TCEA Mindstorms Robotics Challenge 2015-2016

"Power Up"

Game Manual

Designed for TCEA by:
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FINAL DRAFT

Revision History

9/7/2015 (Draft Version 1)

1. Original Release of Game Rules
    a. Section 2.0.3 has been redefined, PLEASE READ!
    b. Game FAQ has initial starter questions.

9/9/2015 (Draft Version 2)

1. Updated 1.3.6 to include example of a properly set up Game Board
2. Updated 1.3.6 to indicate that both sides of the field do not have to be set up similarly as they have done in past games.
3. Added FAQ 3.12

9/14/2015 (Draft Version 3)

1. Changed all references from "Battery Shell" to "Battery Housing".
2. Updated Task 1.4.3 to put a minimum height requirement on the Lightning Rod in order for it to qualify for points.
3. Updated sections 2.0.2 and 2.0.6 to identify qualifying walls for robot starts/restarts.
4. Updated Task 1.4.3 to further qualify what a "deployed" Lightning Rod is.
5. Updated text for Tasks 2.1.1, 2.1.2, and 2.1.3 to be more specific in the outcome of the STATE ONLY bonuses for tasks completed.
6. Removed word "intentionally" from 2.0.10 to remove intent from loss-of-contact.
7. Removed word "western" from 1.3.6 to remove confusion from directionality in other areas of the manual.
8. Section 2.0.4 was revised to be more explicit about Power Cell recovery when the robot is recovered.

9/18/2015 (Draft Version 4)

1. Reordered some of the rules, and completely rewrote rule 2.0.8 to be more specific that Power Cells ***CAN NOT*** be held by team members while the robot is in play.
2. Relabeled items in 1.3.6 to make reference easier.
3. Updated "story" component for Tasks 1.4.2 and 1.4.6, as well as 1.3.1 and 1.3.4.
4. Removed opposing team's SOUTH wall from 1.4.6 consideration due to concerns of interference and entanglement during the match.
5. Updated Task 1.4.5 to add tally exception.

9/28/2015 (Draft Version 5)

1. Added clarifying text in Task 1.4.1 and shortened text in Task 1.4.2
2. Added FAQ 3.15 and 3.16 to support clarifying text in Task 1.4.1.

10/31/2015 (Final Draft)

1. Fixed the dates in this Revision History
2. Cleaned up language in 1.3.4 and Task 1.4.4 (minor, like spelling et. al.)
3. Removed "unrecoverable robot" penalty in 1.4.2, changed to "double penalties"
    a. Updated rules 2.0.4 and 1.3.5 accordingly, and created FAQ 3.17

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(AKA: The guide to the "important stuff")

Section 1 Game Description

1.1 Game Background

The 2015-2016 TCEA Mindstorms Robotics Challenge game is titled, "Power Up" and is designed around the theme of Energy and Power Storage.

Large-scale power generation technologies have advanced significantly in the last several decades. Coal, Oil, Gas, Nuclear, advances in solar energy production, wind power, geothermal energy, and even wave energy conversion technologies are powering our homes, communities, and even our cars. New methodologies are being developed every day to make each one safer, easier to use, and more economically and environmentally viable. But what about small-scale power generation? Small-scale power generation has predominantly only happened in batteries – these devices are essentially a "chemical experiment in a small metal canister." Sure, solar power has also been used in small-scale applications, but in nearly all applications a battery is used in some way to store the solar energy for when no energy is being produced. Developments in battery technologies have only changed the materials used in the "experiment", allowing batteries to become more energy-dense and make the experiment "rechargeable", but the general principle remains the same.

Scientists at an undisclosed company have developed a way of generating energy in what's known as "power cells" – instead of using a depletable chemical reaction to generate power, these "power cells" can generate electricity indefinitely. These scientists have called out to TCEA to help them develop a new automatable and scalable method of producing batteries using this new technology. TCEA has funded a research team to investigate manufacturing solutions, but has turned to you to help provide the robotic "muscle" for this process.

TCEA has provided you access to a test manufacturing facility that makes both the "power cells" as well as "battery housings" that, when combined together, create batteries in roughly the same form factor of existing batteries so that these new "Super Batteries" can be used in everyday devices in place of existing batteries. TCEA would like for you to help develop a low-cost robotics platform to manufacture these "Super Batteries", refurbish old and damaged batteries, recycle materials used in the process of manufacturing the batteries, and send the manufactured batteries to be packed and distributed.

1.2 Game Pieces

For "Power Up," the game pieces consist of Dura ¾" schedule-40 PVC couplers and golfball-sized Wiffle balls. The Dura ¾" schedule-40 PVC pipe couplers are "standard" ¾" PVC pipe couplers that can be found at home improvement stores – such as the Home Depot – for less than 50 cents per coupler. The Dura ¾" schedule-40 PVC pipe coupler is designed as a slip-slip coupler that "joins" two ¾" PVC pipes. A coupler is roughly 2.125" long (2 1/8" in height) and have a 1.3125" outer diameter (1 5/16"). The height can vary +/- ¼", and the outer diameter can vary no more than 1/16". "Power Up" uses eight (8) Dura ¾" schedule-40 PVC pipe couplers for a single team. Finally, "Power Up" also makes use of hollow golfball-sized (1 5/8" diameter) perforated Wiffle-style balls. These balls are also called "practice golf balls" – they can be purchased at many toy stores, sporting goods stores, and online (for example, http://amzn.com/B0019GK7LQ). There is NO specific color designation – the balls can be ANY color, though the most popular colors are white, orange, yellow, and red. "Power Up" uses five (5) practice golf balls for a single team.

In "Power Up", the game field is a test manufacturing facility specifically designed to manufacture a special kind of "super battery." In "Power Up", the Dura PVC Coupler represents a "Battery Housing", and the practice golf balls represent a "Power Cell."

"Power Up" also makes use of one "team-provided" game piece that teams may use during their matches; this game piece – a "***Lightning Rod***" – may optionally be built by teams (requirements are provided in the Game Task descriptions that use them) and may be used to help complete specific game tasks. This game piece is brought with the team to the competition table when the team is scheduled to compete, used during the game, and is returned to the team after each competition match. This "team-provided" game piece may be built using any allowed materials, but **must** be factored in the team's allowance and Bill of Materials.

