2020 Botball
Game Review

Contents

Revision History

Version 1.0

Contributors

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Director's Note

Botball Community,

I am grateful to our dedicated staff and team of volunteers who contributed an incredible number of hours putting together this year's game. We started planning this at GCER 2019 and have put in months of effort to get to this point. I hope that this year's game theme is motivating and challenging and that you are as excited as we are here at KIPR about this year's game! Good luck!

Respectfully,

Steve Goodgame

KIPR Executive Director

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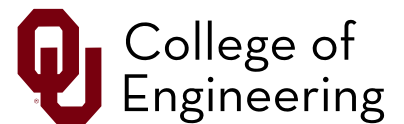
This Year's Game

Botguy Directs Disaster Relief Efforts

Botguy is headed back to the moon! Botguy's human team members have set up a colony on the moon and need the raw materials to continue growing the colony. Botguy is there to help improve the processes of the operation and get resources processed for the colony. Materials need to be sorted into transports and processors or taken to the *Mineral Lab* or *Ore Storage*. Communication to Earth needs to be reestablished by getting your *Communication Satellite* to the *Mountaintop*. Get inside the *Mine* to retrieve the valuable *Titanium Oxide*. Get the materials, grow the colony!
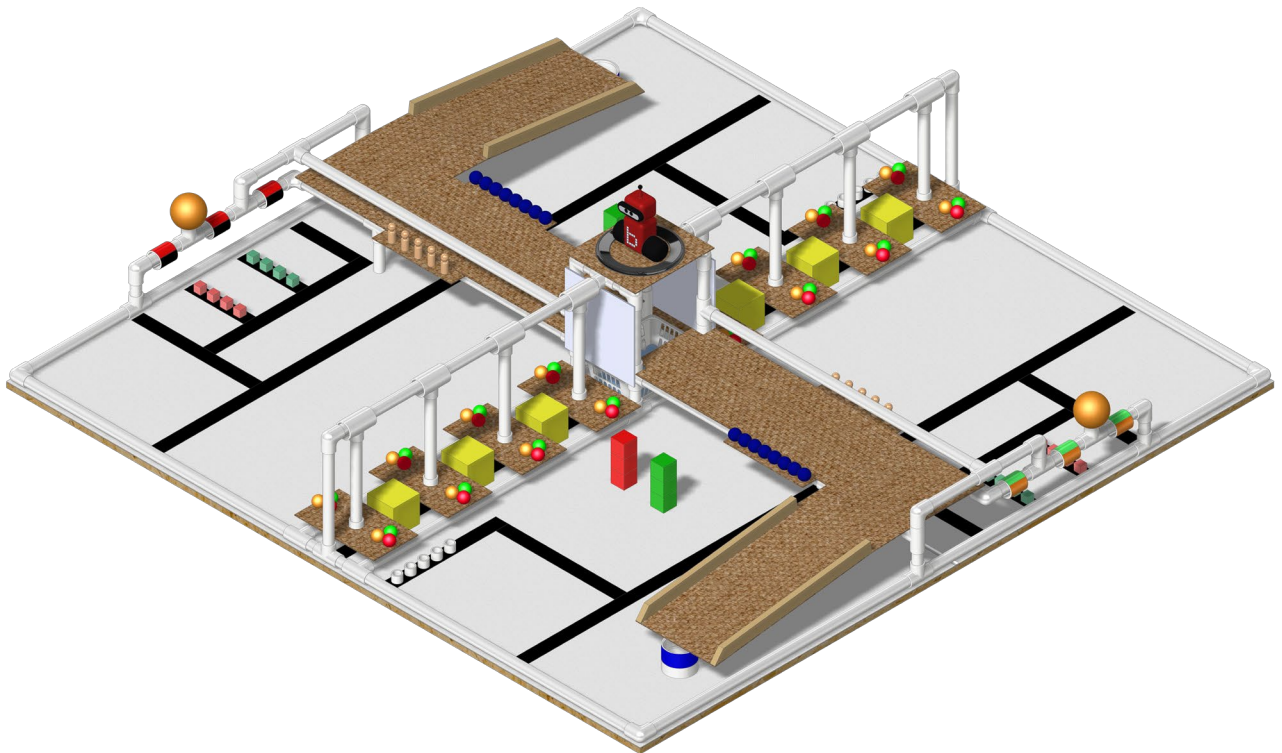
Figure 1 - Game Overview

Game Board Areas

Official game board specifications are on the Team Home Base. All tournament boards and game pieces will fulfill the following specifications within +/- 0.25" or up to 1% of the specification.

The game board is composed of four 4' x 4', reusable modules whose surfaces are pebble grain white fiberglass reinforced plastic panel (FRP). A fully assembled game board will be ~8' x 8'. A panel channel or black or white duct tape is used to close exposed seams where modules abut.

The game board is separated into defined areas for each team. For double elimination rounds, a team is assigned to play on side A or side B by the KIPR scoring software.

- *Side*
- *Mineral Lab – Starting Box*
- *Ore Storage – Starting Box*
- *Material Transport*
- *Mining Ramp*
- *Mining Platform*
- *Mine*
- *Astronaut and Material Staging Areas*
- *Mountaintop*
- *Material Processors*
- *Mine Carts*
- *Mountain Slope*

Figure 2 - Game Areas

Side – A team's *Side* is the surface of the game table as delineated by the **inside edges** of the surrounding PVC, but **excluding** the *Storage*, *Habitat, Material Sorters,* and any other tape lines*.*

Ore Storage and Material Lab – The boundary of the *Ore Storage and Material Lab* areas is defined by the **inside edges** of the tape lines and PVC. These also serve as the team's *Starting Boxes*.

