# Chicago Robotics Invitational

## 2023 Rules
## For POWERPLAY<sup>SM</sup>

The following rules are in addition or modification to the most recent version of the *FIRST* Tech Challenge 2023 Game, POWERPLAY<sup>SM</sup> presented by Raytheon Technologies, and its listed Game Manuals 1 and 2 for traditional events. Refer back to Game Manuals 1 and 2, and the Field Assembly and Setup Guide for rules and details not explicitly listed here.

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| Revision History | | Date |
|---|---|---|
| 1.0 | ● Initial Release | March 27, 2023 |
| 1.1 | ● Clarified Transformer scoring requirements (pg 6)<br>● Updated Round Robin Schedule (Diagram 5, pg 13)<br>● Updated GS7 to account for Transformer actions being nullified (pg 16)<br>● Clarified Scoring Summary (pg 17) | April 12, 2023 |

Updated text will be **bold blue** text to indicate change from the previous revision of the manual.
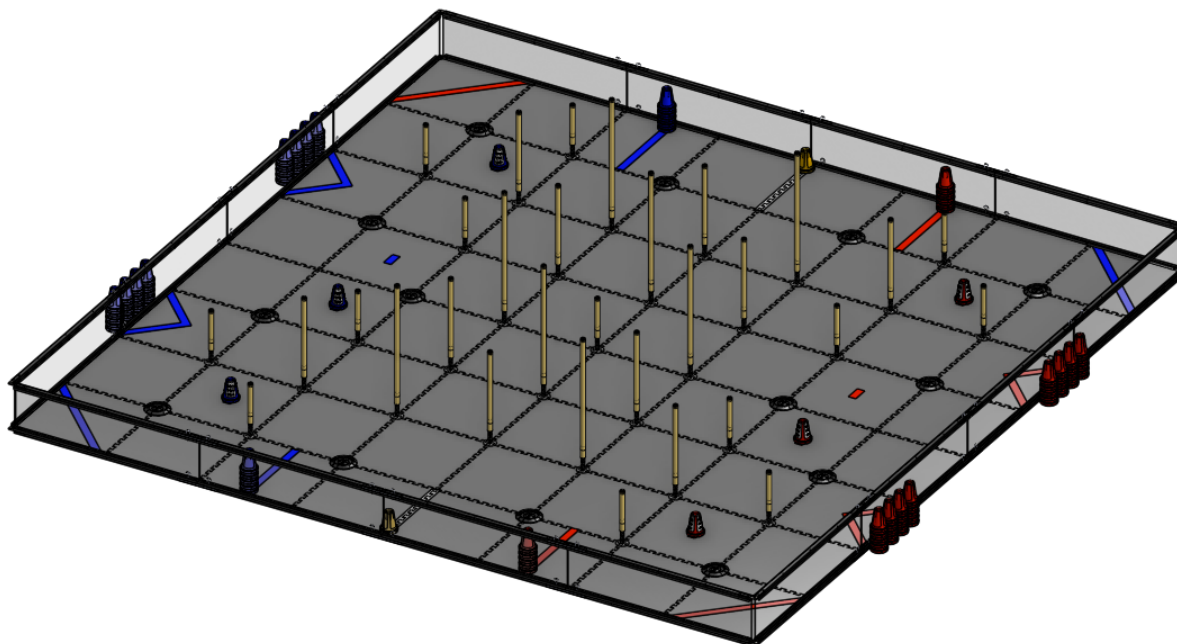
# Chicago Robotics Invitational 2023 Field



Diagram 1: Field Overview ([Onshape CAD Link](#))

## Field and Scoring Achievement Changes

The *Field* has been added to in both length and width to be a larger square *Field*. This means that an extra *Field Wall* segment is placed on each side, with two (2) rows of gray *Tiles* accordingly added. The field is now approximately 8 *Tiles* wide by 8 *Tiles* long, for total dimensions of approximately 16' x 16'.

An *Alliance* for CRI is made up of three (3) *Teams* on the *Field.* During *Elimination Matches*, an *Alliance* may be made up of four (4) *Teams*, but only three (3) of that *Alliance's Teams* are on the *Field* for any given *Match*.