1.3 Field Layout

The competition field for "Power Up" is composed of a simple table frame, 2 competition mats (one for each team), 10 practice golf balls (5 per side), and 16 PVC Couplers (8 per side). The competition mat chosen for this year is SIMILAR to the "Race Against Time" mat PREVIOUSLY produced by LEGO Education – the mat has been discontinued, but TCEA was given the rights to reproduce the mat. Contact TCEA for info on ordering new mats.

> **WARNING:** Teams that participated in TCEA Robotics in previous years may have purchased these mats already, but the mats made after the 2014 competition season have been ***redesigned*** and made of a ***different*** mat material due to LEGO Education discontinuing the product. The pattern printed on the mat is identical to previous years, and there are no distinguishing marks on the mat, so it may be difficult to distinguish a previous year's mat from the current year. It is recommended that teams mark the underside of their mats as "2014+" mats immediately upon receiving their mats to identify the mat as a post-2013 mat (taking caution not to mark in an area or in a way that shows through to the front of the mat).

The competition mat was chosen to provide a uniform field layout for the game so that teams and tournaments would be able to reproduce the same field environment for practice and competition. The mat has 5 primary areas that are of interest to "Power Up" – Battery Housing Refurbishing Line, Battery Testing Zone, Testing Targets, Battery Housing Recycling Center, and the Super Battery Collection Area. The next several sections describe each area in detail.

1.3.1 The Battery Housing Refurbishing Line (BHRL)

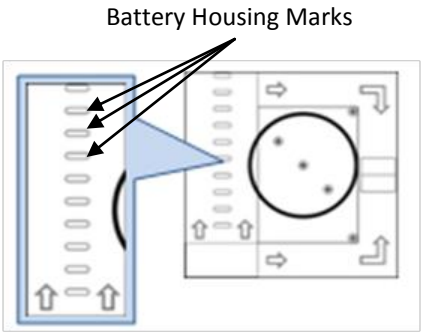

Figure 1 –The BHRL

The Battery Housing Refurbishing Line (BHRL) is a location within the TCEA manufacturing facility where used Battery Housings get repaired, maintained, and reused. Battery Housings are placed on Battery Housing Marks, as designated in Field Setup Section 1.3.6, prior to the start of the match. **Intermediate** teams may use this area to construct initial "Super Batteries" prior to the start of the match (see Section 1.3.6 for more information about how many Power Cells are allowed to be used in this area), but **Advanced** teams must perform all actions with their robots. The Battery Housing Mark closest to the double-arrows is Mark #1, and the Mark farthest away from the double arrows in this area is Mark #10. Note that the BHRL shares some space with the Battery Testing Zone; anything completely within this shared area is considered to be within the Battery Testing Zone and NOT the BHRL.

1.3.2 The Battery Testing Zone

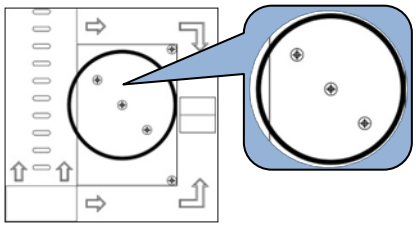

Fig 2 – Battery Testing Zone

The Battery Testing Zone is the primary area of the TCEA manufacturing facility where Super Batteries are tested. This area has a highly positive magnetic charge; so much that the robots that reset the facility each match get confused and "forget" to place an empty Battery Housing randomly on one of the Testing Targets. This area is defined by the interior of the large black circle on the mat – the black circle is NOT part of this zone, but everything within the circle is.

1.3.3 Testing Targets

Fig 3 – Testing Target

The Testing Target is a location where Battery Housings may be placed prior to the beginning of the match. There are five (5) Testing Targets on the competition field; two outside the Battery Testing Zone, and three inside the Battery Testing Zone. The magnetic field inside the Battery Testing Zone confuses the worker bots that reset the field, so they only place two (2) Battery Housings on two (2) random Testing Targets within the Battery Testing Zone, and one (1) Battery Housing on one (1) random Testing Target outside the Battery Testing Zone. Teams must be aware that they have no control over which three (3) Testing Targets will get the Battery Housings. **Intermediate** teams may use this area to construct initial "Super Batteries" prior to the start of the match, but **Advanced** teams must perform all actions with their robots.

1.3.4 Battery Housing Recycling Center (BHRC)

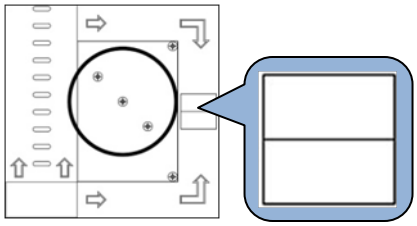

Figure 4 – BHRC

The Battery Housing Recycling Center is where unused Battery Housings may be taken (by robots) during the match to be recycled, and is also the initial starting location for a team's robot. Anything partially or completely within the Battery Housing Recycling Center is completely destroyed at the end of the match (materials are melted down), so robots that are partially or completely within this area at the end of the match will void any points (for this area only) since the materials cannot be melted down with the robot still in the zone. Teams should note that this area is NOT used when/if robots are restarted, please see the Game Specific Rules (section 2) for details on where/how robots are restarted.

1.3.5 The Super Battery Collection Area (SBCA)

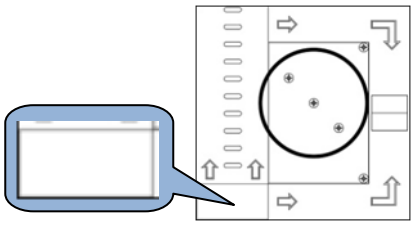

Figure 5 – The SBCA

The Super Battery Collection Area is where completed Super Batteries should be taken by the robot prior to the end of the match. Any Super Batteries touching the mat within the Super Battery Collection Area at the end of the match will be collected and taken to be packaged and shipped to stores. This area is not a human-friendly zone; because poorly programmed machines perform the task of taking Super Batteries from the SBCA to the packaging and shipping center, it is dangerous for any humans to be in or near this area. Therefore, robots ~~may NOT be~~ recovered while any portion of the robot is above the mat in the area of the SBCA will incur ***TWO TOUCH PENALTIES***.