Material Transport – The volumetric space confined **within** the 3" PVC coupler.

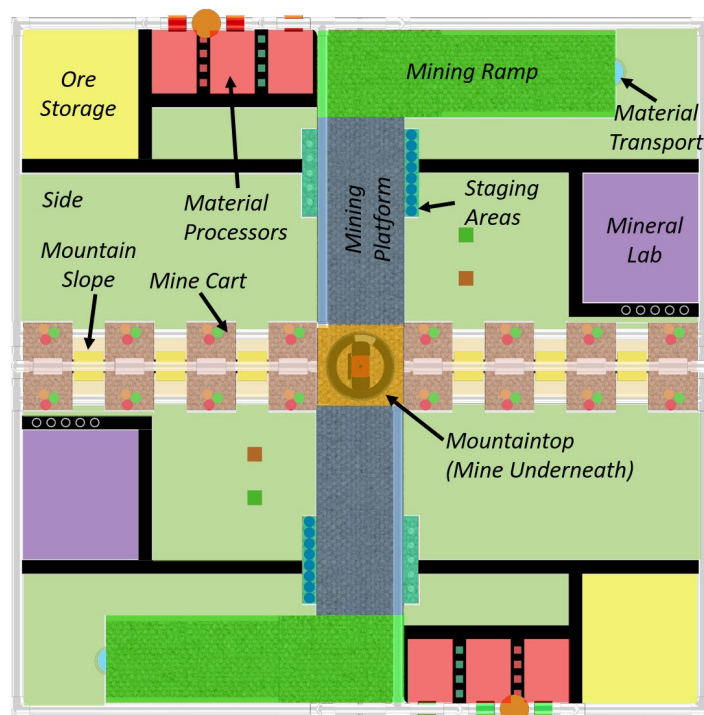*Mining Ramp and Mining Platform* – The surface of the Masonite delineated by the **inside edges** of the **cut** Masonite board.

Mine – The volumetric space **within** the white basket under the *Mountain*.

Astronaut and Material Staging Areas – The surface of the Masonite delineated by the **inside edges** of the **cut** Masonite board and the edge of the *Mining Platform*. The *Astronaut Staging Area* is on the same side as the *Ore Storage* and the *Material Staging Area* is on the same side as the *Mineral Lab*.

Mountaintop – The surface of the Masonite delineated by the **inside edges** of the **cut** Masonite board in the center of the board and also includes the surface of the black ring.

Material Processors – Delineated by the **inside edges** of the PVC and black tape.

Mining Carts – The *Mining Carts* are the surface of the Masonite delineated by the **inside edges** of the **cut** Masonite board surrounding the PVC pipe of the swing.

Mountain Slope – The *Mountain Slope* is the surface of the game board delineated by the **inside edge** of the PVC in the center of the board between the two sides. It is broken into two sides by black tape, one for each side of the game board.

Game Piece

Scoring Pieces

- 1 – *Botguy*
- 2 – *Communication Satellites* (4" orange balls)
- 2 – *Material Transports* (3" PVC Couplers)
- 6 – *Processed Iron Boxes* (2" red cubes)
- 6 – *Processed Quicklime Boxes* (2" green cubes)
- 6 – *Mixed Ore Boxes* (4" yellow cubes)
- 8 – *Small Iron Ore Boxes* (1" red cubes)
- 8 – *Small Quicklime Ore Boxes* (1" green cubes)
- 10 – *Astronauts* (wooden people)
- 10 – *Spacesuits* (1"x1" PVC Pipe)
- 16 – *Iron Ore Rocks* (red poms)
- 16 – *Quicklime Ore Rocks* (green poms)
- 16 – *Helium-3 Containers* (orange poms)
- 16 – *Water* (royal blue poms)
- 24 – *Titanium oxide Ore* (sky blue poms)

Starting Positions

- *Botguy* – Will be placed on top of the mountain centered in the communication ring.

- *Communication Satellites* – Will sit on top of the PVC T between the *Material Processors* closest to the *Ore Storage* area.

- *Material Transports* – Will start supporting the *Mining Ramp* in a raised position, centered on the ramp and halfway under the edge of the ramp.

- *Processed Iron Boxes* – Will be placed 6" from the outside edge of the PVC of the *Mountain Slope* area and 15" from the inside of the *Mineral Lab*.

- *Processed Quicklime Boxes* – Will be placed 12" from the outside edge of the PVC of the *Mountain Slope* area and 15" from the inside edge of the *Mineral Lab*.

- *Mixed Ore Boxes* – Will be placed in between two *Mining Carts* and centered on the black line in the center of the *Mountain Slope*.

- *Small Iron Ore Boxes* – Will be placed 1" from the inside edge of the PVC and 1" apart, centered on the black line under the *Communication Satellite*.

- *Small Quicklime Ore Boxes* – Will be placed 1" from the inside edge of the PVC and 1" apart, centered on the middle black line of the *Material Processor* areas not taken up by the *Small Iron Ore Boxes*.

- *Astronauts* – Will be placed in the *Astronaut Staging Area* with their centers 1" from the edge of the area bounded by the *Mining Platform*. The *Astronauts* will be placed on dots 2" apart with the first dot being 2" from either edge of the short edge of the area.

- *Spacesuits* – Will start on the black line of the *Mineral Lab* closest and parallel to the *Mountain Slope*. These may be placed by the team but they may only be touching black tape.

- *Helium-3 Containers and Iron and Quicklime Ore Rocks* – Will be placed on both short edges of the *Mining Carts* in clumps with one of each of the materials.