## Junctions

With the expanded *Field*, the arrangement of the various *Junctions* on the Field has been altered. The *Ground, Low, Medium* and *High Junctions* are all still of the same design and height, but arranged in the order depicted below. This pattern is symmetric over the centerlines of the *Field*, but it is intentionally not diagonally symmetric.
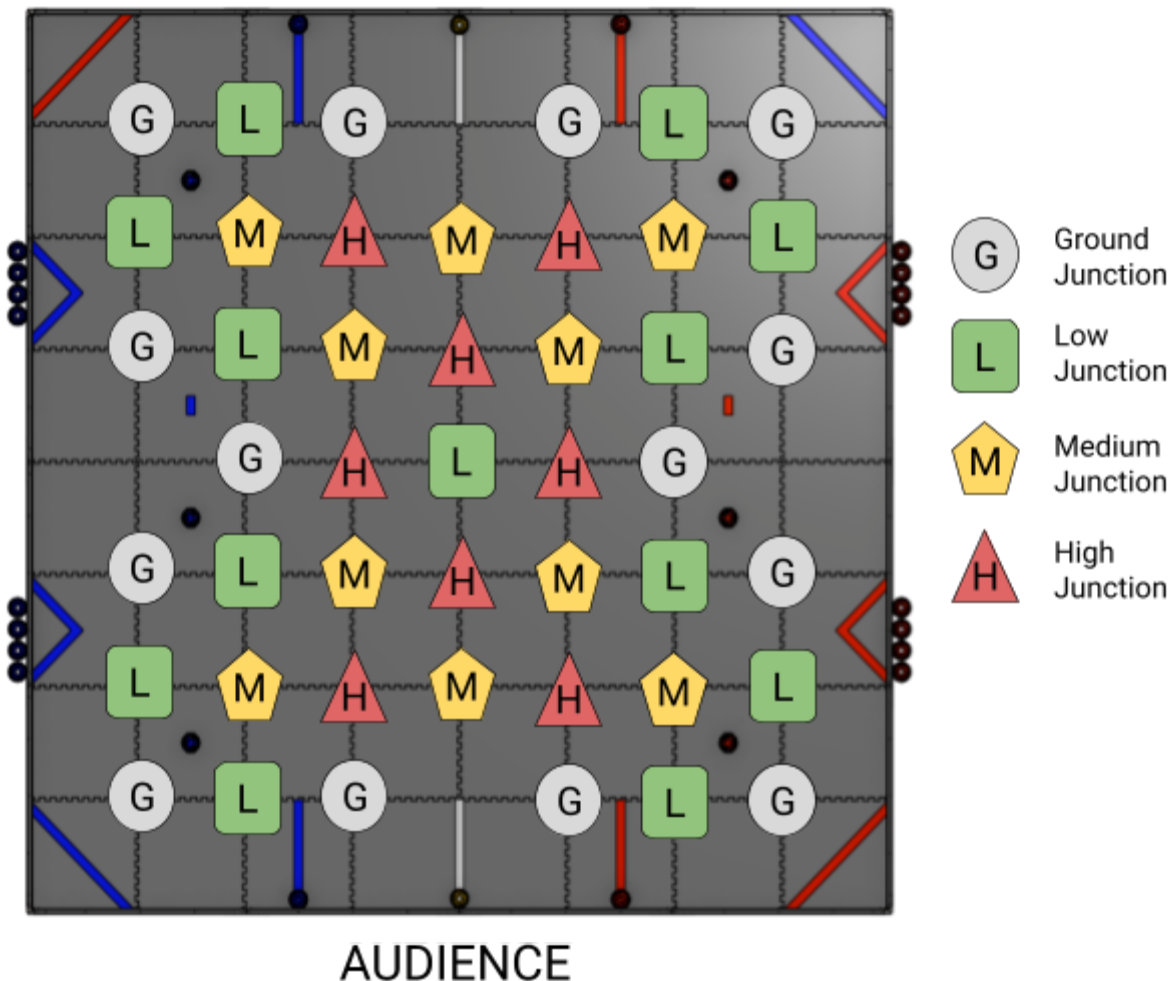


Diagram 2: *Junction* Locations

## Substations

With the addition of two (2) more *Teams* on the *Field*, each *Alliance* has another *Substation* to use during gameplay. The *Substations* are now resized and moved to fit entirely within a *Field Tile*. The *Red Alliance's Substations* are located entirely within *Tiles* H3 and H6, while the *Blue Alliance's Substations* are located entirely within *Tiles* A3 and A6. See the Tile Locations Appendix for the descriptions of these locations. Also note the updated definition of *Drive Team* for the *Human Players* per *Alliance*.
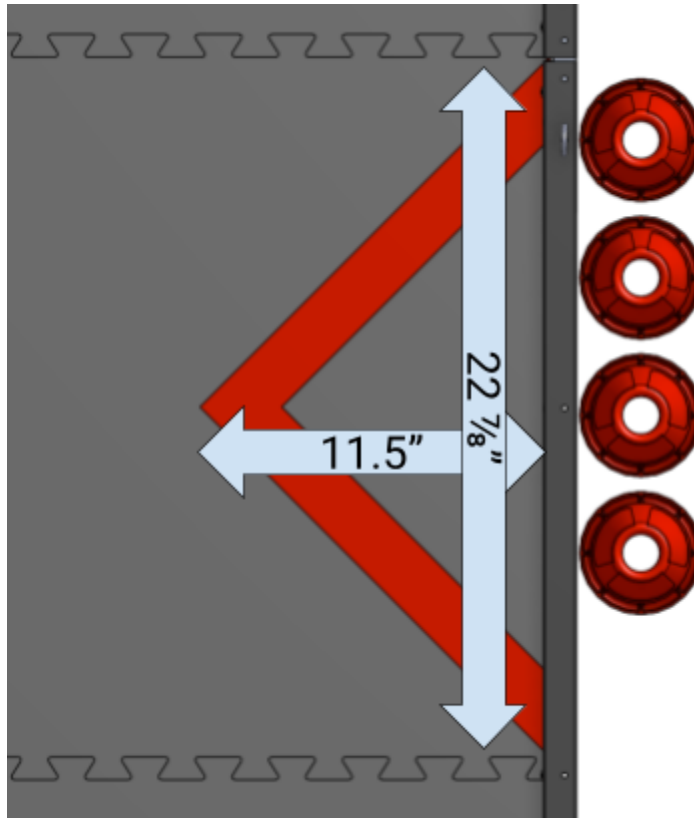


Diagram 3: *Substation* Dimensions

## Transformers

An additional *Scoring Element* has been introduced to the game, which is the same shape and dimension as a cone (but is not a *Cone*). *Transformers* are constructed from a Red or Blue *Cone* but are spray painted yellow using Rust-Oleum Painter's Touch Ultra Cover 2X Gloss Sun Yellow General Purpose Spray Paint.