1.3.6 Field Setup

The Field Mat for "Power Up" should be oriented such that the Battery Housing Refurbishing Line is closest to the center wall. Images depicting the mat in sections 1.3.1, 1.3.2, 1.3.4, and 1.3.5 would all have the center wall running vertically along the left edge of the image. If the mat you're provided with is not exactly 4'x4', the mat should be centered on the field such that there is an equal amount of space between the wall and the mat on the 3 sides that does NOT include the center wall; in these cases, double-sided tape (such as double-sided carpet tape) is recommended to help keep the mat in place.

"Power Up" starts with eight (8) Battery Housings placed on specific areas of the field prior to the start of the match, in the following configuration:

A. One (1) Battery Housing is centered on a random Testing Target outside the Battery Testing Zone. Teams are NOT allowed to influence which Testing Target gets the Battery Housing. The Battery Housing is placed so that the ridged/raised side is facing up.
B. Two (2) Battery Housings are centered on different random Testing Targets inside the Battery Testing Zone. Teams are NOT allowed to influence which Testing Targets gets a Battery Housing. Each Battery Housing is placed so that the ridged/raised side is facing up.
C. Four (4) Battery Housings are centered (both East/West and North/South, as much as possible) on the first, third, seventh, and ninth Battery Housing Marks within the Battery Housing Refurbishing Line. Each Battery Housing is placed so that the ridged/raised side is facing up.
D. One (1) Battery Housing is placed approximately in the center of the Super Battery Collection Area. The Battery Housing is placed so that the ridged/raised side is facing up.

There is NO requirement that both sides of the board be configured similarly.

Each team is provided five (5) Power Cells prior to the start of the match. One team member must be responsible for managing Power Cells. Teams of different competition levels are allowed to place Power Cells on the field or on the robot prior to the start of the match as follows:

E. **Intermediate** teams may place Power Cells onto Battery Housings on the field by hand prior to the start of the match so long as they adhere to the following constraints:
   - Exactly one (1) Power Cell may be placed on a Battery Housing centered on a Testing Target outside the Battery Testing Zone.
   - Up to two (2) Power Cells may be placed on individual Battery Housings centered on a Testing Target inside the Battery Testing Zone.
   - Up to two (2) Power Cells may be placed on individual Battery Housings centered on a Battery Housing Mark of the team's choosing within the BHRL.
   - Teams are NOT required to place Power Cells onto Battery Housings, but **Intermediate** teams **WILL NOT** receive points for robots placing Power Cells onto Battery Housings. Any Power Cells not placed onto Battery Housings prior to the start of the match may be placed onto a team's robot OR may be given to the Referee to be taken out of play – Team Members are NOT allowed to hold onto Power Cells during the match.

F. **Advanced** teams may place Power Cells onto the team's robot prior to the start of the match OR Power Cells may be given to the referee to be taken out of play – Team Members are NOT allowed to hold onto Power Cells during the match. **Advanced** teams are NOT allowed to place Power Cells onto Battery Housings prior to the start of the match.

The team must place the ***Lightning Rod***, if the team has elected to build and use this team-built game piece, onto the robot PRIOR to being measured for compliance. This game piece must be considered "part of the robot" until it is no longer in contact with the robot. This means this game piece must be touching the robot prior to the start of the match, and must be included when measuring the robot for starting compliance. As such, the robot MAY NOT be considered the team's ***Lightning Rod***, and the ***Lightning Rod*** is not a ***Lightning Rod*** until it is no longer in contact with the robot. The Team Captain must indicate to the referee what comprises the ***Lightning Rod*** and also show the referee how this is represented on the Bill of Materials.

Once the ***Lightning Rod*** is no longer in contact with the robot, this item is considered a Game Piece from that point on (and NOT as part of the robot). Game Pieces are NEVER allowed to be touched during the match by human hands once they are on the game field.