- *Water* – Will be placed in the *Material Staging Area* centered between the long edge and the *Mining Platform*. The *Water* will be placed side by side, filling the length of the area.

- *Titanium Oxide Rocks* – Will lay in the *Mine* in no particular position since they will be placed by the judge.

- *Mining Carts* – The first *Mining Cart* will be placed 0.5" from the elbow at the edge of the game board. Each subsequent cart will be placed in 11.25" intervals.
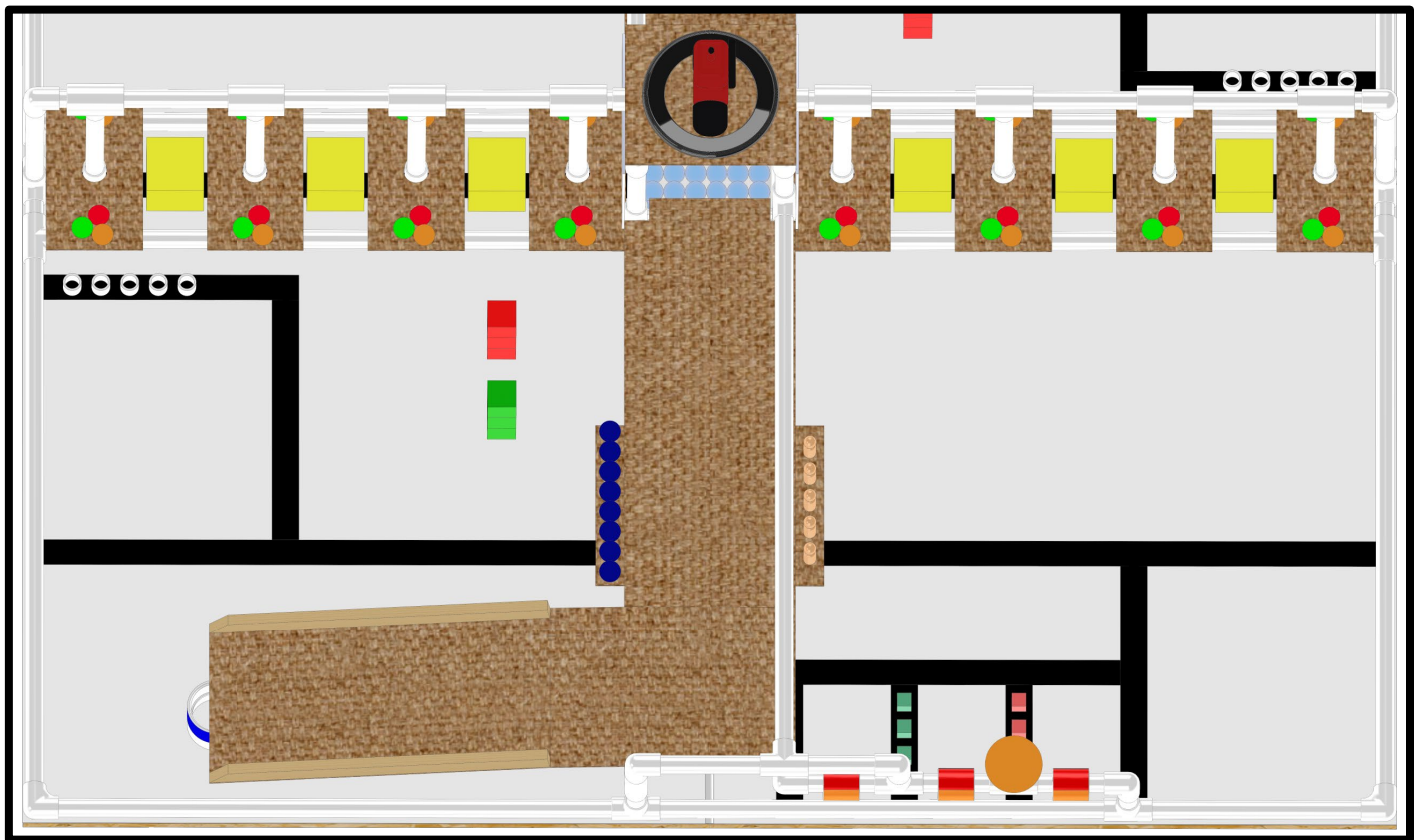

Figure 3 - Game Board Angled View

Scoring

Areas	Itemized Points		Totals
1. Side		Botguy x3	
All Scoring Pieces (not stacked)	#_____ X 1 = _____		
Processed Ore Cubes (not stacked)	#_____ X 5 = _____		
2. Mineral Lab		Types of Ore Boxes	
Astronaut wearing Suit	#_____ X90 = _____		
Astronaut not wearing Suit	#_____ X20 = _____	x_____	
	Subtotal = _____		
3. Mineral Storage		Tallest Stack	
All Ore Boxes	#_____ X 12 = _____	x_____	
4. Mining Ramp/Platform		**X**	
Ramp Down (touching surface)	Yes? 20		
Transport on Ramp or Platform	Yes? 30		
Robot Position	Surface Ramp Platform		
	0 20 60		
Titanium Oxide (sky blue) on ramp	#_____ X 20 = _____	Botguy x3	
	Subtotal = _____		
5. Material Transport		Fully In Zone:	
Ice (royal blue) Poms	#_____ X 15 = _____	Mineral Lab x2	
Titanium Oxide (sky blue) poms	#_____ X 90 = _____	Mineral Storage x3	
	Subtotal = _____	Black Processor x4	
6. Mountaintop		**X**	
Communication Orb	#_____ X 350 = _____		
7. Material Processor 1	Red / Orange / Green / Black		
Ore Boxes	#_____ X 1 = _____		
Resource Poms	#_____ X 6 = _____	Sorted x5	
Matching Ore Boxes	#_____ X 4 = _____		
Matching Resource Poms	#_____ X 24 = _____		
	Subtotal = _____		
8. Material Processor 2	Red / Orange / Green / Black		
Ore Boxes	#_____ X 1 = _____		
Resource Poms	#_____ X 6 = _____	Sorted x5	
Matching Ore Boxes	#_____ X 4 = _____		
Matching Resource Poms	#_____ X 24 = _____		
	Subtotal = _____		
9. Material Processor 3	Red / Orange / Green / Black		
Ore Boxes	#_____ X 1 = _____		
Resource Poms	#_____ X 6 = _____	Sorted x5	
Matching Ore Boxes	#_____ X 4 = _____		
Matching Resource Poms	#_____ X 24 = _____		
	Subtotal = _____		
10. Mine Carts		**X**	
Mine Carts on side	#_____ X 100 = _____		