The *Field* contains two (2) extra tape lines, similar to the *Cone Stack* tape lines, on the midline of the *Field* located directly next to the audience facing wall and far wall of the *Field*. One (1) line is centered between the D1/E1 pair of *Tiles*, and the other line is centered between the D8/E8 pair of

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*Tiles*. Before the start of the match, one (1) *Transformer* will be placed centered on each tape line, touching the *Field Wall,* for a total of two (2) *Transformers* starting on the *Field*.

All *Scoring Achievements* are *Scored at Rest*.

*Autonomous* and *Driver Controlled Points*:

- Each *Cone* below a *Secured Transformer* will earn an additional three (3) *Points* for that *Cone's* corresponding *Alliance*. The *Junction* with a *Secured Transformer* is considered *Owned* by both *Alliances* for purposes of completing a *Circuit*, but both *Alliances* earn zero (0) *Points* for *Ownership.*
- Any *Cone* or *Beacon* placed on top of a *Secured Transformer* will earn zero (0) *Points* and does not **convey** *Ownership*.
- **A *Transformer*** placed on top of a **Secured** *Beacon* has zero (0) *Score* value, **does not impact the *Score* of the *Cones* below it,** and does not **convey** *Ownership*.
- **A *Transformer* in a *Terminal* has zero (0) *Score* value and does not convey *Ownership*.**

*Transformers* that are *Scored* in the *Autonomous Period* will earn points for the *Cones* under the *Transformers* at the end of the *Autonomous Period* in addition to *Points* at the end of the *Driver-Controlled Period* if they remain in place, similar to the scoring of *Cones*.

> For example, if a *High Junction* contains three (3) *Red Cones* and four (4) *Blue Cones* and a *Transformer* is *Secured* on top of those *Cones*, this would generate an additional 9 *Points* for the *Red Alliance* and 12 points for the *Blue Alliance*., no matter which *Alliance Secures* the *Transformer* on the *Junction*. Red would have a total of 15+9=26 points for this *Junction* and Blue will have a total of 20+12=32 points for this Junction. *Ownership* will earn 0 points, but *Ownership* will be shared by both *Alliances.*

## Field Set-Up Changes

There are now four (4) potential starting *Tiles* for each *Alliance,* of which, three (3) positions must be used as described below, provided three (3) *Teams* are present for the *Match*.

1. For the Blue *Alliance:*
   a. One (1) *Robot* must start *Completely In Tile* A2
   b. One (1) *Robot* must start *Completely In Tile* A7
   c. One (1) *Robot* must start *Completely In* either *Tile* A4 **or** A5.
2. For the Red *Alliance*:
   a. One (1) *Robot* must start *Completely In Tile* F2
   b. One (1) *Robot* must start *Completely In Tile* F7
   c. One (1) *Robot* must start *Completely In* either *Tile* F4 **or** F5.

See the Tile Locations Appendix for the descriptions of these locations.

The middle starting position options have two (2) taped *Signal Marks* for the starting position of a *Signal*. The *Signal* will start in the front-most position on *Tile* B4/G4 and teams may place their *Signal Sleeve* on it just like any other *Signal*. *Teams* may request that a *Referee* move this *Signal* to

tile B5/G5, but may not move it themselves, just as they may not move or adjust the *Signals* on other *Signal Marks*.

Every *Substation* has a corresponding *Substation Storage Area* that has twenty (20) *Cones* arranged in the same four (4) stacks of five (5), as in the original game. This results in fifty (50) total *Cones* per *Alliance* on the F*ield*: two (2) off-field *Substation Storage Areas* of 20, and two (2) on-field *Cone* stacks of five (5).

## Signal Zones

There are still two (2) sets of *Signal Zones* for each *Alliance*. Each of these *Signal Zones* are three (3) *Tiles* deep now but still one (1) *Tile* wide. See the below diagram for the exact positions.
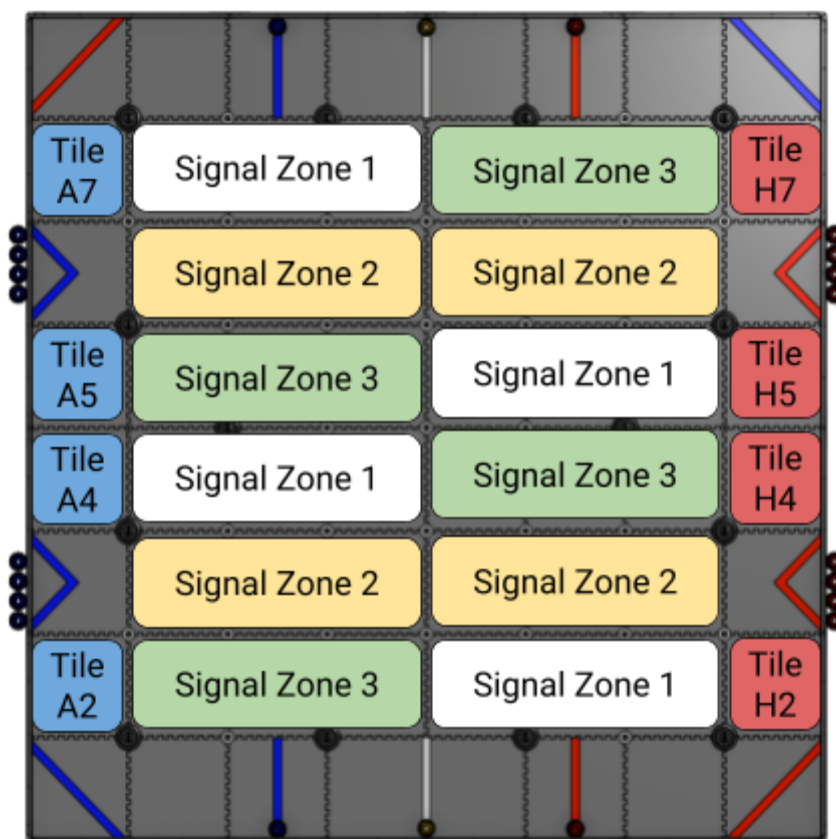


