Beyond Botball 2007
Rules & Game Review

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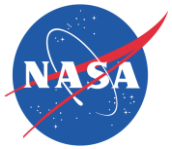

National Diamond Circle Sponsor:

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QuickTime™ and a
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Botball

Rules Update History

- v.2: 11/11/06 Game rules first released

Robot Construction Rules

1. A team's entry (all materials placed on the gameboard) must mass less than 4.5kg (10 pounds).
2. A team's entry (all materials placed on the gameboard) must fit within the starting box which is 40cm long by 70.5cm wide by 38cm high (15.75" long by 27.75" wide by 15" high).
3. The team's entry may not contain or release pressurized materials at greater than 7 bar (100 psi).
4. The team's entry may not release any liquids during the game, or before, during, or after the game while the team is at the game table.
5. The team's entry may not release any gasses while at the game table that are considered hazardous by the judges, or are at a temperature below 0°C (32°F) or above 50°C (122°F).

Robot Construction Rules (2)

6. Robots may not contain features (manipulators, protrusions or materials) that are designed to, or are deemed by the judges likely to, cause damage or destruction to the game board or to a reasonably constructed opponent robot.
7. A team's entry may not contain features (manipulators, protrusions or materials) that are designed to, or are deemed by the judges likely to, cause jamming or entanglement of a reasonably constructed opponent robot. Blocking and containing of opponent robots is allowed.
8. Robots must operate autonomously (no external power or control from outside of the game board area will be allowed).
9. Each team may only have a maximum of four independent structures on the game board at a time.
10. Each robot must have a name suitable for broadcast over a PA system.

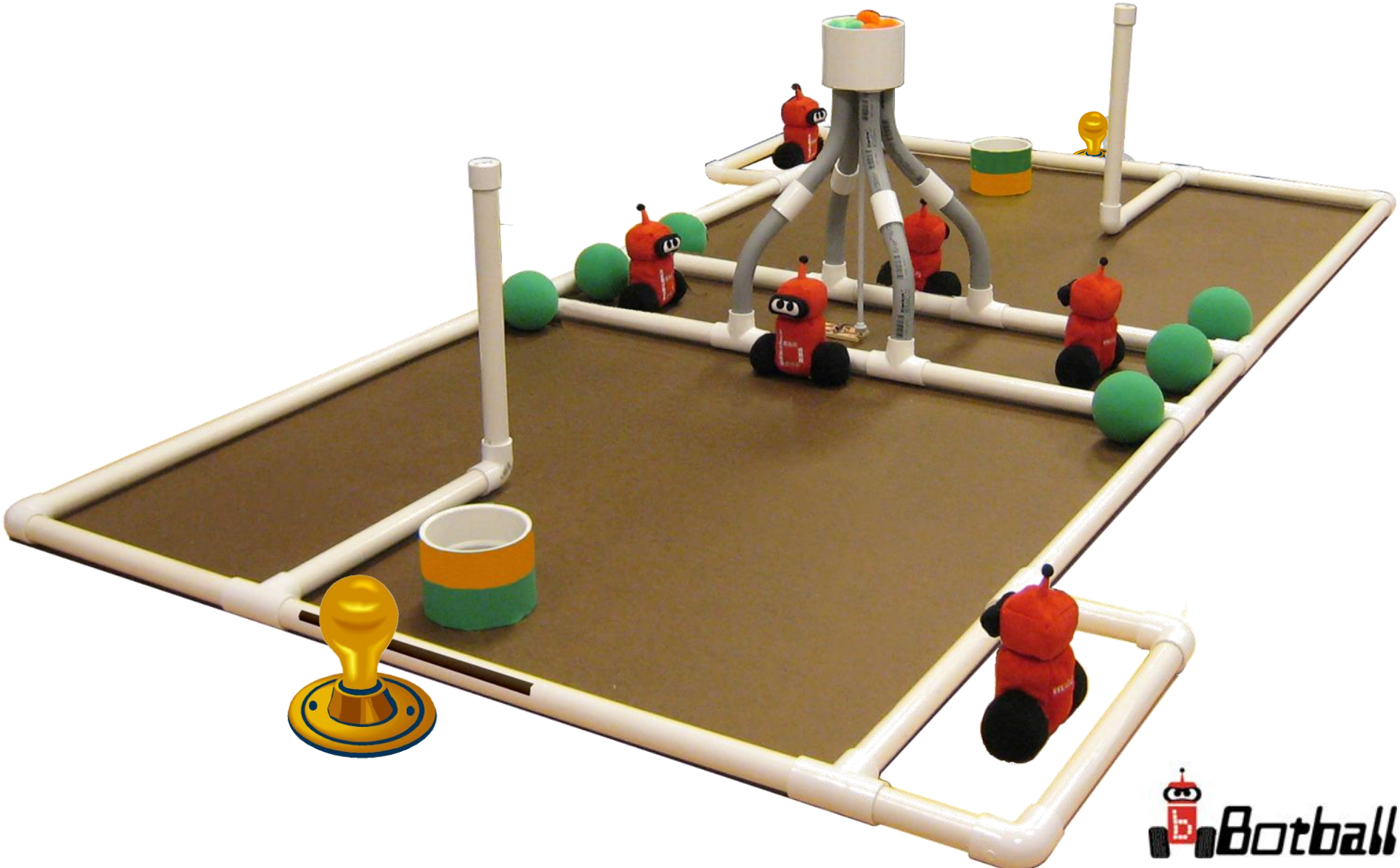
Robot Construction Rules (3)

11. The contents of the 2006 Botball kit and all previous Botball kits are all legal parts for the 2006 Beyond Botball competition, however participants are NOT limited to those parts.
12. Team entries may NOT contain parts that may reasonably be confused with game pieces (entries may not contain colored foam balls, etc)