Scoring Rules

1. **Black Tape Rule:** A game piece touching any Black Tape line does not score.
2. **General Scoring Rule:** A game piece must touch the surface of the scoring area to score, with the exception of the *Material Transports*. Additionally, items in stacks (as defined below) count as touching the surface if the bottommost item in the stack touches the surface of the scoring area.
3. **Volume Rule:** To score in the *Material Transports* some part of an item must break the volume of the scoring area.
4. **Stacking Rule:** *Processed Iron and Quicklime Boxes, Mixed Ore Boxes,* and *Small Iron and Quicklime Boxes* in a stack score if the bottommost item in the stack is touching the surface of the scoring area. Each level must touch the topmost surface of the cube below it. The only surface where stacks do not score at all is the *Side*.

   Note: Judges must be able to visibly determine the stack *height* and *integrity* (all items in stack touching other items in the stack) **without moving any items** otherwise all cubes in the stack score as "flat in the scoring zone of the base item of the stack".

5. **Highest Scoring Rule:** A game piece can only score in one scoring area and will be scored as if it is in the highest scoring area, as determined by base score without multipliers.
6. **Robot Rule:** For the purposes of scoring, a robot is defined minimally as a KIPR Robot Controller with at least two motors or a Create connected to it. A robot with 2 controllers counts as a single robot.
7. **Final Scoring Rule:** The score is determined by final object location, not by how it got there. Judges will wait until any scoring objects still in motion have come to rest before scoring a game.
8. **Mine Cart Rule:** A *Mine Cart* scores on a team's side if it is past the side of the *Mountain Slope* black line closest to that team's *Side*.
9. **Spinner Rule:** A *Material Processor* scores colors based on whether the black mark centered on the pipe of the spinners in the plane of the edge of the board lies within the range of the color on the spinner. Black indicates that all resource poms and 1" cubes may score there otherwise it must match the color of the spinner.
10. **Create Rule:** A non-Create robot can proceed from its side to the other side as part of game strategy in DE.
11. **DE igus© Chain Rule:** If the igus© chain of a team is across the vertical projection of the opponent's side, then it may not touch an opponent's robot or else the team will be disqualified. This is regardless if the action is intentional or accidental.
12. **DE Field Interference Rule:** If a *non-robot structure* enters the vertical projection of their opponent's *field*, then the team will be disqualified for that round. See **Robot Rule** for definition of a robot. For example, if the non-structure covers the playing field (*Side, Mining Platform, Mining Ramp, Material Processors, Mineral Storage,* and *Mineral Lab)*, blocks any vertical space of the field to deny their opponent access, etc.

Tie Breakers & Special Scoring Conditions

If one team never breaks any border of the *Starting Box*, including the 12" ceiling, then they lose the round. If both teams break the boundary of their *Starting Box* and one team's robot does not shut down their motors or does not stop commanding their servos to move at the end, then they lose the round. In the case of a tie score, a team wins if none of the above conditions apply and they are the:

1. Team with the *Communication Satellite* on the *Mountain Top*
2. Team with the most *Astronauts in Space Suits*
3. Team with the most *Mine Carts*
4. Team with the most *Metals* in *Material Transport*
5. Team with the most *Astronauts* in *Mineral Lab*
6. Team with the *Mining Ramp* down
7. Team with the most points scored on *Mineral Lab*
8. Team with the most points on *Side*
9. Team with the robot (defined by the KIPR Robot Controller power switch) closest to Botguy

Game Play

Fair Play and Spirit of Botball

Botball is about the development of **student** skills. Once a team enters the pits with their robots, we require that the **robots not leave the pits** for any purpose until the conclusion of the tournament or suspension of play for the day. Adults are not allowed into the pits, except to help teams carry in equipment as they are arriving in the morning. All adults accompanying a team should understand that responsible Botball mentorship **does not include** working on the robot entries or programming the robot entries for the students but **does** allow for appropriate mentor guidance of the team. **Teams hosting a tournament at their school must check their robots into the pit area at least one-hour prior to the start of the seeding rounds.**

Spirit of Botball: This is a 100% student-driven experience.

Students know this, and adults know better!

Mentors, parents, adults, or other non-students who wish to actively participate in the construction, programming, testing, or documentation of a robot are invited to participate in the KIPR Open or KIPR Aerial.

Practice

Teams are permitted to send up to three team members to the practice tables. Teams will have 3-5 minutes at the table to practice before being asked to wrap up. Teams should reset the table before departing.