Diagram 4: Location of *Signal Zones*

NOTE: More than one (1) *Robot* can be *Parked* in each *Signal Zone*.

## Circuit Points

Completing a *Circuit* is now worth forty (40) points.

## Navigation Points

A *Robot Parked In* either of their *Alliance's Terminals* during *End Game* now earns five (5) points.

## Navigation Images

There will be no *Navigation Images* on the *Field Walls*.

## Alliance Stations

*Alliance Stations* will be 15 foot x 4.5 foot, in line with the longer *Field*. 6 inches of extra space is left on both the front and back of the *Field* to accommodate Field Personnel. The *Alliance Station* is also made a foot deeper to facilitate movement within the *Alliance Station*.

# Definitions

Changes to already existing rules and points are highlighted. New definitions, rules, or sub bullet points may just have the definition name, rule number of bullet point highlighted.

**Alliance** - An *Alliance* for CRI is made up of three (3) *Teams* on the *Field*, competing to earn the highest *Score.* During *Elimination Matches*, an *Alliance* may be made up of four (4) *Teams*, but only three (3) of that *Alliance's Teams* are on the *Field* for any given *Match*.

**Backup Team** - A *Team* who can be chosen to be a fourth (4th) member of an *Eliminations Alliance* in case of *Robot* failure.

**Drive Team** – Up to four (4) representatives; two (2) *Drivers*, one (1) *Human Player* and one (1) *Coach* from the same *Team.* Only two (2) *Human Players* will represent an entire *Alliance* in a *Match.*

**Finals** - The second and last *Round* of the *Elimination Matches*.

**Game Element** – Any item *Robots* interact with to play the game. *Game Elements* for this year's game include *Junctions, Cones, Transformers, Signals, Signal Sleeves*, and *Beacons.*

**Transformer** - A *Scoring Element* that is constructed from a *Cone* but is spray painted yellow. A *Transformer* is not a *Cone*. Two (2) *Transformers* start on the *Field* for a *Match*.

**Own / Owned** – An *Alliance Owns* a *Junction* when one of the following conditions is met:
- That *Alliance* has the topmost *Scored Cone* on that *Junction*, or
- That *Alliance* has a *Scored Beacon* on that *Junction*, or
- A *Transformer* is *Secured* on that *Junction*

A *Terminal* is *Owned* when it has at least one (1) *Scored Cone.*

**Round** - A subdivision of the *Elimination Matches* which will eliminate certain *Elimination Alliances*. For the purposes of CRI 2023, there are two (2) *Rounds*: the *Round Robin*, and the *Finals*.

**Round Robin** - The first *Round* of the *Elimination Matches* wherein each *Eliminations Alliance* plays each other *Eliminations Alliance* exactly once. Each *Eliminations Alliance* is ranked by *Ranking Points* and *Tiebreaker Points* from the *Round Robin Matches*, and the two (2) highest ranked *Alliances* advance onto the *Finals*.

**Scoring Elements** – Objects that *Robots* manipulate to earn points for their *Alliance*. The *Scoring Elements* are *Cones*, *Transformers, and Beacons*. A *Signal* is not a *Scoring Element.*

**Secured**  - *A Cone* or *Transformer* is

- *Secured* in a *Ground Junction* when the 4-inch diameter base of the *Cone* or *Transformer* is *Completely In* the recess of the *Junction* or *Completely On* a *Secured Cone.*

- *Secured* in a *Low, Medium* or *High Junction* when the pole passes through the 1.25" diameter hole of the *Cone* or *Transformer* or it is *Completely On* a *Secured Cone.*

A *Cone* or *Transformer* is *Secured* only if the large opening is facing toward the *Playing Field Floor.*

**Series** - A subdivision of the *Round Robin* in which each *Elimination Alliance* plays exactly once.

# Tournament Rules

## Alliances & Ranking

Each *Alliance* for CRI 2023 is made up of three (3) *Teams* in each *Qualifying Match*. *Competition Rankings* from *Qualifying Matches* are calculated per Game Manual Part 1 - Traditional Events, Section 5 (also see definitions).