The Story

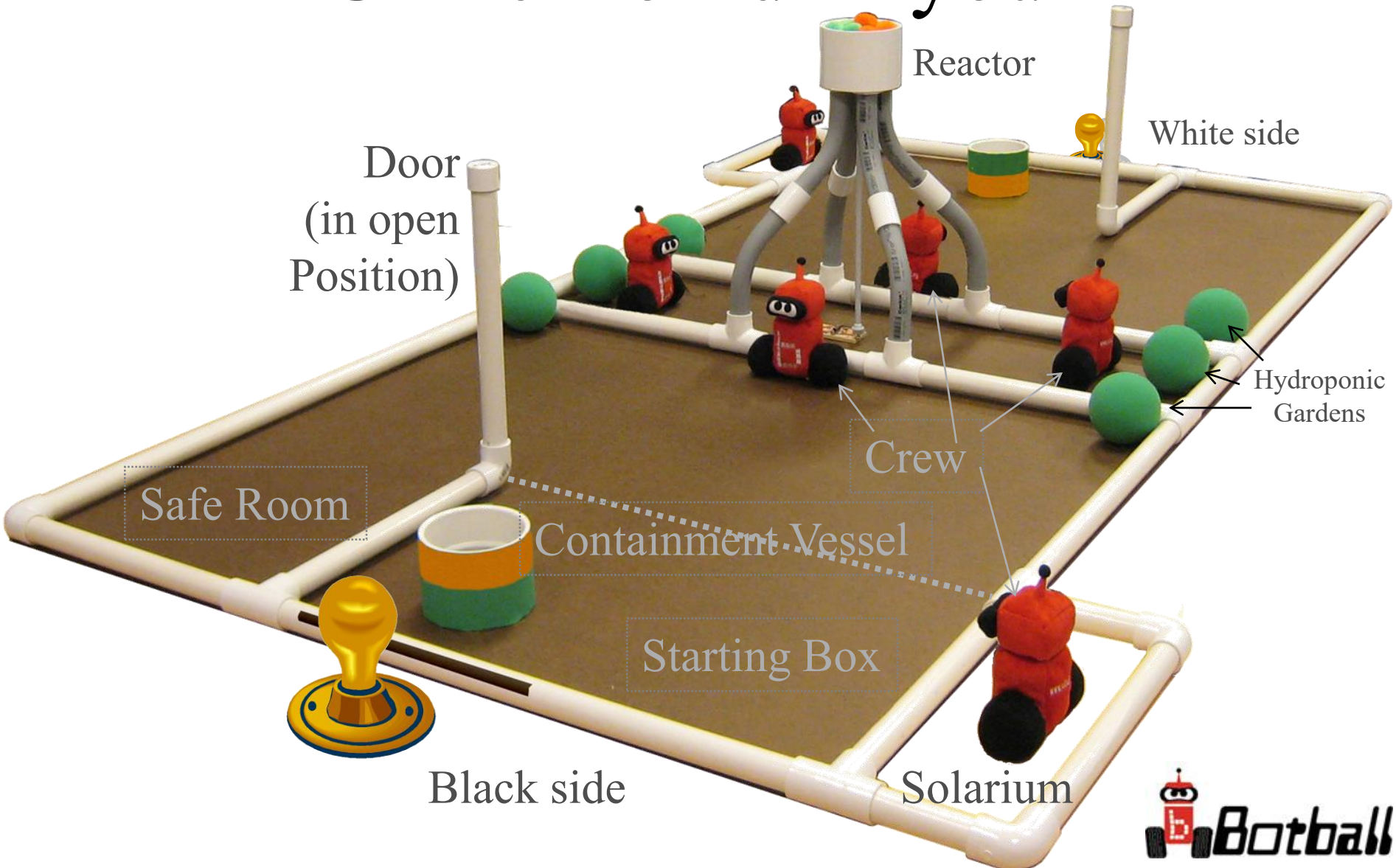
The Starship KIPR has been equipped with many modern conveniences, hydroponic gardens, tanning salons, a solarium, a radiation safe room and a warp core reactor. A Federation efficiency expert thought it would be good to have the tanning salon and gardens near the reactor -- perhaps that was not such a good idea. The alarms have sounded and the reactor is leaking. You need to get the crew to the safe room and shut the door. You need to move the gardens into the Solarium and you need to put the fissionables into a containment vessel or back into the reactor.

The *Reactor Accident* Game Board



Botball

Game Board Layout



Botball

Arena Construction Tools

- **Straight edge**
- **Measuring tape or other rule**
- **Pencil**
- **Rubber mallet (for PVC)**
- **Scissors (for colored paper to wrap containment vessels**
- **Screw driver (for reactor plunger)**
- **PVC pipe cutter (a simple ratcheting knife that cuts PVC both cleanly and accurately)**

PVC Parts

1” PVC Pipe Lengths

- A: 6” X 2
- B: 10.5” X 4
- C: 15.75” X 14
- D: 22.5” X 2
- E: 27.75” X 2
- F: 39.75” X 2

- 1” PVC Connectors:
  - 90°: X 8
  - T: X 14
  - end caps: X 2
  - coupler: X 4
- 1.5” PVC
  - coupler X 6 (2.75” tall)
  - 1.5 to 1” reducing coupler
- 4” PVC Connectors:
  - coupler: X 5 (3.75” tall)

- 1” PVC Conduit
  - 45 degree bend: X8

PVC Cuts

4 X 120” lengths of schedule 40 1” PVC pipe

Cut the pieces as follows to maximize PVC:

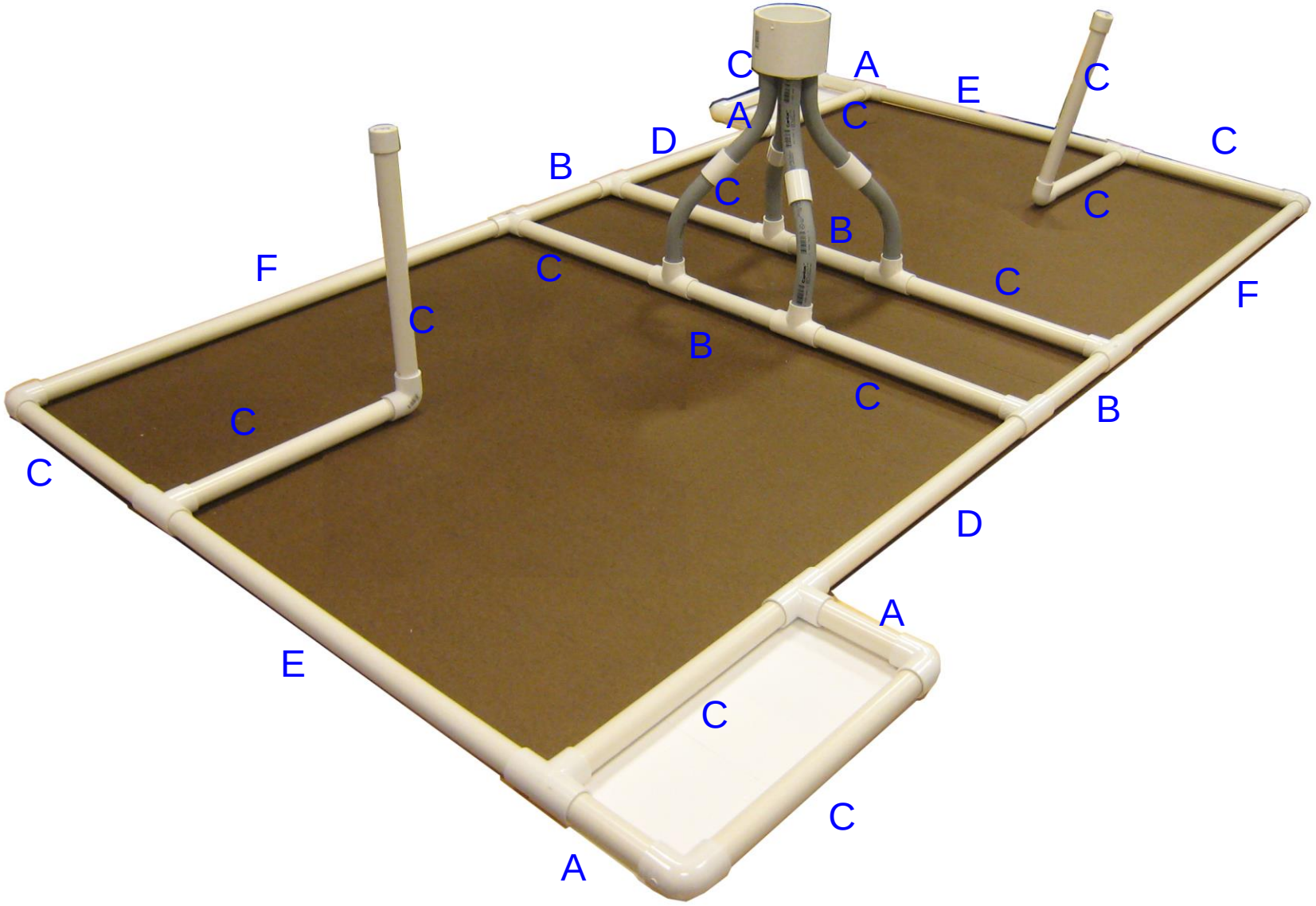
PVC1: 1 X A + 7 X C (116.25” used)

PVC2: 1 X A + 7 X C (116.25” used)

PVC3: 1 X A + 1 X B + 2 X E + 2 X D (117” used)

PVC4: 1 X A + 3 X B + 2 X F (117” used)

PVC Placement



Reactor Legs

Types of 45° Bends

Reactor Leg Assembly

Practice board alternative

Note: for this construction the PVC pipe needs to be cut longer than these lengths to provide for insertion into each joint

