is certain that issues of equity and fairness will arise through the course of these games, and we ask that the participants remain willing, open-minded, generous and gracious in spirit and actions and appreciative of the referees decisions and motivations.
- b. Excessive whining will not be tolerated and will be grounds for disqualification.
- c. Nothing is meant to be unfair. If there are obvious inconsistencies or omissions in the format of the game, please point them out, along with a suggestion to make them better. What will be said and done will be said and done by the referee(s) for the betterment of everyone. The referee(s) will endeavor to maintain parity, they will not be too concerned about anything else.

6.) Playing

- a. Contestants must drive their own machines
- b. One driver is allowed to operate the machine at a time. However, drivers may take turns driving during a match.
- c. One driver and two coaches from each team are allowed in the playing area during a round. Up to 3 Team Cleaner Uppers are allowed to move around the table area but we insist that they remain crouched or kneeling. No team cleaner upper can exceed 4 feet in height during match play.
- d. All contestants in the playing areas must wear safety glasses. Prescription glasses are allowed.
- e. One member from each team will be given 5 large whiffle Balls and five ping pong balls. These playing pieces, AND ONLY THESE PLAYING PIECES can be placed in, on or near YOUR machine, and then only if your machine is in YOUR room. This means you can load your machine by hand, but you cannot interfere in any way with other players or machines. You may only place playing pieces in your room.
- f. Machines that throw projectiles of any kind may only be loaded while they are within their own "Rooms". On the other hand, they may only launch projectiles when they are NOT in their room. Launching from your loading zone is prohibited. This prevents a team from "Setting up" and repeatedly scoring points from a predetermined position. The machine must travel out of their room in order to launch projectiles.
- g. All player held playing pieces must enter into game play through contact with the team's machine, or be loaded directly onto the playing field, and only in their respective rooms. The designated team member before the end of match play must put all pieces in play. **Failure to comply with this rule, or the spirit of this rule will result in disqualification.**
- h. Machines should be prepared for vigorous interaction with their opponents. Shoving pushing and pinning are expected, but malicious destruction of an opponent's machine will not be tolerated. The referees will disqualify contestants who in their opinion have maliciously damaged an opponent's machine.

- i. Contestants, whose machines cause unacceptable damage to the table or game playing pieces, may be disqualified. The table will not be disqualified for damaging contestants' machines. As stated above, the judges will act at their discretion.
- j. Machines interlocked or pinned for more than ten continuous seconds will be separated to their respective starting positions.
- k. It is entirely possible and acceptable that a machine exits the playing field either by driving through the dumping gates, or by being pushed through the dumping gates by an opponent, or opponents.

7.) Starting Configuration

- a. The table will be divided into 4 quadrants marked in 4 different colors, Red, Green, Blue and Yellow.
- b. Machines must be designed and configured in such a way as to not interfere with any playing pieces prior to the start of a match.
- c. Each Quadrant and color will be assigned to a team, and each machine will be labeled with a corresponding colored marker.
- d. Machines will be placed in the extreme outside corners of their respective rooms. You may point your machine in any direction you prefer.
- e. Each quadrant will be referred to as the "Room". The room and the playing pieces of the same color will be associated with the machine placed within that room at the start of the match.
- f. The playing field will contain 16 large blocks, 4 of each color; Red, Blue, Green, and Yellow.
- g. The playing field will contain 16 small wooden balls, 4 of each color, Red, Blue, Green, and Yellow.
- h. The playing field will contain 1 (approximately 10" diameter) BattleBall.
- i. Each team will be given 5 whiffle balls, and 5 ping pong balls marked with colors that correspond to the team color.