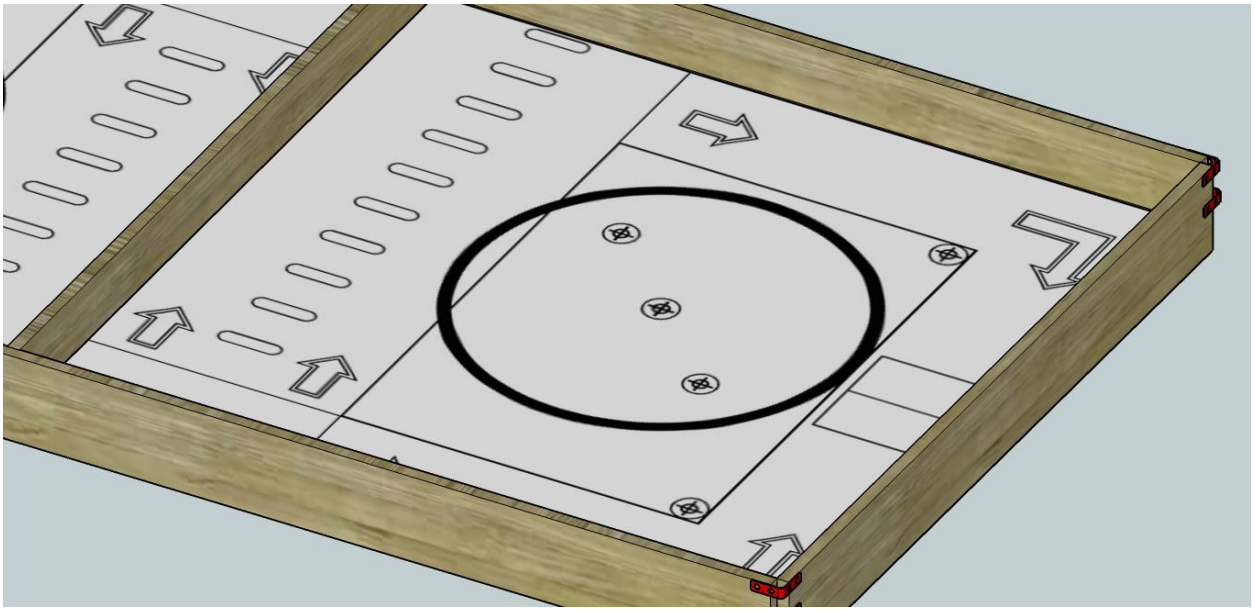

Figure 6 – Example of a properly oriented game board

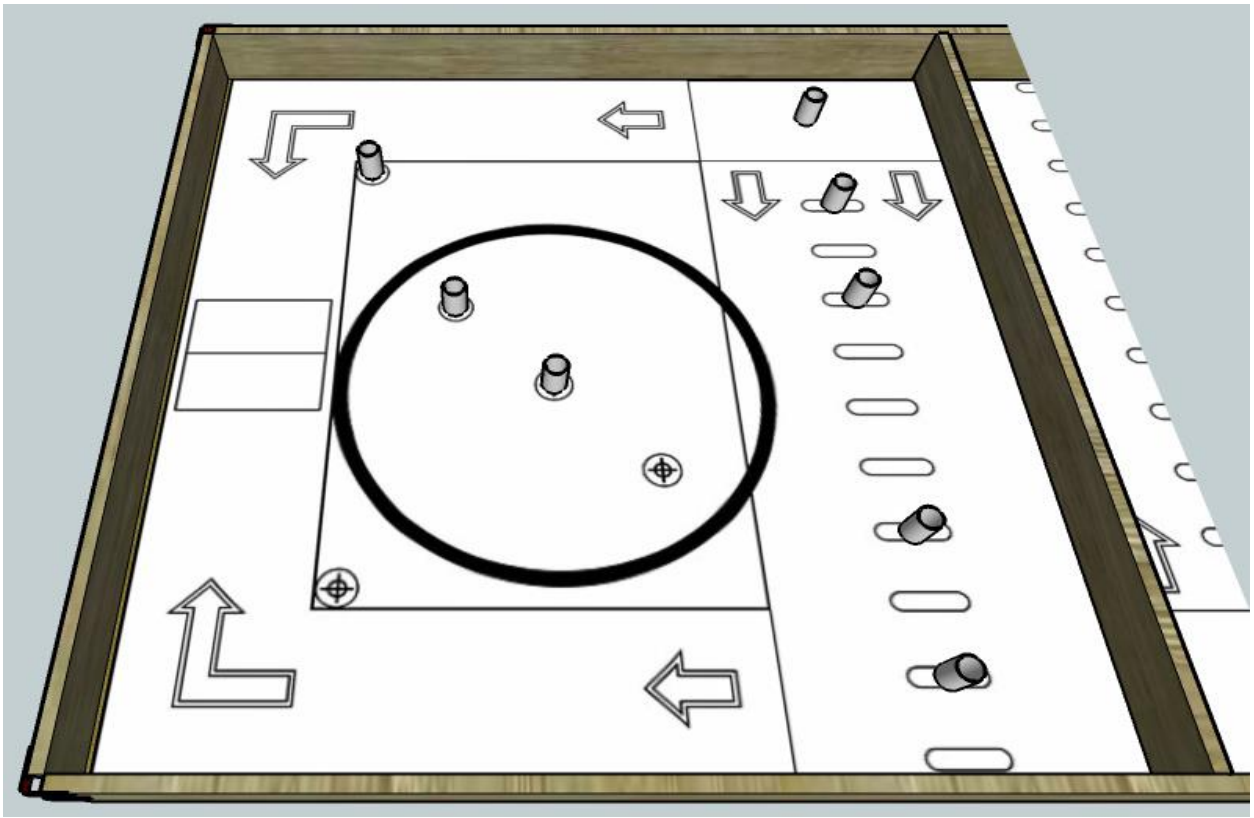

Figure 7 – Example of a properly set up game board

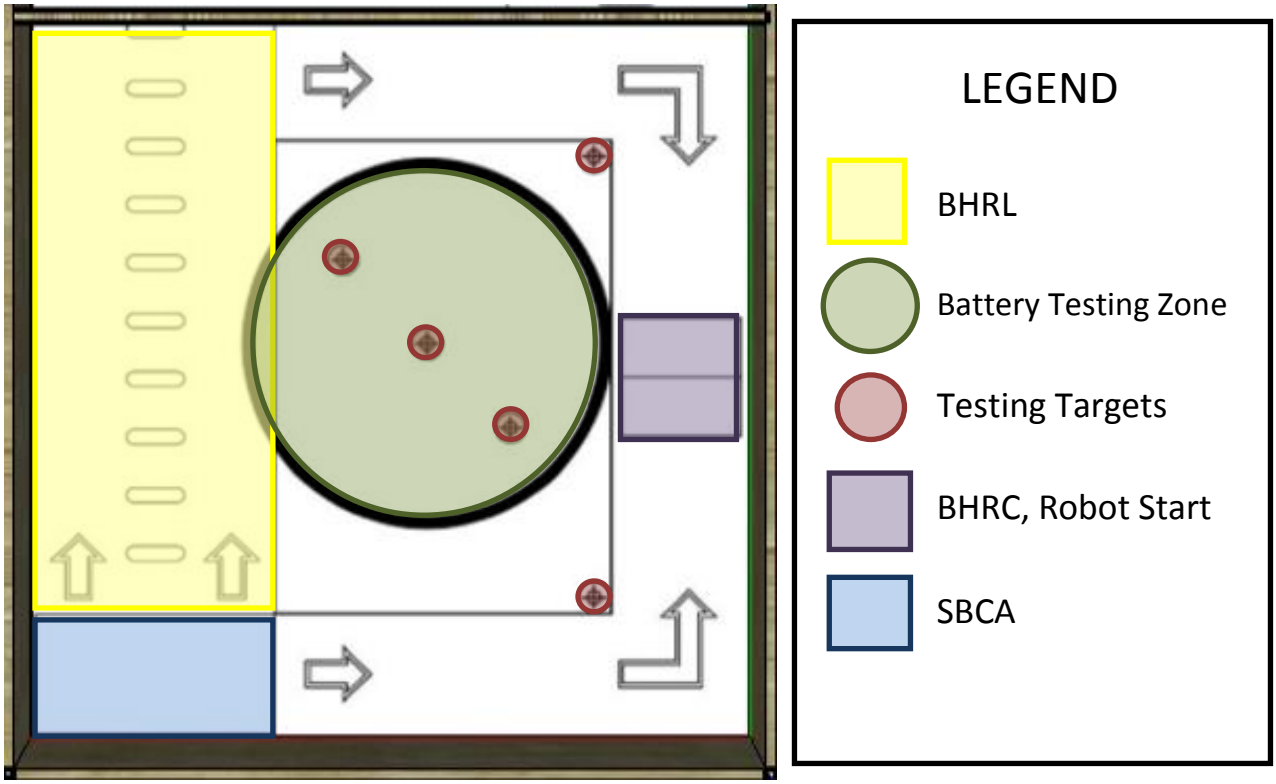

Figure 8 – Zone Breakdown of Game Board (not rotated to represent correct orientation)

1.4 Game Tasks

In "Power Up," a team's robot must perform specific tasks on the challenge field. There are six (6) major tasks to perform. These tasks can be completed in any order (unless the Task specifies otherwise), and not all tasks must be performed. Each task completed by the robot accumulates points, though the tasks are not evaluated until the END of the match (unless the Task specifies otherwise) – if a task is completed, and then undone by robot action before the end of the match, then the task is obviously not completed. Some tasks may grant partial points for completing them partially, while others may require the entire task to be completed before any points are awarded.

1.4.1 Manufacture Super Batteries

This game task ONLY applies to **Advanced** Teams. **Intermediate** teams will receive NO CREDIT for performing this action.

Super Batteries are created when a Power Cell is placed on top of a Battery Housing. The goal of the Manufacturing Facility is to manufacture as many Super Batteries as possible. *At the end of the match*, each Power Cell on top of a Battery Housing earns 50 points. Power Cells may "lean" on walls for extra support, but Super Batteries must not be in contact with any robot parts.

Points Awarded for creating a Super Battery: **50 points**
Maximum Possible Points Awarded for this Task: **250 points**

1.4.2 Take Super Batteries to the Collection Area

Super Batteries need to be taken to the Super Battery Collection Area (SBCA) in order to be packaged and shipped to stores. Each Super Battery that is partially or completely touching the mat in the Super Battery Collection Area at the end of the match is worth 50 points. However, there's a twist – the machines within the SBCA cannot tell the difference between an empty Battery Housing and one with a Power Cell. Our customers will only pay for half the shipment if they get an empty Battery Housing in the shipment. Therefore, Battery Housings without a Power Cell within the SBCA at the end of the match **HALVES** all points for Super Batteries within the SBCA.

Remember, the Super Battery Collection Area is a dangerous place for humans. Therefore if your robot is partially or completely over any part of the mat in the Super Battery Collection Area, humans ~~***CAN NOT***~~ will incur TWO TOUCH PENALTIES when recovering their robots. Be careful when programming robots to deliver Super Batteries!

Points Awarded for each Super Battery in the SBCA at end of Match: **50 points**
Maximum Possible Points Awarded for this Task: **250 points**

1.4.3 Power Up!