Arena

1” PVC connector

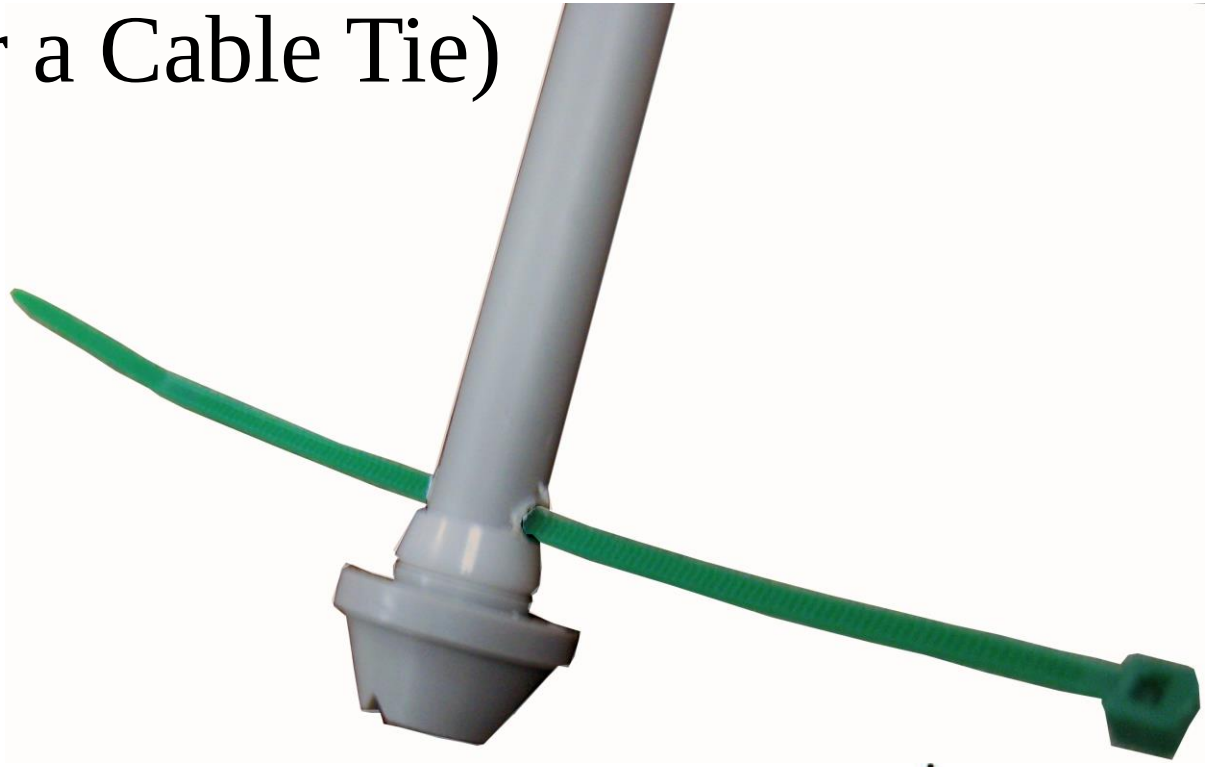
PVC conduit: 34481 06063

4” connecting piece of 1” PVC pipe

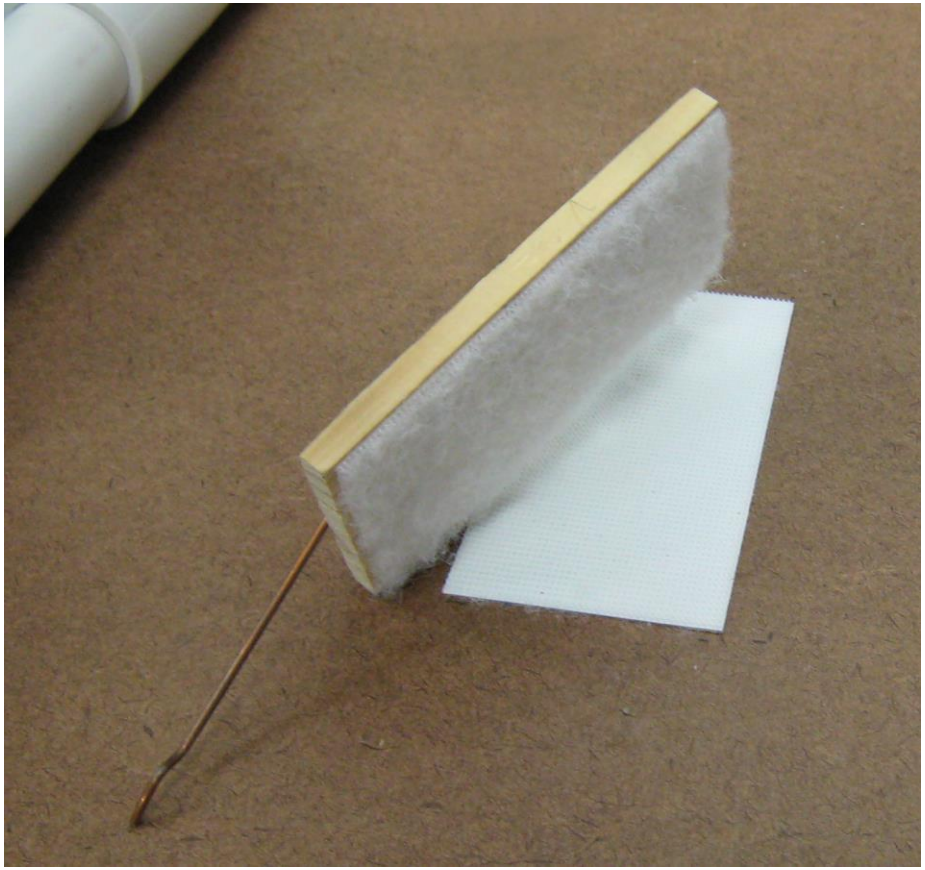
PVC conduit: 34481 03902

Botball

Notch the Push Rod with a Razor Knife and Drill a 1/8” Hole Perpendicular to the Notch (for a Cable Tie)