8.) Tie Breakers

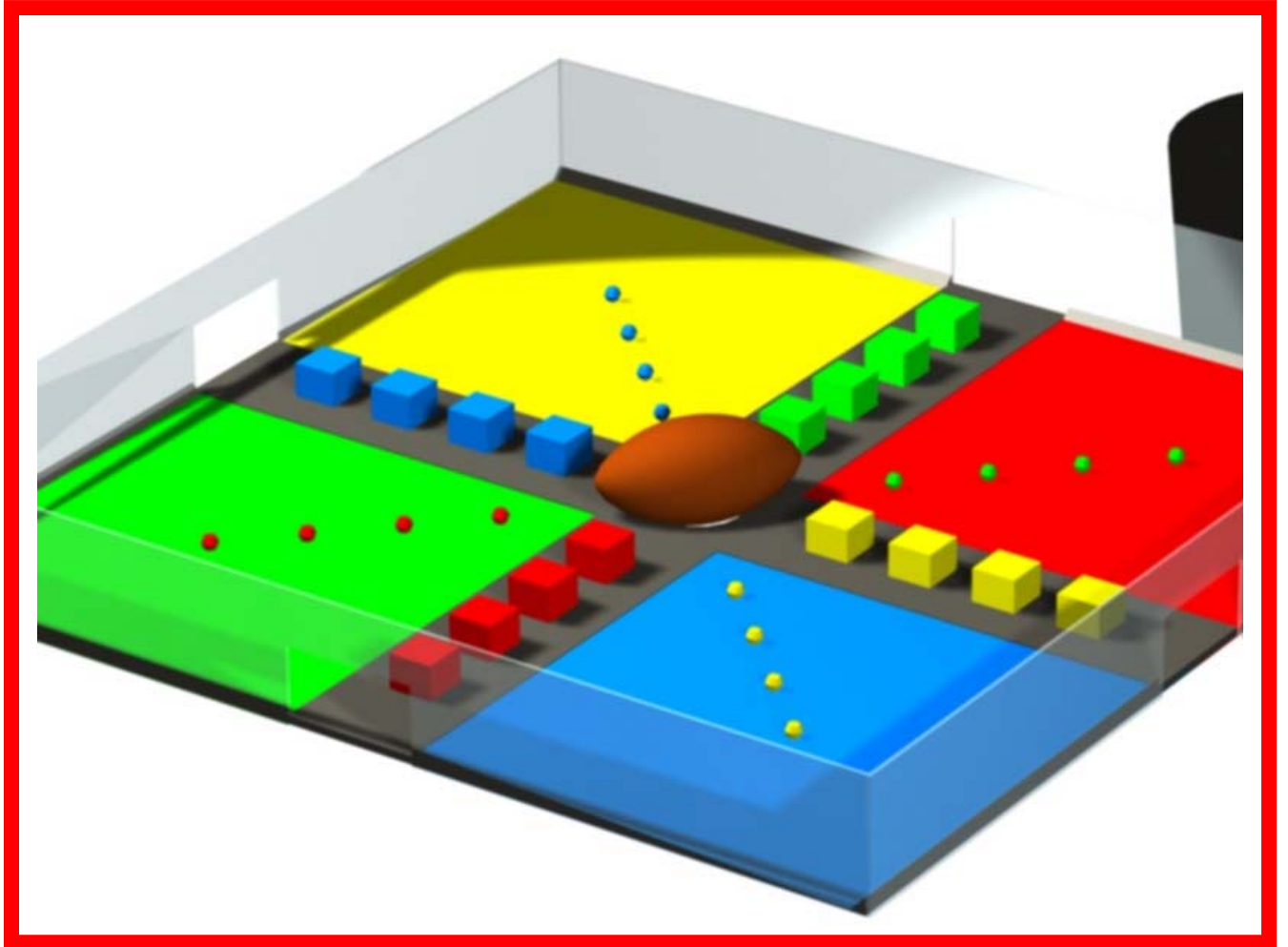
- a. In the event of a tie for either high or low score, the winner will be decided by these criteria and this order.
 - i. The machine that possess the BattleBall
 - ii. Coin toss.

9.) Allowable Parts and Materials

- a. The only parts and materials you are allowed to use are the materials you have been given. And, no, you may not receive extra parts because you got a better idea after you used up the parts you had.
- b. DO NOT RESHAPE, DRILL, BEND. CUT or in any way change or deliberately alter any of the flat plate or metal parts.
- c. You may cut the axles to any length you choose.