Teams are not permitted to bring a laptop, tablet, or other programming device to the table to conduct code changes unless otherwise permitted by KIPR at the tournament. If a team is observed doing this, then the student with the wireless device will be asked to leave the table. If a team member is sitting in the audience reprogramming the robot wirelessly, then the team will be asked to leave the table. The objective

is to reprogram your robot(s) in the pit area and bring them to the table to execute the code. Teams are allowed to bring a mouse to the table to interface with the KIPR Robot Controller.

On-Deck

Entry to the On-Deck

Only the current year's kit materials that total up to a single kit are allowed in the on-deck area. The intent is that teams do not bring up multiple sets of robots to the game table to choose which ones they will play. In the event that a robot is swapped while in the on-deck for another robot, then that team will be disqualified for that round. If this is observed by the on-deck manager, then he or she will inform the Head Judge who will then enforce the disqualification for the round.

Inspections

Regional tournaments might have a robot inspection prior to teams entering the on-deck area. This is dependent on KIPR staff or volunteers who are available to execute the process. Inspectors will have a parts list on hand and may reference it as documentation if they determine there is a violation.

The objective is to verify that teams have no illegal parts present on their robot. If a team is found to have an illegal part, then a couple of scenarios can play out. If a team has a timeout card available, then they may take a timeout in order to take their robot back to their pit to remove the illegal part. If a team does not have a timeout card, then the robot with illegal parts will be disqualified for that round. Please see the Timeout Card section for further information.

Setup – Before Hands-Off

Up to two students from a team may bring the team's robot(s) to the tournament table and perform the setup. If at any point during or after setup, a team is observed with a laptop near the game table and appears to be reprogramming their robot, then the team may be disqualified by the Head Judge. Teams will place their robot(s) within their *Starting Box(s)* as desired. Teams may position either or both of the starting lights on their side as they wish, provided:

- Starting lights must be attached to the outside edge of the game table alongside the *Starting Box(s)*. Starting lights must either be aimed at the team's light sensors or at the floor and cannot be aimed so as to disrupt an opponent (judges' ruling).
- Starting lights may **not** break the vertical projection of the board inside its PVC boundary. This is for safety as robots do occasionally break the bulbs if they make contact.
- There are two starting lights for each team, so each KIPR Robot Controller can have its own starting light. Both lights will turn on and off at the same time and cannot be controlled individually.
- Teams cannot touch starting lights after Hands-Off.

Teams will greet each other and:

1. Visually inspect each other's robots before calibration. Inspection is limited to a maximum of 1 minute unless a specific part violation challenge (refer to parts challenges under Challenges section) is made. Teams are encouraged to utilize the Bill of Materials spreadsheet provided on the Team Home Base for each of their robots to ensure they won't have a robot's construction challenged. The Bill of Materials is also useful as documentation.

2. Teams must notify table judges **before the end of "Hands-Off"** if they believe the table is not set up properly. When both teams are ready, each team positions/activates its robots and then – **Hands-Off**!

If judges determine a team is taking too long to calibrate, then they will issue a 30-second warning. At the end of the 30 seconds, a team that is not ready for "Hands-Off" will be assigned a fault, and the setup clock will be reset. If a team receives a 2nd fault in a round, then they forfeit the round. The maximum setup time, which may be extended at judges' discretion, is 90 seconds.

If it is observed by any judge that a team pulled a robot off of the table and swapped the robot out that was not in the on-deck area, then that team will be disqualified by the Head Judge.

Before the Game Begins – After Hands-Off

Once "Hands-Off" has been declared, the team members will position themselves so as not to block the view of the table by the audience. No part of a team's robot(s) may leave the *Starting Box* until the round has begun. Movement is okay so long as the *Starting Box* boundary isn't violated. If a moving violation happens, then the judges will call a fault on the team. Team members may not move the starting lights at any time after hands-off. A judge may move the light to avoid potential damage to a light. If a team receives a 2nd fault in a round, then they forfeit the round. Team members may not signal to their robots after "Hands-Off" to start their robots.

Timeout Card

Each team will be given a single red Timeout Card that is labeled with their team name and number when they register on-site. Only the team whose name appears on the card may use it. The card can only be used at an on-deck robot inspection if it is being used at the tournament or while that team is at the table before "Hands-Off". While a team is at the table, any time **before** "Hands-Off", a team may turn in their timeout card and get a 3-minute timeout. The team may spend that time in the pits or at the table, but not to practice at the table. However, the team may practice the starting light sequence. Only a single timeout per team is allowed for the entire tournament. Teams are advised to save their timeout card for the Double Elimination rounds, as Seeding rounds are best 2 out of 3.

If your region has on-deck robot inspections and your robot is deemed to have an illegal part **during seeding rounds**, then you may use your time out card to take your robot to the pit to remove the part. If your region has on-deck robot inspections and your robot is deemed to have an illegal part **during double elimination rounds**, then your robot will be disqualified. It is highly recommended that teams carefully and meticulously review the parts on their robot prior to entering the inspection area.

After the Game Begins – Lights On

Once the starting lights have turned on, the round counts unless a judge rules otherwise. At the start of the game, the starting lights turn on and robots are then allowed to leave the *Starting Box*.

The round lasts two minutes (120 seconds). The lighting sequence is:

- 0 seconds: lights turn on; robots can leave starting boxes
- 15 seconds: lights turn off
- 115 seconds: Lights turn back on and blink for five seconds
- 120 seconds: lights turn off; game over; robots must turn off motors and freeze/power down servos

End of Game

Robots must **stop driving their motors, including those on the Create, and stop servo motion** by the end of the round or that team will lose the round in all situations except against a team that does not break the boundary of the *Starting Box* (in Seeding, this condition will give a score of 0). Incidental motion from a servo holding a position under load is OK.