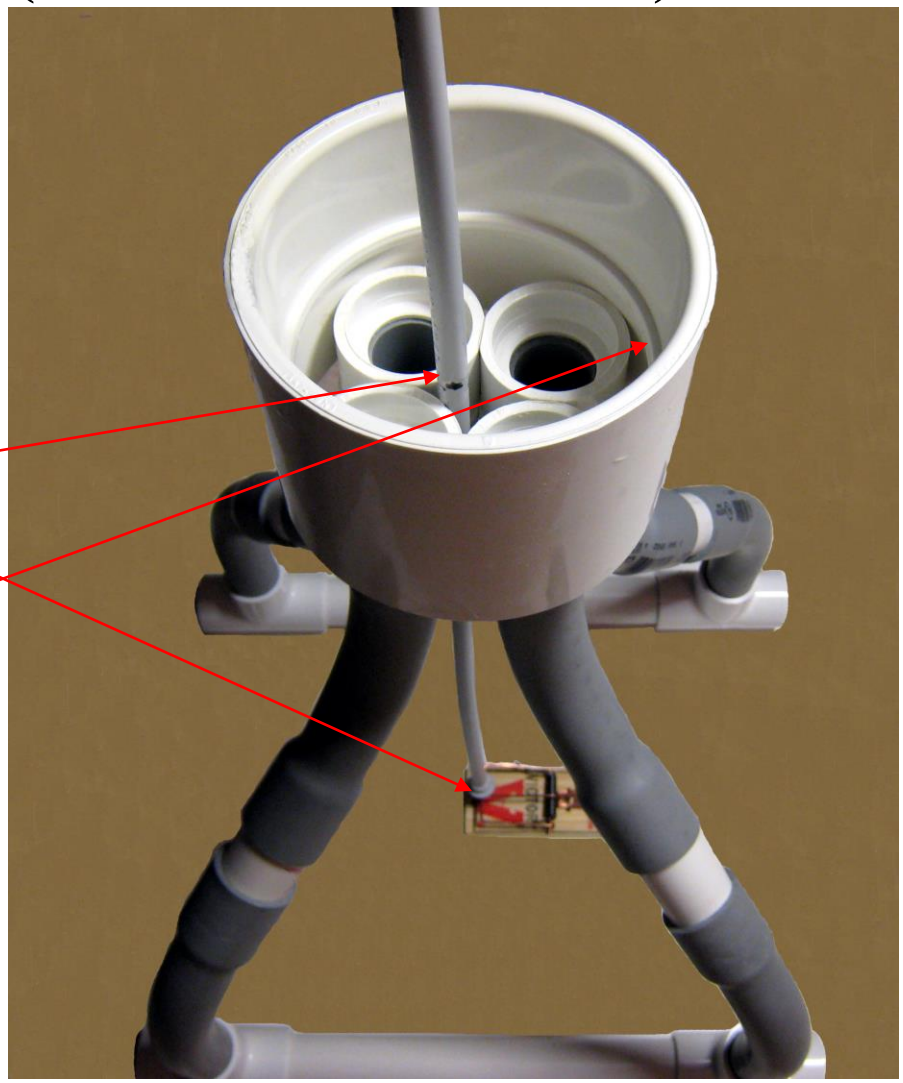


Use Velcro to Attach the Mousetrap to the Arena Surface



Getting the Length of the Push Rod (17.25” ± 0.5”)

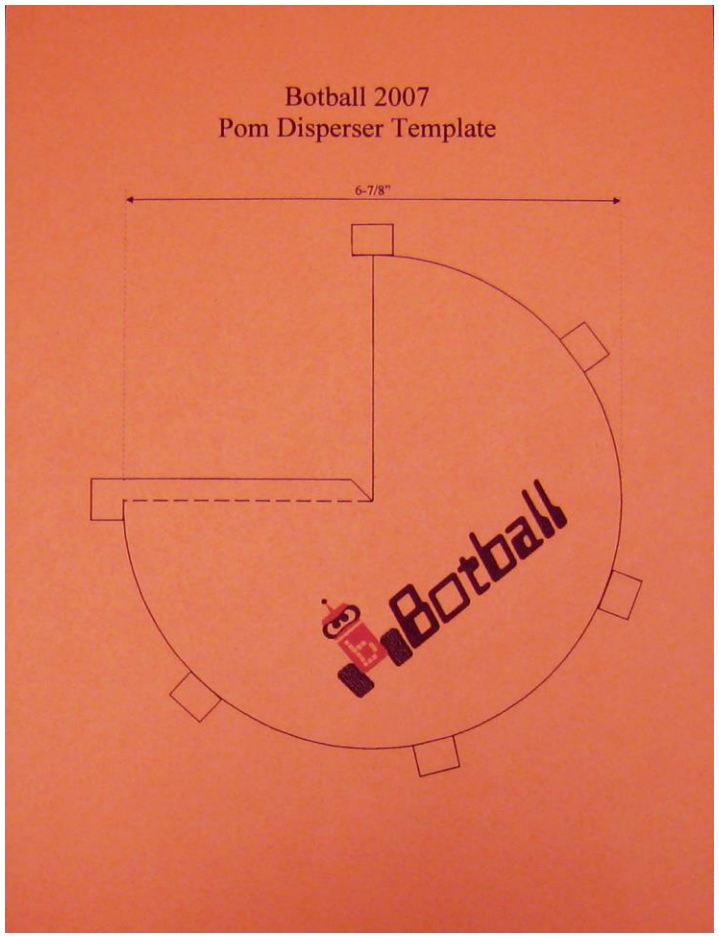
1. Cock mousetrap
2. Insert push rod and rest the notch on the mousetrap spring arm
3. Mark the tube at about the level of the bottom of the 4” connector’s restraining rim

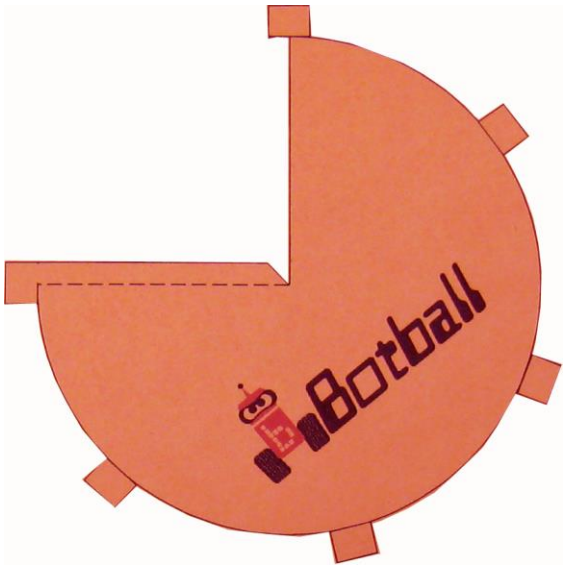


Basic Volcano Assembly

Drill a 1/4” hole in the knockout and attach push rod using a 1/4” lag bolt or other screw that’s large enough. Note that a corrugated cardboard circle cut to

Pom Disperser (1)