Hi-Lo BattleBall

Game Table Specifications

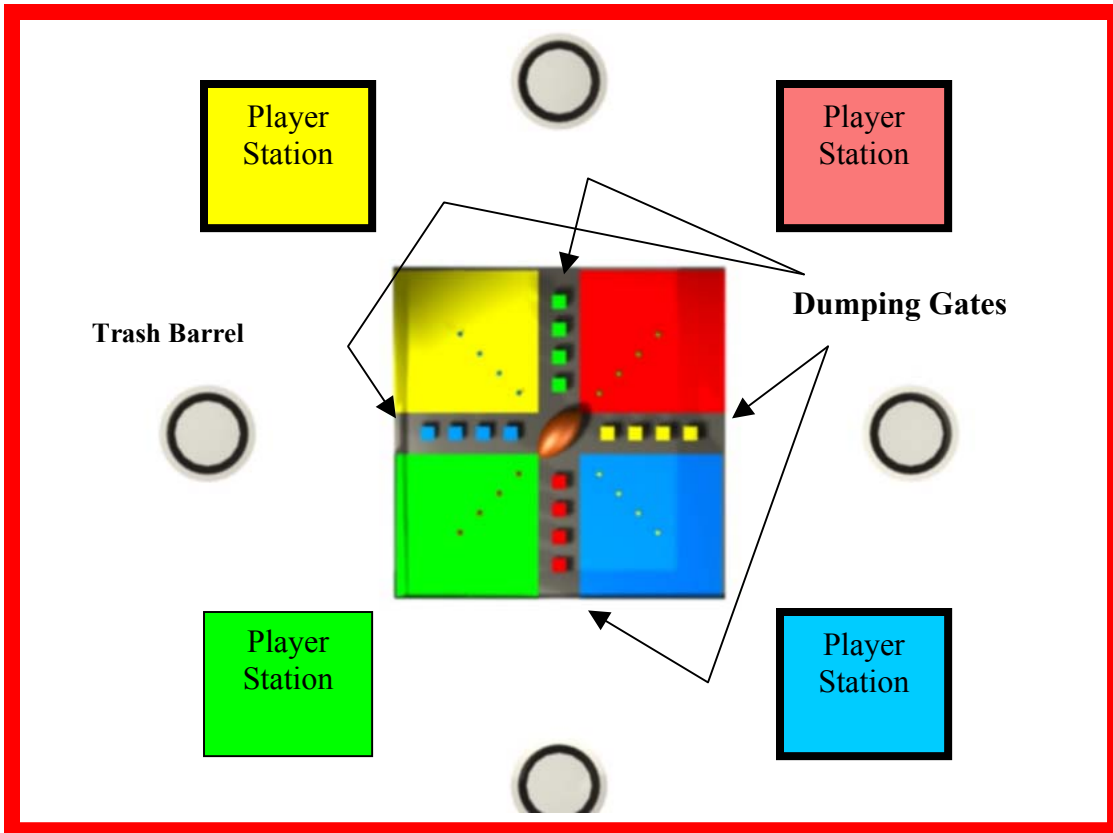


The table top surface measures 96" square. The surface is $\frac{3}{4}$ " AC Plywood or equivalent. The surface is painted with enamel.

The perimeter of the table top is lined with 2" x 2" pine cut diagonally to form a 45 degree lip. The outside of the table is lined with a $\frac{1}{4}$ " polycarbonate bulkhead, 12" high. There are 7" x 12" openings called dumping gates, cut in the center of each polycarbonate bulkhead.