**<C29> Elimination Matches** - *Elimination Matches* differ from *Qualification Matches* in the following ways:

    a. **Alliance Size** –
        i. Standard *Alliance*: Three (3) *Team Alliances* – all *Teams* play in all *Elimination Matches* in which the *Alliance* competes.
        ii. *Alliance* with a *Backup Robot*: Four (4) *Team Alliances*. Three (3) of the *Teams* represent their *Alliance* in each *Match* as described below.
    b. **Four (4) *Team Alliances*** – (The *Alliance* includes a *Backup Team):*
        i. The *Alliance Captain* must let the referee know which three (3) *Teams* are playing in each *Match*, including calling a *Backup Team*. Failure to do this in a timely manner as described below results in a random draw to decide which *Team(s)* will compete in the *Match*. *Teams* should communicate this to the *Head Referee* at least four minutes (4:00) prior to the start of the *Match*.
        ii. The *Team* that is not playing in a *Match* is allowed to have an extra *Drive Team* member in the *Alliance Station*. This additional representative may only serve as a *Coach*.
    c. **Match Timing** – There are no *Team* requested timeouts. An *Alliance* has eight minutes (8:00) from the initial announcement or display of the *Match* results for their *Robots* to be set up on the playing field and ready for the start of their next *Match*. A *Match* may begin early if both *Alliances* are ready to begin a *Match* ahead of time.
    d. **Team Disqualification** – If a *Team* is *Disqualified* during *Elimination Matches*, the entire *Alliance is Disqualified*.

## Alliance Selection

Following *Qualifying Matches*, the *Alliance Selection* will occur to form six (6) *Alliances* of three (3) *Teams* each for the *Elimination Matches*. *Alliances* will be selected using a snake draft, in 1-6, 6-1 order. Typical *Alliance Selection* rules still apply.

Of the remaining eligible *Teams*, the highest ranked *Teams* must either accept or decline to be included in a pool of available *Backup Teams* until there are six (6) *Teams* that accept to be added into the *Backup* pool. *Field Staff* will coordinate the assembly of this *Backup* pool immediately after *Alliance Selection* has been finalized. If a *Team* is not available to accept inclusion in the *Backup* pool, it will be assumed they have declined the invitation.

Once a *Team* has accepted their invite into the *Backup* pool, there will be a designated place for *Backup Teams* to stay in the *Competition Area*. At least one (1) *Team* representative must stay in this area during the entirety of the *Elimination Matches*. The two (2) highest ranked *Teams* in the *Backup* pool also must have their *Robot, Driver Station* and any other materials needed for a *Team* to prepare their *Robot* for gameplay within three (3) minutes in this area. The other *Teams* in the *Backup* pool who are not the highest ranked *Teams* will be called to come to the *Competition Area* if these higher ranked *Teams* are called.

## Backup Teams

In the *Elimination Matches*, it may be necessary for an *Alliance* to replace one (1) of its members due to a faulty *Robot*. In this situation, the *Alliance Captain* has the option to bring in only the highest seeded *Team* from the *Backup* pool to join its *Alliance*. The team whose *Robot* and *Drive Team* get added to an *Alliance* during the *Playoff Matches* is called the *Backup Team* for this *Alliance*.

The resulting *Alliance* is then composed of four (4) *Teams*. The *Backup Team* must be a part of the three (3) *Teams* who are playing for the next *Match* after the *Alliance* calls them. After the first *Match* that the *Backup Team* is playing is over, *Alliances* may play any three (3) of the four (4) *Teams* for any *Match*.

Each *Alliance* is allotted one (1) *Backup Team* coupon during the *Elimination Matches*. If a second *Robot* from the *Alliance* becomes inoperable, then the *Alliance* must play the following *Matches* with only two (2) (or even one (1)) *Robots*.

An *Alliance Captain* may choose to call up a *Backup Team* by submitting their *Backup Team* coupon to the *Head Referee* no later than when the *Alliance Captain* must notify the Referee which Teams are playing in the next match, as specified in <C29>. After that point, they will not be allowed to utilize the *Backup Team*.

The *Head Referee* will not accept the *Backup Team* coupon unless it lists the number of the *Team* whose *Robot* is being replaced and is initiated by the *Alliance Captain*. Once a *Backup Team* coupon is submitted and accepted by the *Head Referee*, the *Backup Team* coupon may not be withdrawn by the *Alliance*.

## Elimination Matches

The *Elimination Matches* are when the *Alliances* compete to decide who the winning *Alliance* is. The *Matches* are played in the following *Rounds*:

### Round Robin Round

Instead of standard *Semi-Final Rounds,* there will be a six (6) *Alliance Round Robin*. In this format, each *Alliance* plays one (1) *Match* against each of the other *Alliances*.  This *Round Robin* format will be run in the following order:

| Match | Series | Field | Red Alliance | Blue Alliance |
|---|---|---|---|---|
| 1 |  | 1 | 1 | 2 |
| 2 | 1 | 2 | 4 | 3 |
| 3 |  | 1 | 5 | 6 |
| 4 |  | 2 | 3 | 2 |
| 5 | 2 | 1 | 6 | 4 |
| 6 |  | 2 | 5 | 1 |
| 7 |  | 1 | 4 | 2 |
| 8 | 3 | 2 | 6 | 1 |
| 9 |  | 1 | 5 | 3 |
| 10 |  | 2 | 2 | 6 |
| 11 | 4 | 1 | 3 | 1 |
| 12 |  | 2 | 4 | 5 |
| 13 |  | 1 | 6 | 3 |
| 14 | 5 | 2 | 1 | 4 |
| 15 |  | 1 | 2 | 5 |