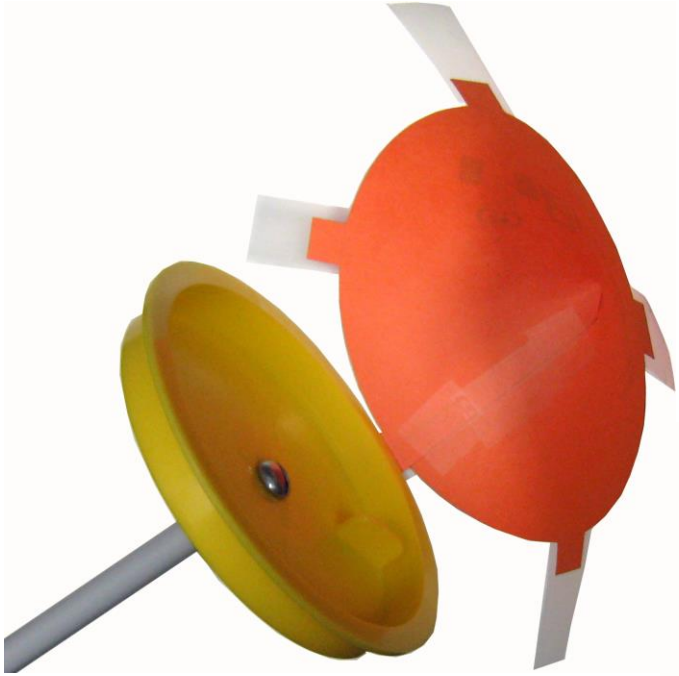
Using Adobe Acrobat Reader, print the pdf file "BB07PomDisperserTemplate.pdf"

Double check that the diameter is 6 7/8"

and cut out the Pom Disperser Patte

Pom Disperser (2)

Fold into a cone shape, tucking the seam tab underneath and taping first from inside, then from outside. Add a piece of tape to each radial



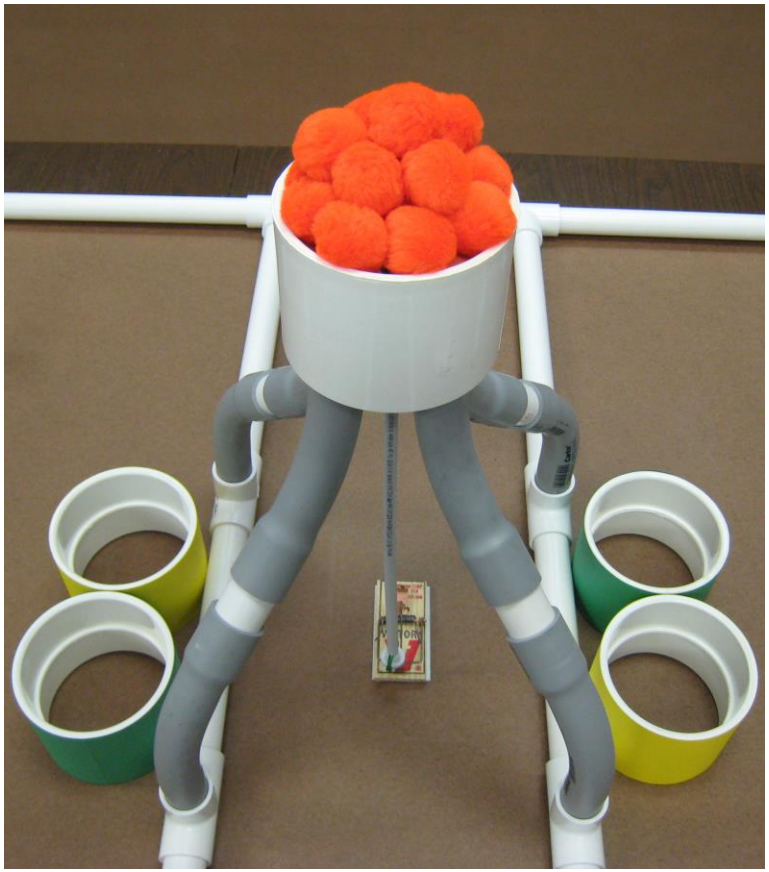
Use the radial tabs to attach the disperser to the (assembled) plastic knockout

Botball

Mousetrap Attachment

First insert push rod (with disperser) through top of volcano, then with the mousetrap uncocked, connect the cable tie around the mousetrap spring arm.

Completed Assembly



Botball

Non PVC Supplies

- Paper for containment vessels (any brand: black, Astrobrite: cosmic orange and gamma green)
- 6 - 4" green foam balls
- 6 - BeanieBot plush toys

  All of the above are available from the KIPR online store as the “2007 Beyond Botball Game Pieces Set”
- mouse trap
- 1 plastic closet (toilet supply) line cut to 17.75 length
- 1 #14 sheet metal screw (.5 to 1” in length
- 1 – 4' x 8' sheet of smooth masonite board
- 2 – 60W lamps

Game Board Setup

- The starting box is a 15.75" x 27.75" rectangle to the back right of each end of the game board
- The starting boxes are determined by the inside edges of the PVC pipe and a penciled line 15.75 in front of the rear piece of PVC
- The center section of the board -- the reactor zone -- is not on either side and no points are scored by pieces in that zone
- The top of the reactor is 20.5 +/- 0.5 inches (52cm +/12mm) above the surface of the field.
- All measurements on official boards, whose uncertainty is not otherwise specified will be as specified within +/- 1/4 inch (6mm). Deal with it.