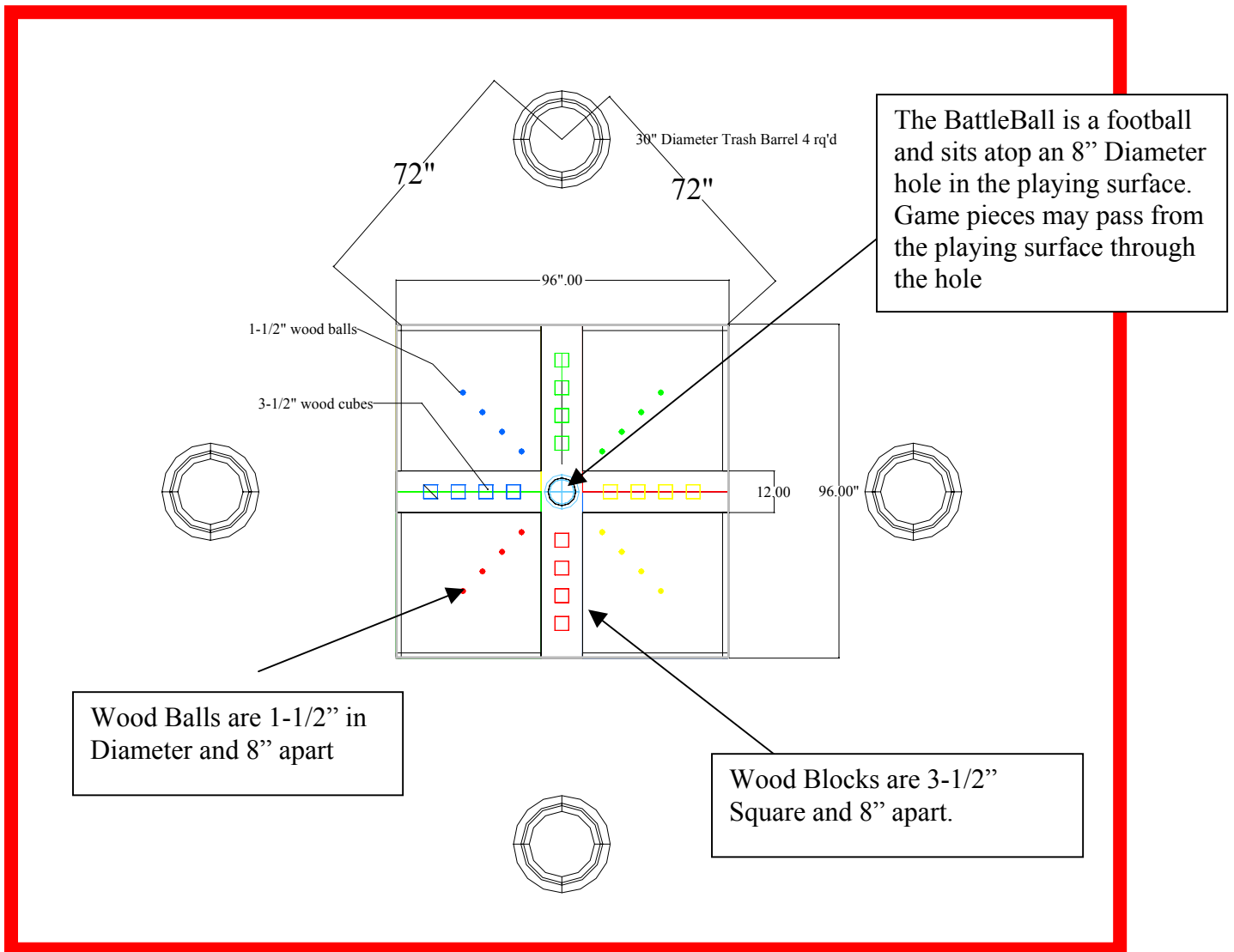
The Wooden cubes measure 3-1/2" square. The small wood balls are 1-1/2" in diameter and they sit on $\frac{1}{2}$ " diameter holes drilled through the plywood surface.

Table Set Up



4 large trash barrels surround the Playing field. These barrels serve as targets for game pieces. Any team that manages to loft a playing piece into one of the four outside barrels will multiply their point total x 2.