Scoring is based on the location of pieces at the end, not how the pieces got there. Scoring takes place when the round has ended and items have come to rest.

If all motion has stopped before 120 seconds, the judges may ask the teams if their robots are done and if so, then they may end the round at that time. Both teams must agree in order for this to end the round.

Final Scoring and Rulings

If your team does not agree with the score as calculated, then they must immediately notify the table judge(s) **before** leaving the table and **before** any items have been moved on the table. If they do not agree with the table judge's ruling, then they may ask to speak with the Head Judge. The Head Judge will spend no more than 5 minutes on the decision. Teams will be required to initial the

score sheet <u>before</u> leaving the table, signifying acceptance of the ruling. If they do not agree with the ruling, then the Head Judge is permitted to sign for the team to progress the event forward.

There are no instant replays. No external videos will be used in consideration of scoring. If a team is unhappy with a judge's decision, then they should politely challenge it then and there. **Challenges to scoring after the teams have signed the score sheet will <u>not</u> be considered.**

<u>Spirit of Botball</u>**: Mentors, spectators, and team members should respect teams' and judges' final decisions.**

Challenges

Challenges may only come from judges and team members at the table. If either team wants to challenge the validity of the robots they are facing, then they have to bring it to the table judges' attention <u>during the inspection period</u> and the Head Judge will come over. Teams should bring the list of parts to the table to aid in the inspection. Challenges must be specific. Teams are encouraged to have a Bill of Materials for each robot they bring to the table as a means for minimizing the likelihood of a robot's construction being challenged. There is a Bill of Materials spreadsheet on the Team Home Base, which can be used to specify which kit parts are allowed to be used for the robots at the table.

The Head Judge is the final arbiter of a challenge and can dismiss what they believe to be spurious or irrelevant challenges. Teams determined by the judges to be in safety or performance-changing violation will be given 60 seconds by the judges to make a correction, remove offending pieces, or take the robot off the table; otherwise, the robot must be removed for the round or the team can forfeit. A robot that is determined before the beginning of a round to be in a safety or performance-changing violation of the construction rules will not be allowed to play while in that state. A robot ruled to be unsafe for humans will not be allowed to run until modified.

If a team wants to execute a challenge, then they must wager their round. If the team that makes the challenge is correct, then they win the round and the other team is disqualified for that round. However, if the team that makes the challenge is incorrect then they will be disqualified for that round and the other team will win the round. In the case that both teams wish to make a challenge, the one to approach the judge with the challenge first will be the determining challenge.

Acknowledgements

The KIPR Robot Controller is a powerful device, but the use of threading can cause unpredictable results, such as the robot not stopping when utilizing the *shutdown in* function. Teams are encouraged to limit their use of threading and to make sure they take precautionary steps to stop their robot within the time limit of the game. If the robot fails to stop moving after the time limit, then it will result in a score of 0 for a Seeding round or a disqualification for a Double Elimination round.

It is also recommended to limit the amount of time teams use the camera during the round, since prolonged use with the camera on can cause the Wallaby to crash.

Seeding Rounds

Seeding rounds take place before Double Elimination. There will be three Seeding rounds. The order in which teams appear in each round is set by tournament software and is the same for each round. In Seeding, a team plays the game unopposed, and the score for both sides counts, where your Seeding Round score is (*the score for your side*) + (*the score for the other side*). Note that Seeding scores are the **sum** of the entire board and **teams are encouraged to cross sides and use the whole board for scoring during Seeding**. Unlike the Double Elimination rounds, a Create chassis is permitted to cross to the other side.

Seed scores of less than 0 will be counted as 0. A team's Seed Score is the average of their best two Seeding rounds. The tableside used by a team for a Seeding round (the side from which the robots will start) is determined when teams are called to be on deck for their turn in a Seeding round.

A student team member must bring any concerns about the seeding round scores to the attention of the Head Judge before the bracketing for the double elimination rounds. Bracketing occurs within ~5 minutes of the completion of the last seeding round. Only math errors on scoring will be accounted for.

Double Seeding Rounds

Double Seeding will only be played at the Global Conference on Educational Robotics. Double Seeding rounds are played with one team on each side of the board, decided upon randomly by the software. There is not a winner or loser in the rounds. The scores of each team will be recorded as they are in Seeding except no scores will be dropped for the final score.

Double Elimination (DE) Rounds

A team is out of the Double Elimination tournament when it has lost two games. Initial matches are decided by KIPR tournament software using Seeding round scores. As the tournament progresses, the order of matches and table sides for the competing teams are determined using KIPR tournament software. The two teams for a match play each other and the highest score at the end of the game wins, subject to tie breakers and special scoring conditions. The size of Double Elimination scores does not affect ranking, only wins and losses.

During a Double Elimination match, a team's Create chassis may not ever be entirely on the other team's side. During match play, the table judge, through observation, may decide that a robot is guilty of interference, and then disqualify the team for that round.

Alliance Matches

Logistics

At selected tournaments, if a team is eliminated from the Double Elimination tournament before the Finals of Double Elimination play, then that team may sign up to play in Alliance Matches. Alliance Matches will pair up two teams to play the game collaboratively with the goal of scoring the most points. Each team will bring one robot to the table to run simultaneously. The teams will place their robots in any of the *Starting Boxes* (i.e. both on the same side or split between the two sides).