Team Pre-Game Setup

- Each team may position their reactor vessel anywhere in their starting box, including on top of a robot that is in the starting box
- Each team may adjust the door to their safe room:
  - They may loosen or tighten the fit of the pvc
  - They may adjust the angle so long as the angle is within 45 degrees of vertical
  - A robot may only be in contact with the door at the start of the round if the door is leaning into the starting box

Game Rules & Scoring

- After “Hands-Off” Robots must stay in starting box until the starting lights come on
- The center region of the field, including the PVC cross-members, is the reactor zone. Items within the vertical projection of the reactor zone, but not in the reactor are not on either team’s side and do not score.
- Each item only counts for points in a single category
- Each team scores points by:
  - placing Botguys in their safe room and closing the door
  - placing green balls in their solarium
  - removing poms from their side of the board
  - placing the appropriately colored pom in their containment vessel
  - placing the appropriately colored pom in the reactor

Black Scoring Summary

	Safe Room	Reactor	Black Side	Solarium	Containment Vessel
Orange Fissionable	0	5	-1	0	0
Green Fissionable	0	0	-1	0	1
Botguy	5	0	0	0	0
Green Ball	0	0	0	5	0

White Scoring Summary

	Safe Room	Reactor	White Side	Solarium	Containment Vessel
Orange Fissionable	0	0	-1	0	1
Green Fissionable	0	5	-1	0	0
Botguy	5	0	0	0	0
Green Ball	0	0	0	5	0

Scoring: Balls

A. There are 6 balls.
B. Balls only score if they are in a solarium
C. A ball is your solarium is 5 pts for each ball
D. A ball is in your solarium if its center is within the positive vertical projection of the inside edge of the PVC marking your solarium.

Scoring: Poms

A. There are 10 green and 10 orange poms (fissionables)

B. Each side has a single containment vessel:

   1. The black side CV has an orange top and green bottom
   2. The white side CV has a green top and orange bottom

C. A pom scores 1 point if its color matches the bottom of the CV and its center is contained within the volume of the CV

D. A pom scores 3 points if its color matches the top of the CV and its center is within the volume of the reactor vessel

E. A pom of either color scores -1 if it is within the vertical projection of that team's side (including solarium and safe room) but not in the containment vessel

Scoring: Botguys

A. Botguys only score if they are in your safe room AND the safe room door is closed

B. Each Botguy in your safe room with the door closed is worth 5 points.

C. A Botguy is in the safe room if the entirety of the Botguy (with the exception of the antenna) is within the vertical projection of the exterior of the PVC defining the safe room AND the door is within 45 degrees of horizontal in the closed position.

D. A team's robots are allowed to "transport" Botguys into the safe room, by non-planar means, after the door is closed

Tie Breaking

Tie breaking (in order):

1. The team with most Botguys saved
2. The team with lowest negative fissionable score
3. The team with highest reactor score
4. The team with highest green ball score
5. The team with the most Botguys totally or in part in the safe room
6. Power switch closest to reactor score

Seeding/Performance Rounds

- S/P Rounds take place before the double elimination
- S/P rounds consist of best two out of three, unopposed rounds.
- All teams play Black side
- Scoring = (black points) - (white points)
- Scores of less than -1 will be counted as -1
- Passing on a round gives a score of -1 for that round
- Seed Score = average of best two rounds

Double Elimination Tournament

- A team is out of the tournament when it has lost two games
- Initial matches are decided by seeding round
- Matches are arranged using KIPR tournament software
- Judges' decisions are final

Double Elimination

- A team's robot must have broken the border of the starting box sometime during the 90 seconds of game play or they will forfeit that round. If a team has two robots, only one is required to break the bounds of the starting box.
- Robots must stop all motors and other actuators at the end of the round. Failure to do so will result in loss of round (unless the other team never broke the starting box.
- If neither team's robots break the starting box bounds during game play, the round will be replayed once. If neither team moves out of the starting box during the replay, the round will be decided by coin flip.
- At least one robot from a team must be outfitted and programmed to respond to the starting light. A robot team that operates exclusively on a timer triggered by a hand operated switch is not allowed and will automatically cause that team to forfeit that round.

Tournament Logistics

1. No part of any non-team member, is allowed over the vertical projection of the outer edge of the pit area (with the exception of tournament staff)
2. Robots may only leave the pit to go to the game tables
3. Teams will know their side assignment (black or white) at least 1 minute before the match
4. Up to 2 members from a team bring the robot to the tournament table and set it up

Tournament Logistics (2)

1. Teams shake hands and visually inspect each other's robots before calibration.
2. If either team wants to challenge the validity of the robots they are facing, they have to do it then.
3. Inspection is limited to a max of 1 minute unless a specific challenge is made.
4. Challenges have to be of the form:
    1. That robot contains high explosives
    2. That robot's hardened steel spike is designed to damage other robots.
5. Judges will be the final arbiter.
    1. Judges can dismiss what they believe to be spurious challenges
    2. Teams found in violation will (unless the judge decides there have been extenuating circumstances) forfeit that round.
    3. In no case will a robot that is determined before the beginning of the round to be in violation of the construction rules be allowed to play while in that state.

Tournament Logistics (3)

1. The starting lights (located directly behind the starting boxes) are on for calibration, then turned off for final calibration
2. When both teams are ready or judges decide adequate time has been allowed for calibration, robots are activated and then -- Hands off!
3. After Hands off, no part of a team's robot(s) may leave the starting box until the starting lights turn on
    1. If this happens, the judges will call a fault on the team
4. If a team receives a 2nd fault in a round, they forfeit the round

Tournament Logistics (4)

1. When the starting lights turn on the robots must autonomously start.
2. Lights will remain on for 5 seconds, turn off for 40 seconds, pulse for ten seconds, turn off for 30 seconds and flash the last 5 seconds.
3. Robots are not allowed to drive under the reactor.
4. During the light pulsing period a judge will force the reactor to go critical -- spraying 7 orange and 7 green fissionables across the board. The judge will also distribute an additional 3 orange and green fissionables across the board in a method designed to approximately balance the distribution.
5. Once the starting lights have lit, the round counts unless a judge rules outside interference.

Tournament Logistics (5)

1. Teams cannot use infrared links to program their robots within 10 yards of the game board
2. Teams may not broadcast ANY physical or electromagnetic signals to their robots once the teams are in “Hands-Off”.
3. Robots must cut power to their motors and turn off or stop issuing motion commands to servos by the end of the round or risk forfeiting the round
4. Scoring is based on the location of pieces at the end of the round, not how the pieces got there.
5. If the judges determine that a robot violates the construction rules, that robot will not be allowed to run until it has been modified to meet the rules.