The starting match duration is one (1) minute (60 seconds). This is likely not enough time for your robot to complete enough tasks in the game to be successful. Every team's robot contains a TCEA Time Bandit, a device capable of allowing your robot to circumvent this rule and give your robot a full two (2) minutes (120 seconds). Unfortunately this device needs a huge jolt of electricity in order to work – 1.21 Gigawatts to be exact, the same amount of power that can be obtained from a lightning bolt.

In order to power the TCEA Time Bandit and gain one (1) extra minute of game time, robots need to deploy a ***Lightning Rod*** prior to the one (1) minute elapsed mark – at the one minute mark, lightning will strike any Lightning Rod deployed on the game field. The ***Lightning Rod*** is a team-supplied item that must be made from Allowable Materials. For a list of Allowable Materials, please see the Administration Manual – all materials used for the ***Lightning Rod*** must be included on the team's Bill of Materials. ***Lightning Rods*** are not allowed to be used without a correctly-formatted and properly completed Bill of Materials. A ***Lightning Rod*** is considered deployed when it is no longer in contact with a robot and in contact with the mat.

Lightning Rods are also useful to protect structures, people, and just about everything from a lightning strike. 50 points are awarded for having a ***Lightning Rod*** touching the North (center) wall at the end of the match, protecting the manufacturing facility from future strikes. In order to be awarded the points, the ***Lightning Rod*** must be measured to be a minimum of 6 inches tall measured from the surface of the mat at the conclusion of the match.

Points Awarded for a Lightning Rod touching the North Wall at End of Match: **50 points**
Maximum Possible Points Awarded for this Task: **50 points**

1.4.4 Recycle Unused Battery Housings

Battery Housings not used to create a Super Battery should be recycled. Battery Housings partially or completely touching the mat in the Battery Housing Recycling Center at the end of the match are worth 50 points each, up to 4 Battery Housings. If the robot is partially or completely over the mat in the Battery Housing Recycling Center at the end of the match, no points are awarded for this task.

Points Awarded for each Battery Housing (up to four) in BHRC at End of Match: **50 points**
Maximum Possible Points Awarded for this Task: **200 points**

1.4.5 Cleanup on Aisle 5

In a manufacturing test facility, cleanliness is mandatory. 50 Points will be awarded each if there is NOTHING, not even the robot, partially or completely over the mat within the Battery Testing Zone and Battery Housing Refurbishing Line (BHRL) at the end of the match.

Exception: Robot parts from the opposing team touching or spanning the Battery Testing Zone or BHRL are not included in the tally for cleanliness and will not count against this Task.