Scoring

Alliance rounds will follow all of the same scoring rules as a regular Seeding round. The total Alliance score is (*Your side's score*) + (*Ally side's score*). The Alliance team with the highest combined score from a single run will win the Alliance Tournament. Alliance matches will be conducted until tournament officials suspend play (usually when the final Double Elimination rounds are near complete).

Tiered Rounds

Logistics

At selected tournaments, if there are enough teams, then there might be a chance of breaking out the Double Elimination rounds into multiple tiers. The objective is to play against your peers.

Construction Rules

The official construction rules for the 2020 Botball Game consist of the latest revision of this 2020 Botball Game Review document and any updated game rules posted on the Team Home Base (including those posted in answers to FAQs or otherwise). Posts on the 2020 Team Home Base in the Game Rules Question area will be used to update the document and provide notice of any rule changes or adjustments.

Kit Rules

1. Sensors from the 2017, 2018 and 2019 kit may be used as long as they don't exceed the type or number in the 2020 kit.

2. Only this year's metal chassis (steel) will be allowed in robot construction.

3. Robots may be constructed out of any or all of this year's kit parts except: the boxes, bags, wrapping or packing material, the chargers, download cables, wrenches, screwdriver and color stickers. Materials supplied at the workshop for creating your game board (e.g., Botguy, poms, etc.) are not part of the kit and cannot be used on your entry. The included camera and Create are the only USB devices that may be plugged into a robot during the game. **Consult the official parts lists for allowable kit parts!**

4. Small removable mounting dots/strips such as those produced by Glue Dots, UGlu and/or Scotch Brand Restickable Dots/Strips, blue tack (acquired at team's expense) may be used for construction purposes. They may not be exposed for sticking things otherwise in any manner. In particular, this means you may **not** use your mounting dots/strips to contact the game board, game elements, or the other team's entry. **Note that neither hot melt glue nor any other adhesives, other than removable mounting dots/strips, are allowed in robot construction.**
   a. Mounting dots/strips are available at stores such as Home Depot, and online from vendors such as Amazon.

3. Judges may require excessive adhesive to be removed. Teams should always try to come up with a mechanical means for construction and only resort to using adhesive methods as a last resort.

4. Supplied servo accessories such as grommets, screws, etc. may only be used to mount pieces to the servo horn.

5. Servos and motors may be mounted to structural pieces using the supplied machine screws.

6. Teams may trim the connector potting material as needed to ease insertion or mounting of sensors. Damaged pieces will be replaced at team's expense.

7. Plastic servo horns may be trimmed as desired. Damaged pieces will be replaced at team's expense.

8. Teams are allowed to add the following pieces to their entry:
   a. Up to 100cm of thread or line (maximum diameter 1mm, non-metallic only) may be used as desired except for offensive measures such as entanglement and entrapment.
   b. Paper (maximum 20#) so long as the amount can be taken from a single standard US letter-sized (8.5" X 11") or A4-sized (210mm x 297mm) sheet. See rule 9.
   c. Standard 3/16" thick foam board as long as the amount can be taken from a standard US letter-sized or A4 footprint. See rule 9.
   d. Up to 10 standard office rubber bands of maximum size #19 may be used (#19 is 3.5" x 1/16" x 1/32").
   e. Up to 10 Paper Clips, smooth, metal (between 1" and 1 ½" in length). Paper clips can be bent

in any fashion but cannot be cut, broken or plugged into any wire or robot controller

    f. Coins, up to 250 grams (~100 U.S. pennies) to be used as a counterweight only. Please be prepared to prove that it is within the legal weight limit if necessary. Coins may be rolled in wrappers (up to two rolls) to make it easier to weigh.

9. If the team's entry uses paper and/or foam core board, then the team MUST bring a template showing how the material you are using was cut out of **each** 8.5" X 11" (or A4) sheet. The paper/foam core board may only be held in place through the use of other kit parts (including removable mounting dots/strips detailed above if used as allowed for other kit parts). **Paper and foam core board may only be black or white; only grayscale may be used for printing including official logos for sponsors of your team, or QR codes.**

10. Rubber bands may not be glued or melted. Rubber bands may be cut, but only a total of ten whole rubber bands or five cut rubber bands may be used on a team's entry. For any combination having both whole and cut rubber bands, the limit is 5.

11. Soda straws, paper, electrical tape and/or foil may be used as light guides for sensors (light guides may be shielded by using tape, but not in a fashion that is for structural purposes or for manipulation). Light guide materials are in addition to the allowable parts.

12. Teams are not allowed to shield robot sensors externally to their official entry (i.e., teams are not allowed to stand between their robots and the audience to keep the robots from sensing the audience). Teams should orient and calibrate the sensors on their robot appropriately so that this is not an issue. Teams using cameras may request that anyone whose attire includes significant color markings closely matching game object colors stand well back from the table.

13. Team are limited to ten (10) 4" white zip ties (included in the kit), and they may be used for any purpose. You may replace damaged ties with ones of equivalent size (black or white).

14. Lego parts cannot be physically modified.

15. Metal parts may not be cut or broken to a smaller size. Straps and plates may be bent if desired.

    • Warning: At tournaments KIPR will not provide replacements for metal parts that have been altered or damaged. Replacements may be purchased from the online Botball Store.

16. Optional Create parts are the top plate, dust bin, and brush bar box. If any optional pieces are removed, they may NOT be reused anywhere else on the entry. The Create may not be assembled/disassembled otherwise.