**Diagram 5: *Round Robin* Schedule**

Each *Alliance* participating in the *Round Robin Round* will earn *Ranking Points* and *Tiebreaker Points* just like in *Qualification Matches.* Each *Alliance* participating in the *Round Robin* will be ranked based off of the following criteria:

| Order | Criteria |
|---|---|
| 1 | Total *Ranking Points* (high to low) |
| 2 | Total *TieBreaker Points* (TBP1) (high to low) |
| 3 | Total *TieBreaker Points* (TBP2) (high to low) |

Based on this *Round Robin Ranking* after all of the *Round Robin* matches are completed, the top two (2) ranked *Alliances* will advance to the *Finals Round.*

## Finals Round

The highest ranked *Alliance* from the *Round Robin Ranking* will be the *Red Alliance* in the *Finals Matches*. The second highest ranked *Alliance* from the *Round Robin Ranking* will be the *Blue Alliance* in the *Finals Matches*.

*Finals Matches* are played to decide which *Alliance* wins the event. The event winning *Alliance* is the first *Alliance* to win two (2) *Matches*. Any tied *Matches* are replayed until one (1) *Alliance* has two (2) wins.

## Gameplay Rules

Unmodified bullet points under some of the following rules have been omitted from this Game Manual for the sake of brevity, but still apply.

**<G12> Playing Field Access**

    c) Violations of this rule outside of normal *Match* play that are not sanctioned by the event will result in a *Yellow Card,* including scheduled practice times and *Robot* calibration.

**<G13> Pre-Match Robot Placement** – At the beginning of a *Match*, each *Alliance Robot* must be set up on the *Playing Field* according to section 4.5.1 *Pre-Match*. After *Robots* are set up on the *Playing Field, Drive Teams* must stand *Inside* their respective *Alliance Station***.**

    a) During the *Qualification Matches* and the *Finals Round* of *Elimination Matches*, the blue *Alliance* Robots are set up on the *Playing Field* first, unless the red *Alliance* waives their right to set up on the *Playing Field* second.

    b) During the *Round Robin Round* of the *Elimination Matches*, the lower seeded *Alliance Robots* are set up on the *Playing Field* first, unless the higher seeded *Alliance* waives their right to set up on the *Playing Field* second. *Alliance* color doesn't change the ranking of a *Team* during the *Elimination Matches*.

    c) During *Elimination Matches*, four (4) *Team Alliances* (due to the addition of a *Backup Robot)* may only place three (3) *Robots* that are intended to compete in that *Match*. After the *Robots* are placed, the *Alliance* cannot swap in the *Alliance's 4th Robot* for a *Robot* already placed.

**<GS3> Autonomous Interference** - *Robots* may not *Interfere* with the opposing *Alliance's Scoring* attempts during the *Autonomous Period*. A *Major Penalty* will be assessed for each occurrence. Interactions at the centerline, including at centerline *Junctions* or *Transformer* starting positions, will not be considered *Interference*.

**<GS5> Descoring**

    d) Robots may not *Descore Secured Transformers* from Junctions. Each violation of this rule results in a *Major Penalty* per *Scored Transformer*.

**<GS6> Robot Control/Possession Limits for Scoring Elements** -

    f) *Robots* may *Control* or *Possess* a maximum of one (1) *Transformer* at one time. While a *Robot Controls* or *Possesses* a *Transformer*, that *Robot* may NOT *Control* or *Possess* any *Cones* or *Beacons*. *Controlling* or *Possessing* more than the allowed quantity of *Transformers* and/or *Controlling* or *Possessing Transformers* while possessing a *Cone* or *Beacon* is an immediate *Minor Penalty* for each *Scoring Element* above the limit plus an additional *Minor Penalty* per *Scoring Element* in excess of the limit for each 5-second interval that this situation continues.

> NOTE: *Transformer* movement from the original starting location of one inch or less is inconsequential and therefore, does not violate rule <GS6>.  Movement of the *Transformer* from the original starting location beyond this limit is subject to <GS6> f) rules. See Q&A 204 regarding *Cone* stack movement, which is handled in a similar way.

**<GS7> Junction and Terminal Constraints** -

   a) A *Cone* or *Transformer* must be placed on a *Junction* with the large opening toward the *Tile Floor* to *Score*. A *Cone* or *Transformer* placed on a *Junction* in any other orientation is not *Scored* and may be removed by either *Alliance*.

   d)  A *Cone*, *Transformer*, or *Beacon* may not be added to a *Junction* that has been *Capped*. These *Cones, Transformers*, or *Beacons* have zero (0) Score value**, do not impact the Score of Cones below them (in the case of *Transformers*),** and do not convey *Ownership*.

   e) A *Transformer* in a *Terminal* has zero (0) *Score* value and does not convey *Ownership*.

   f)  A *Cone*, *Transformer,* or *Beacon* may not be added to a *Junction* that has a Secured *Transformer*. These *Cones, Transformers,* or *Beacons* have zero (0) *Score* value, **do not impact the *Score* of *Cones* below them (in the case of *Transformers*),** and do not convey *Ownership*.