Points Awarded for nothing in BHRL at End of Match: **50 points**
Points Awarded for nothing in the Battery Testing Zone at End of Match: **50 points**
Maximum Possible Points Awarded for this Task: **100 points**

1.4.6 Three-Way Stop

In the event of an emergency, can you shut down the facility quickly? Each wall contains an Emergency Stop button (virtually, there's no actual button – think of it as "touch a wall, stop the madness") and it takes three buttons being pressed at the same time to shut down the facility – they don't have to be "pushed" at the same time, they just have to be in the pressed "state" at the same time. Your robot needs to prove that it is indeed a Captain of Safety and is able to shut down the facility of necessary. A robot that is in contact with exactly three (3) walls at the end of the match will score an additional 100 points. These walls can be on your side of the board, the opponent's side of the board, or a combination of the two.

Clarification: The EAST or WEST wall beyond the CENTER wall is still considered part of the EAST or WEST wall. The only walls that count as unique walls are YOUR EAST, WEST, SOUTH, and NORTH (center) walls.

Be very careful of the starting robot size restrictions in the Game Specific Rules (Section 2). Also be aware that touching your robot FOR ANY REASON will require rule 2.0.4 to take effect.

Points Awarded for touching three (3) walls at the End of Match: **100 points**
Maximum Possible Points Awarded for this Task: **100 points**

Section 2 Game Specific Rules

These rules are here to define game-specific actions or specifications, on top of or in replacement of any general rule that might be in place.

Starting Points

2.0.1 Teams start out with 100 points.

Robot Start Configuration

2.0.2 Robots must start the match:

A. Touching the mat within the Battery Housing Recycling Center (BHRC) AND must be touching the South Wall. Robots may start the match at any location within the BHRC and in any orientation as long as these rules are followed.

OR

B. Touching both the South and East OR South and West walls, and be within size limitations, in any orientation (see Section 2.0.3 for sizing restrictions).

2.0.3 Prior to the match, the robot will be placed in a corner of the table on its drive wheels in an orientation chosen by the team – nothing on the robot may extend past the inner plane of the walls. The referees will then measure twelve (12) inches from the corner of the wall along each wall - the robot shall not extend beyond these twelve (12) inches in either direction. The robot shall also not be taller than twelve (12) inches as measured from the surface of the mat. The "Robot" is defined by everything the team brings to the table for the game (including team-supplied game pieces). There is no weight limit on the robot. While the robot is active in play, there is no restriction on the size of the robot.

- NOTE: This is very different than in previous years. Instead of essentially defining a sizing box, a method of measurement is established. Understand that the walls on the table may not be perfectly vertical, so Referees will give Benefit of the Doubt when appropriate but do not expect much leniency.

Robot Recovery and Restarts

2.0.4 During match play, team members are allowed to "recover" their robot during play from anywhere on the game field (except within the SBCA, see Game Task 1.4.2 for more details) – this is equivalent to having a recovery team retrieve the robot from the test facility. If a team decides to recover their robot (by initiating touch contact with the robot):

- Any game pieces touching the robot (except team-supplied game pieces and Power Cells) must be left where they lie.

- Power Cells may be recovered by a team if the robot is in contact with the Power Cell at the time of recovery. Teams may elect, however, to leave the Power Cell where it is. Teams MAY NOT abuse this by using gravity and an "absent robot" to place Power Cells onto Battery Housings.
- The robot is "***disabled***" and must immediately be taken to either the southeast or southwest corner of the field to be restarted.
- The team will incur a touch penalty
    - For each touch penalty incurred, the team will lose 10 points.

A team is allowed to incur **a maximum of 10 touch penalties**. Once a robot begins motion, the robot is considered "active" and if touched will incur this touch penalty. Touching a robot without having the necessary touch penalties remaining will immediately end the match for the team.

2.0.5 While the robot is "***disabled***" in a corner of the game field, the team may change programs or repair/rebuild the robot. No new outside parts may be added to the robot, but parts may be removed – and once they are removed, and the robot restarted, they may not be re-added to the robot. The robot may be started again in either the southwest or southeast corners as long as ALL of these following conditions have been met:

1. The robot is physically touching the South wall AND either the East or West wall.
2. **The robot is no larger than the starting size** – referees will estimate robot size, and if the referee determines the robot is likely still within size the team may immediately restart the robot. If the referee feels the robot is not within size, the referee will quickly remeasure the robot.

Field Variance and Game Debris

2.0.6 Robots must be able to handle some field variances, such as tolerances in board length/width/height and slight waviness in the field mat. Teams should not rely on specific field attributes that can vary with tolerances (such as the amount of spacing under the center wall, the vertical angle of the field walls, etc…) when designing their robots.

2.0.7 Teams may request that any element - that is not a part of their robot or was not presented to the team at the start of the match (e.g. Battery Housings) – be immediately and permanently removed from the field of play at any time during a match if that element resides on their half of the playing field; exceptions to this would be parts still attached to an opposing robot. Such elements would be considered, "debris," and could be (but is not limited to) stray parts from the opposing team's robot and/or game pieces from the opposing side of the playing field. These elements are to be held by the referee until the end of the match.

Special Game Piece Interactions

2.0.8 Power Cells that start with the robot at the beginning of the match (e.g. any Power Cells not placed on Battery Housings prior to the match by **Intermediate** Teams and not taken out of play) are considered PART OF THE ROBOT until they are removed/dropped/detached from the robot (either by the robot or by the exception in 2.0.4 second bullet). Team Members are NOT allowed to hold onto Power Cells during the match while the robot is active (moving). **Any Power Cells in the possession of Team Members while the robot is active (moving) on the board must be surrendered to the Referee and taken out of play**.

2.0.9 Teams must have a properly formatted and correct Bill of Materials to be allowed to score any points for task 1.4.3.

2.0.10 Team-Supplied Game Pieces are considered PART OF THE ROBOT until they are removed/dropped/detached from the robot. Once a Team-Supplied Game Piece has been removed/dropped/detached, the Game Piece can no longer be touched/recovered by Team Members and may no longer be considered PART OF THE ROBOT for the remainder of the match.

2.0.11 No adhesives of any kind (this includes, but is not limited to, tape, glue, sticky-tack, etc.) are allowed to be used on Game Pieces, the Field Mat, or Field Walls.