17. Teams are limited to the number and size screws as follows: 20 -#8-32 quarter inch, 45 -#8-32 half inch, and 35 -#8-32 three-quarter inch screws. All #8-32 screws are black. There are 10 silver M3 x 14mm screws and six silver M3 nuts. There is also #8-32 threaded rod: 10 - 1", 2 - 2", 2 - 3", and 1 - 6" long.

Robot Logistics

1. Each robot if named can only have a name (G-rated) approved by an adult team leader before the tournament.

2. Multiple processors (such as two KIPR robot controllers) may exist on a single robot.

3. It is not necessary to use all the parts in a kit.

4. Each *Starting Box* is 18" x 16" x 12" tall.

5. The *Starting Box* boundaries are given by the **interior edge** of the PVC and **interior edge** of the black tape that delineates it.

6. All elements of a team's entry must be within the volume of the *Starting Box* at game start.

7. After game start, robots are allowed to expand in size.

8. Starting light sensors may be shielded as demonstrated in the workshop slides and <u>neither sensor nor shielding may extend outside the *Starting Box*</u>.

9. All independent structures not under computer control should be clearly marked with the team's number. Maximum label size is 1" diameter (Avery #5410), or you may use permanent marker directly on the structure. Teams may only run robots with their team number on them.

10. Robot teams can have a maximum of 4 independent structures on the game table at a time
    a. A team's entry, including any supplied game pieces, must fit in the *Starting Box* **without any external restraint** at game start (the *Starting Box* floor and border PVC is not an external restraint).
    b. Each structure must be large enough so that it does not, in the judge's opinion, constitute a jamming or entanglement hazard.
    c. Examples of structures include: robots, barricades, detachable baskets, etc.
    d. A team's entry can contain as many robots up to the structures limit as can be constructed from the parts in a single kit.
    e. Items intentionally ejected from a robot count as structures (judges judge intention); there are special rules regarding projectiles, discussed later.
    f. The igus© chain **must** be permanently affixed to a robot (defined as a KIPR Robot Controller with a minimum of two attached motors) by at least one end of the chain. Using the igus© chain in a gear-driven system for motion of a robot component counts as being affixed to the robot. The igus© chain may **not** be used as a projectile (even tethered) or as an independent structure. If the Head Judge deems the use of the igus© chain to be in violation of this rule, the offending team will be disqualified for the round.

11. No electrical modifications may be made to any KIPR robot controller, the Create, any sensors or any motors, except for substitution of batteries with one approved by KIPR.

12. No wire extensions may be used except those provided in the kit.

13. Entanglement strategies that involve an independent structure are not in line with the Spirit of Botball and may be subject to disqualification as determined by the Head Judge.

Safety

1. Human & Robot Safety:
   a. No untethered robot-launched projectiles, other than game pieces, are allowed.
   b. No tethered projectiles containing metal pieces are allowed.
   c. No metal pieces are to be used in effectors that move or rotate at high speed.
   d. No metal protrusions are to be used that are likely to cause electrical or safety risks for other robots (including arms and projectiles).
   e. Judges will determine how safe a robot is. <u>Teams may alert judges to a potential safety or entanglement hazard, but judges will interpret whether or not a robot is safe, needs to be modified, or is not allowed to run</u>.

2. Electrical tape, either black or white, may be used to cover metal pieces that are deemed to otherwise be a safety risk to robots or humans. Judges might require this to be done at the game table. Note that tape is not allowed to be used for structural purposes.

3. If the Head Judge decides that a robot is not considered safe, then the robot will not be allowed to run until it has been modified.

External Communication

1. No external communications (e.g., IR, Bluetooth, wireless, or semaphores) may be used during tournament play with the exception of one robot to another robot that are both in play on the game table.
2. The USB cables & chargers may not be used during game table tournament play with the exception of the Create cable.
3. Communication between robots for your team's entry is allowed
4. Your robot controller may have WiFi turned on or off at the tournament, however we strongly advise teams to use USB communication at all times as teams can remotely access your Wallaby and gain your password.
5. Any teams found in violation of any communication hacking or tampering with another team's robots or equipment is in violation of the "Spirit of Botball" and may be disqualified from the rest of the tournament.

Teams found in violation of any communication rule may be disqualified from the tournament at the discretion of the Head Judge.

Overall Winner Calculations

A team's overall score is calculated as the sum of their Seeding, Double Elimination, and Documentation scores. The overall score is between 0 and 3. The exception to this is at GCER where Double Seeding will be played and the score will be between 0 and 4.

Documentation Scoring Formula

$$\text{DocScore} = \frac{3}{10}(\text{Period1Doc\%}) + \frac{3}{10}(\text{Period2Doc\%}) + \frac{1}{10}(\text{Period3Doc\%}) + \frac{3}{10}(\text{OnsiteDoc\%})$$

Seeding Scoring Formula

$$\text{SeedScore} = \frac{3}{4}\left(\frac{n - \text{SeedRank} + 1}{n}\right) + \frac{1}{4}\left(\frac{\text{TeamAverageSeedScore}}{\text{MaxTournamentSeedScore}}\right)$$

Double Seeding Scoring Formula

$$\text{DoubleSeedScore} = \frac{2}{3}\left(\frac{n - \text{DoubleSeedRank} + 1}{n}\right) + \frac{1}{3}\left(\frac{\text{TeamAverageDoubleSeedScore}}{\text{MaxTournamentDoubleSeedScore}}\right)$$

Double Elimination Bracket Scoring Formula

$$\text{DoubleEliminationScore} = \left(\frac{n - \text{DERank} + 1}{n}\right)$$

Note: For all formulas n = Number of Teams at Tournament or in bracket
Note #2: Weighting of brackets and number of brackets will be released at GCER