**<GS8> Junction and Terminal Defense –**

   a)  A Robot may not impede or obstruct an opposing *Alliance Robot* from *Scoring* a *Cone* or *Transformer* on a *Junction* once the *Cone* or *Transformer* is In the *Junction Area*. Each violation of this rule results in an immediate *Minor Penalty* and additional *Blocking Penalties* per rule <G28>.

**<GS10> Cone/Transformer Constraint** – *Robots* may not place a *Transformer* or their own *Alliance's Cone/Beacon* on top of an unscored *Transformer* or opposing *Alliance's Cone/Beacon*. A *Minor Penalty* is assessed for each affected *Scoring Element*. *Cones* placed in violation of this rule may be removed without penalty. This rule does not apply to an upside-down *Cone* or *Transformer* on a *Low, Medium,* or *High Junction*.

**<GS11> Scoring while In a Substation** – A *Robot* must be *Completely Outside* of a *Substation* in order to *Score* a *Cone, Transformer,* or *Beacon*. Each violation of this rule results in a *Minor Penalty*.

**<GS15> Transformer Constraint** - *Transformers* may not be *In* any *Alliance Specific Area*, including the *Terminal* and *Substations*. An immediate *Major Penalty* plus an additional *Minor Penalty* for each 5-second interval that this situation continues will be assessed to that *Area's Alliance*. Intentional and/or repeated violations of this rule will escalate to *Yellow Cards* quickly.

> NOTE: Additionally, <G28> will apply to any *Transformers* moved to be defensively trapped by an *Alliance* such that possession of a *Transformer* by the other *Alliance* is not possible.

## Scoring Summary

| Scoring Achievement | Autonomous Points | Driver-Controlled Points | End Game Points |
|---|---|---|---|
| *Robot Parked in Terminal* | 2 | | 5 |
| *Robot Parked in Substation* | 2 | | |
| *Robot Parked* only on the *Signal Zone* that corresponds to the *Signal* image | 10 | | |
| *Robot Parked* only on the *Signal Zone* that corresponds to the team supplied *Signal Sleeve* image | 20 | | |

| | | | |
|---|---|---|---|
| *Cone* placed in a *Terminal* | 1 | 1 | |
| *Cone Secured on Ground Junction* | 2 | 2 | |
| *Cone Secured on Low Junction* | 3 | 3 | |
| *Cone Secured on Medium Junction* | 4 | 4 | |
| *Cone Secured on High Junction* | 5 | 5 | |
| *Transformer Secured* on *Junction* | 3 per *Alliance's Cone* **Secured** below *Transformer* | | |