2.1 State Championships Variation

It has become a kind of tradition to have a variant to the rules for the State Championships. This gives teams an extra "something" to strive for, and if known in advance teams can design for it in the beginning.

2.1.1 In the State Championships ONLY, there will be a 50 point bonus for each Super Battery manufactured in Task 1.4.1 (**Advanced** teams ONLY). Therefore, each Power Cell on a Battery Housing at the end of the match is instead worth 100 points each, for a maximum Task 1.4.1 score of 500 points.

2.1.2 In the State Championships ONLY, there will be a 50 point bonus for Super Batteries collected in Task 1.4.2 (**Intermediate** teams ONLY). Therefore, each Super Battery that is partially or completely touching the mat in the Super Battery Collection Area is instead worth 100 points, with a maximum Task 1.4.2 score of 500 points. Task limitations and restrictions still apply.

2.1.3 In the State Championships ONLY, there will be a 50 point bonus for completing Task 1.4.6 (**Advanced** and **Intermediate**). Therefore, a robot that is in contact with exactly three (3) walls at the end of the match will instead be worth 150 points.

Section 3 Game Intent FAQ

In this section, the game designer answers some of the most frequently asked questions about the "Power Up" game (and some questions the game designer knows is going to be asked before they're actually asked). This is designed to help teams and referees understand the task rules, scoring methods, and anything else related to the game and its mechanics.

3.1 What are the size requirements on the Lightning Rod?

For activating a TCEA Time Bandit, there aren't any. You can pretty much call anything a Lightning Rod (except the robot) and use it. Make sure it's called out specifically on the Bill of Materials, though. For having the Lightning Rod count for points, six (6) inches.

3.2 Is it intentional that there's a difference between Intermediate vs Advanced?

Absolutely. I generally reserve differences for tasks that I deem as being "too difficult" for Intermediate teams to accomplish outright, and so instead offer something more attainable via a rule difference. This year building Super Batteries turned out to be more difficult for intermediate robots than I had hoped. Since Intermediate-qualifying teams can compete in Advanced if they want more of a challenge, I gave Intermediate teams a huge break this year.

3.3 Why don't we have some kind of sensor challenge?

I admit I've been putting this off for way too long. But truth be told, this can be a huge nightmare for sourcing game pieces. Teams and tournaments have to be able to buy the exact same pieces in the exact same color with the exact same shape (with little to no margin). I'm open to revisit this if anyone is willing to give me a hand with this in 2016-2017.

3.4 So what's the game this year?

Yeah, I get this question every year. In the rules I specify the scoring condition as specific and clear as I can, but try to leave more of the details of how it's done to the reader (so as to not give away too many solutions). However, those who don't carefully take the time to analyze the game can get lost in those details, so sponsors have always asked on the forums for a "high level view" of the game. Maybe one day we'll have a Game Animation that shows how the game works while providing outlandish scenarios that teams would never attempt to replicate while still explaining how things are expected to be done. And maybe one day I will win the lottery and have time to do that. Until then, this brief section will have to suffice.

This year's game doesn't have as much "depth" as previous years, but it does bring back some game elements that coaches have traditionally loved (and hated). Advanced teams start out with a huge disadvantage because they have to fit the Power Cells on their robot within their size constraint, whereas Intermediate teams can just place the Power Cells onto Battery Housings by hand and don't have to store them on the robot (if they're all placed prior to the start of the match). Advanced robots then have to place Power Cells onto the Battery Housings for them to be worth any points (**task 1.4.1**). The tradeoff is that if Intermediate teams want to place Power Cells prior to the start of the match, they are almost forced to place Power Cells onto specific Battery Housings; robots that do all the placing are restriction-free. The challenge both divisions have to deal with is the randomness of where Battery Housings are placed on the board. Once this is done, and by no means do I think this is trivial, assembled Super Batteries need to be taken to the Collection Area (**task 1.4.2**). Be careful, there's a Battery Housing in the SBCA that Intermediate teams cannot place a Power Cell on that will HALVE the points for Super Batteries if left in there. In parallel to this (meaning whether or not you can assemble and transport Super Batteries), the robot needs to take unused Battery Housings to the Recycling Center (BHRC) (**task 1.4.4**). Both divisions also have to deal with time – the initial match time is only sixty seconds! Teams must deploy and use a Lightning Rod prior to the sixty seconds being exhausted in order to gain an additional sixty seconds (for a total of 2 minutes) (**task 1.4.3**). There is a task for removing everything out of two zones, so robots want to make sure to clean up those zones before the end of the match (**task 1.4.5**). Finally, there's a fun end-game challenge – to have the robot touching three walls by the end of the match (**task 1.4.6**). Be careful about where you place the Lightning Rod, and where the robot (and any extensions from the robot) is located, as this can affect task 1.4.5!

3.5 What's up with the robot sizing rule this year?

Thanks for asking. Robot sizing is a tough problem each year, and this was an attempt to simplify the process for Referees. Let's hope it works.

3.6 What is a Bill of Materials, and why do you require it?

Every year I get this question, and sometimes even at the events. Sometimes even the State Championships. So for once and for all, here it is. I understand that it's tough to make robots entirely out of LEGO pieces. Sometimes a creative solution can be had by just adding one or two non-LEGO items. TCEA allows you to do that, but you have a spending limit in order to keep things fair, and a requirement to track this. Even if you use no non-LEGO items, the Bill of Materials is like testimony saying, "Hey, I only used LEGO parts in my robot." Please review the Admin Manual to see the correct format for a Bill of Materials. The document is even searchable, please make sure you search for it.

The Bill of Materials also needs to have materials specifically called out for the Lightning Rod, if used, so the referee is absolutely clear about what the Lightning Rod is.

3.7 Is there a place where I can ask questions if this FAQ isn't enough?

You betcha! Check out the TCEA Robotics Forum on the web!
http://forum.tcea.org/

3.8 Is there any expectation that the fields will be level? I mean, you've introduced balls into the competition that roll…

No, there is no expectation that the fields will be level. The expectation is that you'll figure out how to manage the balls without allowing them to escape you. Once the balls are out of your control, they can go pretty much anywhere on their own.