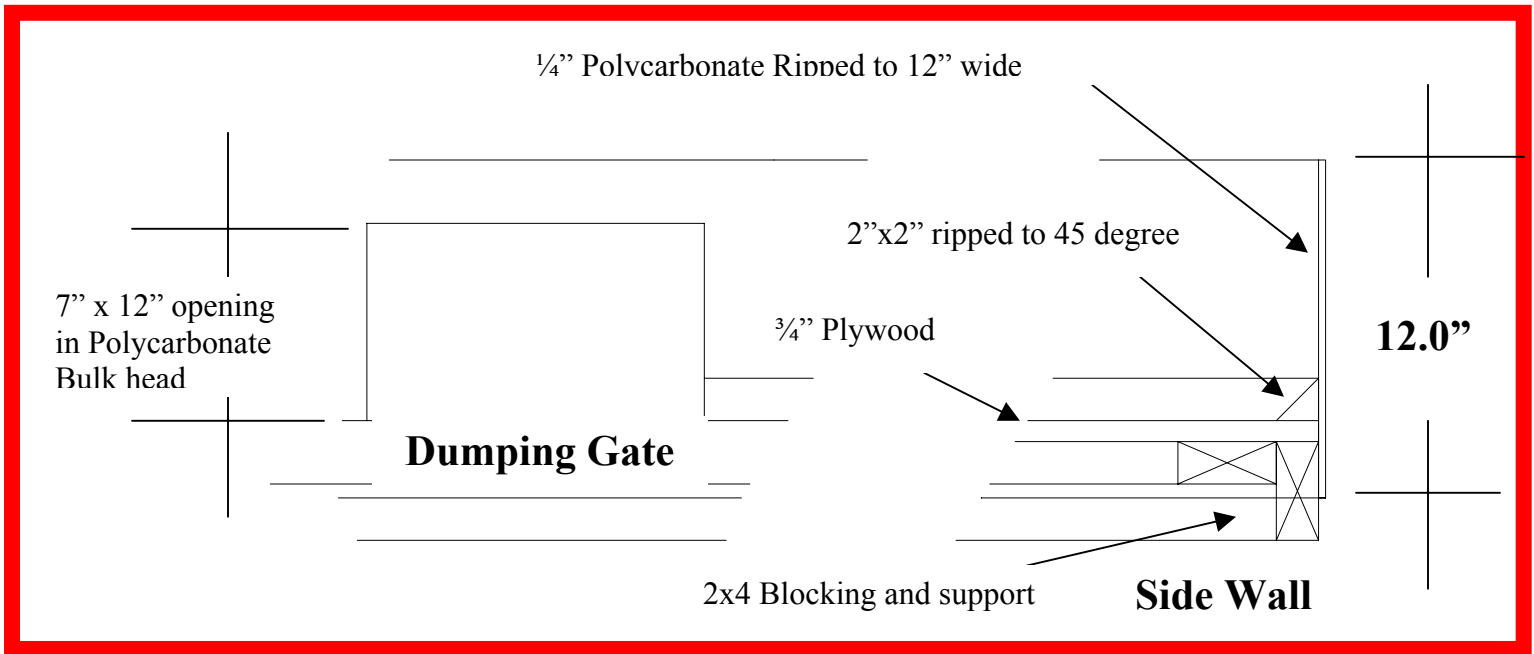
Table Dimensions



Game pieces may leave the field in one of several ways:

- 1.) By passing through the 8" diameter hole under the BattleBall
- 2.) By passing through the 7" x 12" Dumping Gates in the Polycarbonate.
- 3.) By being launched from the field by a machine
- 4.) By being pushed over the side of the polycarbonate wall.

Table Dimensions cont'd



Links that will help you build a machine to play Hi-Lo BattleBall.

1.) This link will show you how to identify and set up the pneumatic components used in the GEARS-Invention and Design system.

<http://www.gearseds.com/documentation/identify%20and%20assemble%20pneumatics%20rev2.pdf>

2.) This will help you build a catapult to launch game pieces or design some other pneumatic actuated system.

http://www.gearseds.com/documentation/build_a_pneumatic_test_module.pdf

3.) This is a link to an illustrated catalog of parts found in the GEARS-IDS Invention and Design System Kit.

<http://www.gearseds.com/documentation/parts%20catalog%20rev3.pdf>

4.) This link illustrates the construction of a mobile chassis that could be used to play BattleBall.

<http://www.gearseds.com/documentation/Build%20drive%20train%20and%20chassis.pdf>

5.) This link will help you set up and configure a hobby RC controller for your mech-athlete.

<http://www.gearseds.com/documentation/configure%20RC%20Control%20System%20rev%20204.pdf>