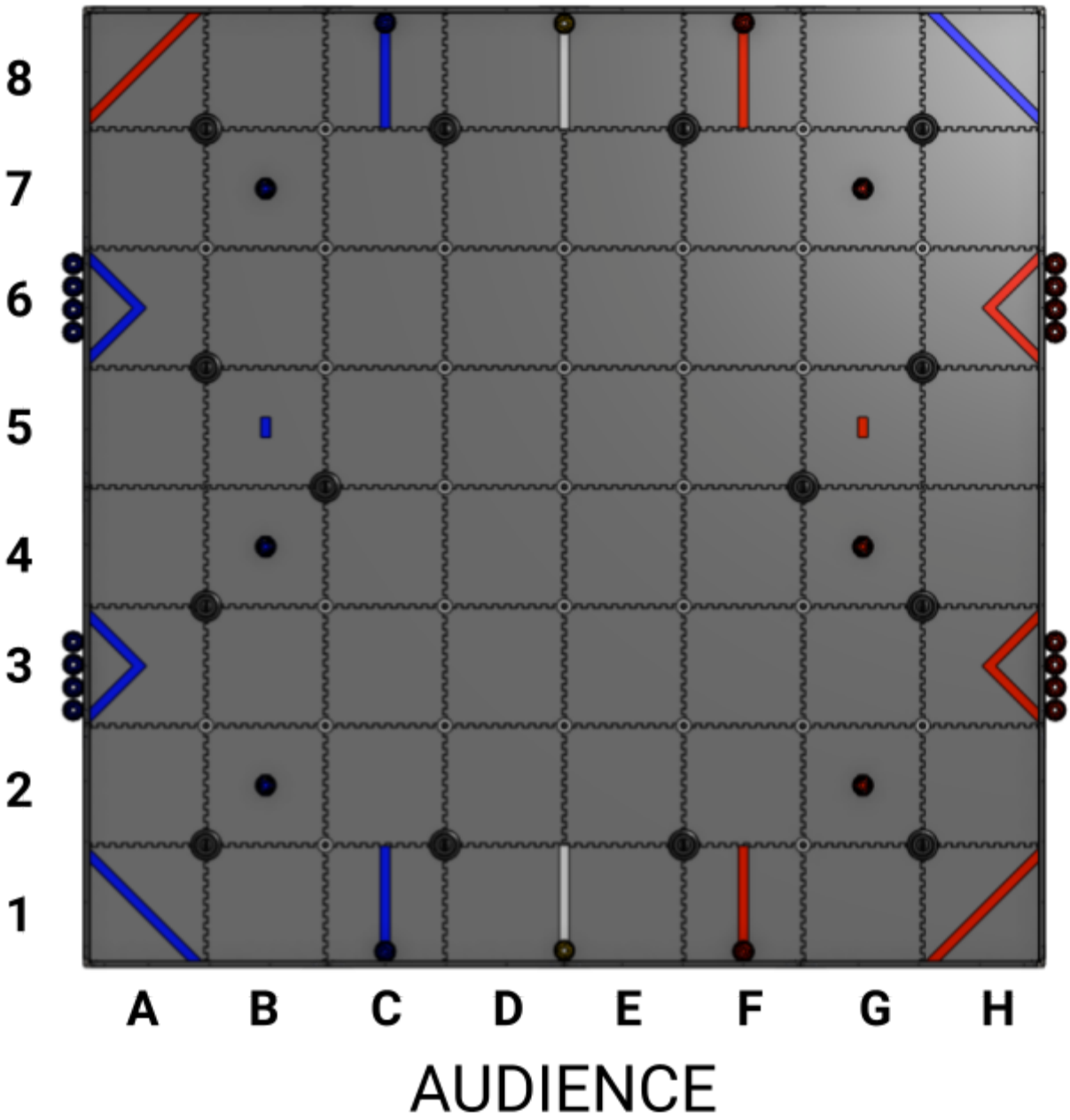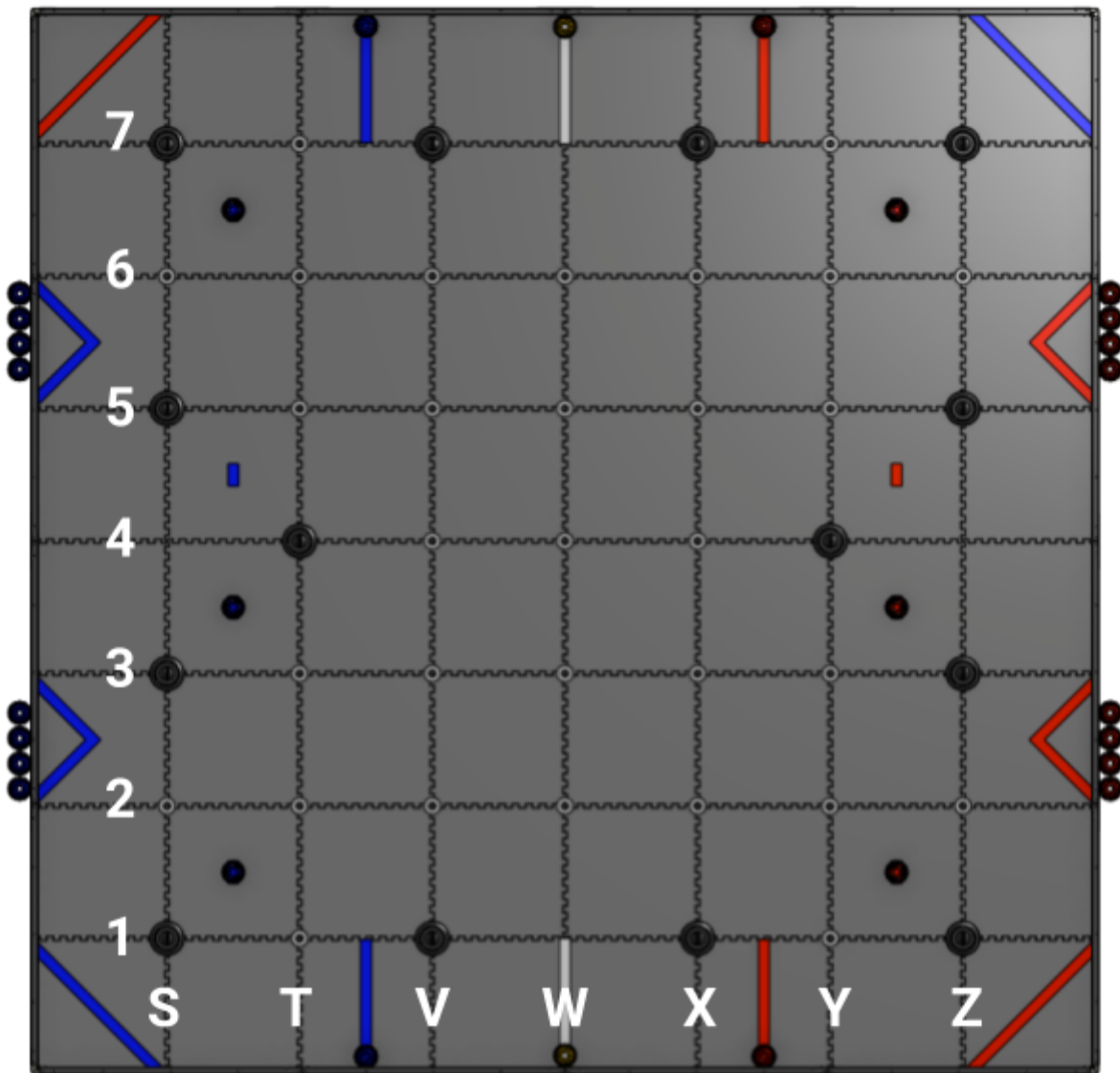| | | | |
|---|---|---|---|
| *Junction Owned* by *Cone* | | | 3 |
| *Junction Owned* by *Beacon* | | | 10 |
| Completed *Circuit* | | | 40 |

## Tile Locations



Diagram 6: *Tile* Locations

## Junction Locations



Diagram 7: *Junction* Locations