3.9 I understand that the rules start off as DRAFT, and can be changed until they are finalized. When will the rules be finalized?

The rules are generally finalized towards the middle of October. If you find rules that don't make sense after that point, the rules will be followed to the letter of the rule as written. So it's in everyone's best interest to make sure the rules are bullet-proof by then – so please help us vet the rules and make suggestions/corrections/questions on the forums (http://forum.tcea.org/) ASAP! The final rules will be marked as such on the title page, and have a history which includes the Final rules changes. The FINAL rules are the only ones that will be accepted/referenced at competition – BE SURE to bring a copy of the final rules to the competition with you!

3.10 If the robot comes back to the Robot Start Zone on its own, can I grab the robot and reset it without penalty?

What robot start zone? That thing doesn't exist once the robot starts moving. Huzzah! Ok, fine, the better question is, "If the robot touches two walls on its own, can I grab the robot and reset it without a penalty?". No, absolutely not. There's no such thing as touching the robot without a penalty once the robot starts moving in the match.

3.11 Do I have to say something dumb once I deploy the Lightning Rod so the referee knows I've deployed it (and doesn't try to stop my robot)?

You don't HAVE to, but that doesn't mean you CAN'T. I for one am a huge proponent for screaming out "one point twenty one Jiggawatts!" (an homage to Back to the Future). Oh, that makes you seem less gangsta? Fine, have it your way. Just make sure you

clearly indicate to the referee how and where you're going to deploy the Lightning Rod prior to the start of the match just so they're clear.

3.12 If some of the game pieces are RANDOMLY placed, how are my kids supposed to know where game pieces are? Can we know where the pieces are going to be in advance so we can at least reprogram our robots? Is the field going to ALWAYS randomize each match?

Yup, you're right. With a randomly changing game board (from match to match) it's not possible to know where exactly ALL of the game pieces will be prior to arriving at the competition table and waiting for the referee to randomize the table. And yes, the table will randomize each time you arrive – however, due to the nature of the ***limited number of possible combinations*** (hint hint) of the game board, it's *possible* you might get the same configuration each time you arrive at the table (*though unlikely*). No, you're not allowed to reprogram your robots at the competition table. I guess that's going to have to be a design/strategy challenge that you'll need to overcome.

3.13 Are teams able to move the Housings to the SBCA prior to placing a Power Cell on them?

Every Task includes the statement "at the end of the match". Therefore NOTHING is evaluated during the match EXCEPT penalties and Lightning Rod legality (for extended time). Feel free to perform any action in any order, we only look at the state of the field at the end of the match.

3.14 Okay, I need a plain-Jane answer: What are the differences between how Advanced and Intermediate teams play this game?

The only difference between the two divisions lies in the ability for **Intermediate** teams to place Power Cells on Battery Housings prior to the start of the match. When placing Power Cells onto Battery Housings prior to the start of the match, **Intermediate** teams are restricted in the number of Power Cells that may be placed on Battery Housings in different areas of the board - **Intermediate** teams are NOT allowed to place a Power Cell onto the Battery Housing within the SBCA prior to the start of the match. Both **Intermediate** and **Advanced** teams must load any remaining Power Cells onto their robots, OR give them to a referee to be taken out of play (team members are NOT allowed to hold onto Power Cells while the robot is active/moving). Once the match starts, there's absolutely NO DIFFERENCE in how the two divisions play the game, except **Intermediate** teams won't receive points for having their robots create Super Batteries – if **Intermediate** teams want credit for doing this, they should play in the **Advanced** division!

3.15 What does 1.4.1 mean when it says, "Power Cells may `lean' on walls for extra support, but Super Batteries must not be in contact with any robot parts."?

The geometry of the Super Battery is such that the Power Cell is wider than the Battery Housing. Now imagine if the Super Battery is pushed up against a wall, but not far enough (or hard enough) to knock the Power Cell off the Battery Housing, the Power Cell will be leaning on the wall but still be sitting on top of the Battery Housing. This is okay, and still counts as a successful Battery Housing for purposes of 1.4.1. However, let's take the case where a team creates a "cradle" out of legal robot materials for the Power Cell and/or Super Battery as a whole, and leaves that "cradle" on the Power Cell and/or it's touching the Super Battery – this will NOT count as a successful Super Battery. A successful Super Battery is one which has NO parts that originally started with the Robot touching it (not even the Lightning Rod) at the end of the match.

3.16 How would a Power Cell resting on top of three Battery Housings (formed in a triangle) be scored?

It depends on where it's located and which rule we're evaluating. If this "three Battery Housings with a Power Cell resting on them" structure is outside the SBCA, this would score as a single successful Super Battery for purposes of 1.4.1 scoring – the reason is because 1.4.1 is written such that "each Power Cell on top of a Battery Housing earns 50 points." One Power Cell on top of a Battery Housing (which Battery Housing counts? Pick one) is good for 50 points, even if it's technically resting on multiple Battery Housings. Assuming this entire structure was completely within the SBCA, it would only count for 25 points for 1.4.2 scoring because two of the Battery Housings won't have a Power Cell on top of it so the points are halved for 1.4.2.

3.17 Task 1.4.2 was changed to incur TWO PENALTIES on a touch while the robot is within the SBCA, instead of making the robot unrecoverable – WHY, and how does this work?

Creating the possibility for a team to be able to effectively end their match seconds after it started was something we (game designers for TCEA) decided nearly a decade ago to never allow in our game(s) again – this is when we added the wall to separate teams, and began the initial discussions for "touch penalties" (back then robots were not recoverable). After careful deliberation and game analysis, it was decided to adhere to this long-standing decision and give teams the ability to recover their robots while in the SBCA. HOWEVER, teams that opt to recover their robot while it's in the SBCA will incur two touch penalties for that recovery instead of just one. Teams have a maximum of 10 touch penalties, and each time a touch penalty is incurred the team will lose 10 points – when incurring the Task 1.4.2 "double" touch penalty, the team will incur TWO touch penalties and will lose 20 points for each recovery. Consult rule 2.0.4 for more details.