Tournament Logistics (6)

1. Construction rules apply only to what is brought to the Game Table.
2. There are no instant replays, we do not want to see videos of questionable decisions. If a team is unhappy with a judge's decision, they should challenge it then and there. Challenges to scoring after the teams have left the table, will not be considered.
3. Teams cannot touch, borrow equipment, modify robots or computers, or beam commands to another team's stuff (including their pit table) without the permission and presence of a member of that team
4. The security of a team's equipment is the responsibility of that team -- **don't leave valuables unattended.**

Winner

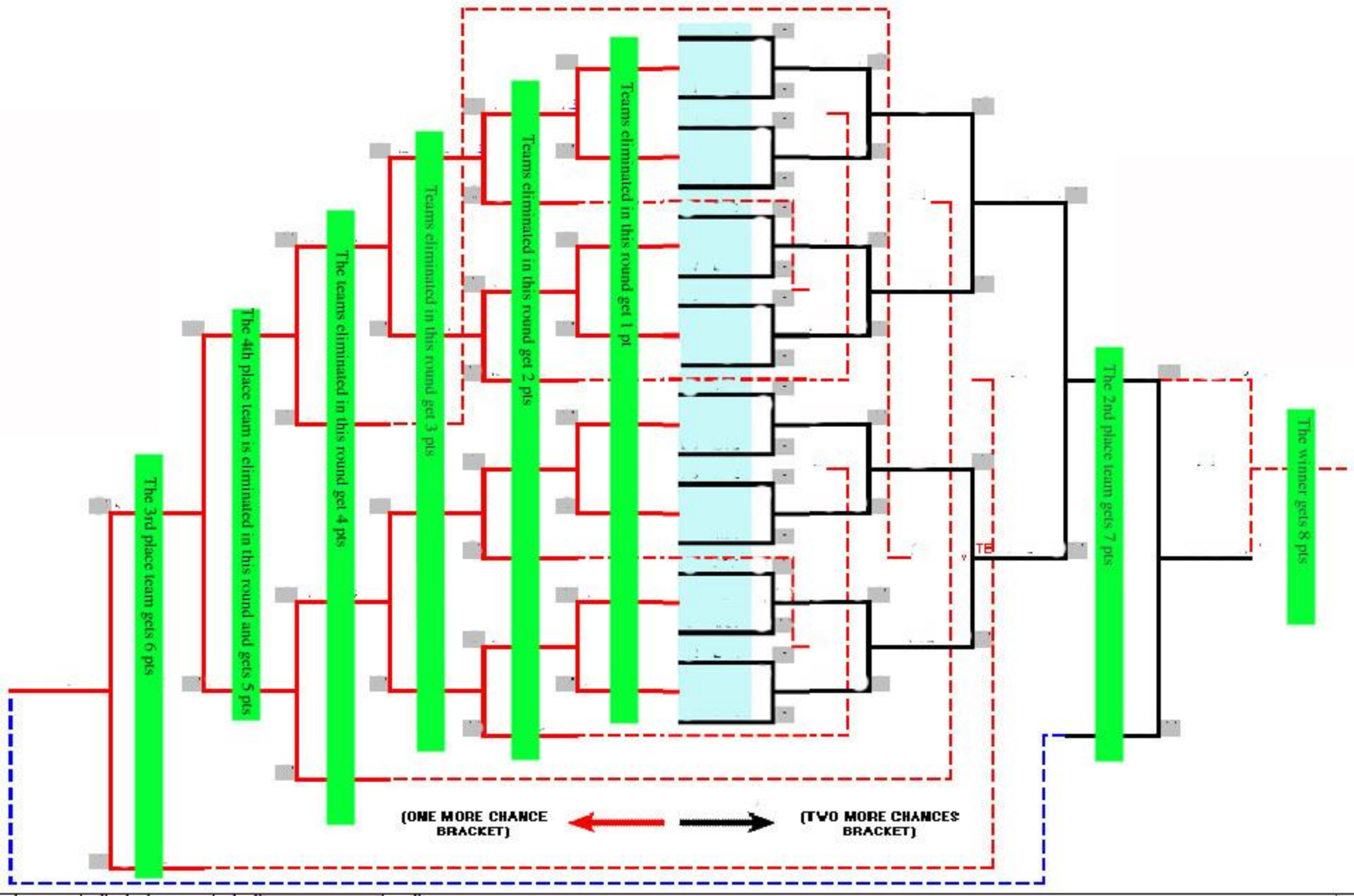
- Trophy winners will be selected by summing their points in each of the two contests (N= # of teams):
  - Seeding rounds:

    LOG_2 (N/*rank*)+LOG_{10}(3*(*seed_score*+2*))*
  - Double elimination:

    winner gets: 2*Ceiling(LOG_2N)

    (see next slide)

For 8<N<=16: Max score = $2LOG_2 16 = 8$



Scoring Example

- Winning the double elimination does not guarantee winning the tournament
- In a 16 team contest, a team that wins the seeding with a score of 59 gets (4+2.66=6.66pts) and then finishes 7th or 8th in the double elimination (3pts) would have 9.66pts
- A team that finishes 9th in the seeding with a score of 15 (.83+1.71=2.54pts) and wins the double elimination (8pts) would have a total of 10.54pts

Team Membership

- At least one Beyond Botball team member must be beyond High School in their educational careers
- College students, professional engineers, hobbyists, poets, and anyone else fulfilling the criteria above are all encouraged to participate

Things to do Before You Come to the Tournament...

- Test your robots from start to end:
  - Go through the entire starting sequence
  - Make sure you can calibrate to the starting light
  - Make sure the robots stop when they are supposed to: verify with a stop watch!
- **Does the starting sequence work with very bright overhead lights** (tournament tables will have bright lights hung about five feet above the tables) - **Test the shielding of your sensors!**

Check
www.botball.org
regularly

Good Luck!